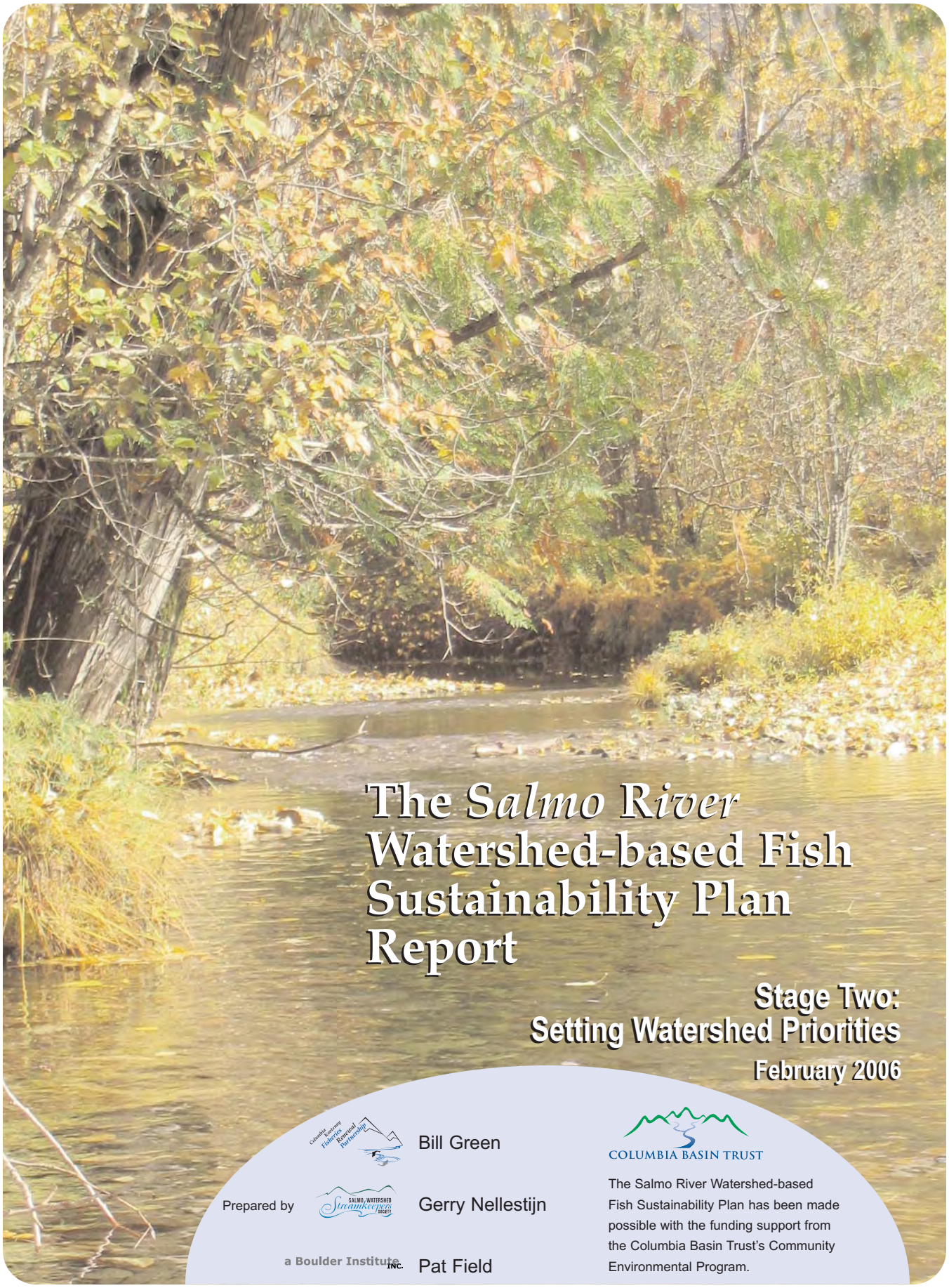

The *Salmo River* Watershed-based Fish Sustainability Plan Report

Stage Two: Setting Watershed Priorities

February 2006

Prepared by

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COLUMBIA BASIN TRUST

The Salmo River Watershed-based Fish Sustainability Plan has been made possible with the funding support from the Columbia Basin Trust's Community Environmental Program.

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The Salmo Watershed Streamkeepers Society and the
Columbia Kootenay Fisheries Renewal Partnership co-hosted this planning activity.

Here's to More Fish In The Salmo River!

Executive Summary

Stage II of the Salmo River Watershed-based Fish Sustainability Plan has been lengthy but rewarding. Starting in early 2000 the Columbia Kootenay Fisheries Renewal Partner (CKFRP) supported the 'Salmo Working Group'. By late June, the Working Group reached consensus for immediate conservation and restoration projects, as well as conditional support for a strategic planning initiative.

Collaborative, community-based stewardship was seen as an essential characteristic for increasing the health of the aquatic ecosystem in the Salmo River Watershed.

In 2002, the Salmo Watershed Streamkeepers Society (SWSS) joined the CKFRP and proposed that the strategic planning initiative should adopt the Watershed-based Fish Sustainability Planning (WFSP) framework developed by the governments of B.C. and Canada, whose overall goal is to ensure "long-term conservation of fish and fish habitat". This proposal was endorsed and a Watershed Planning Team (WPT) and a Watershed Technical Team (WTT) were formed in the summer of 2002 with a broad representation of watershed interests, including industry, government and community and technical expertise. As a critical first step in the WFSP process, consultants were contracted to prepare detailed Watershed and Riparian Profiles. Following completion and adoption of these profiles in the summer of 2003, a series of WPT, WTT and public meetings were held between September 2003 and March 2004, to gather community input and direction with a view to developing a plan and setting priorities for the Salmo River watershed. The outcome was the establishment of three plan components – a strategic overview, a strategic direction and strategic options. From the many options that were discussed and considered, the following five key objectives were selected as priority areas:

- Promote conservation and stewardship action by local residents, businesses and governments
- Restore the physical functioning of riparian, floodplain and aquatic ecosystems.
- Conserve available habitats and restore riparian floodplain functions as opportunities arise.
- Restore and enhance instream habitats.
- Effectively manage fish harvesting.

Public outreach and community involvement have been essential elements throughout this process, leading up to the completion of Stage II, as they will continue to be for the next two stages of the WFSP. The additional documentation contained in the Appendices of this report provides a thorough overview of the history of this process to date, and serves to keep it as open and transparent as possible.

Acknowledgements

This project could not have been realized without the dedication and cooperation of many individuals and organizations who gave so generously of their time and expertise to complete Stage II of the **Salmo River Watershed-based Fish Sustainability Plan**. We have endeavoured to make the following list as complete as possible; please forgive us if your name is missing from these acknowledgements. There were many others who were "kept informed" throughout the process – we thank you for the feedback you offered, which was respected and incorporated into the plan when appropriate.

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Al Gerun, mine owner, President of Chamber of Mines, Nelson
Fred Critchlow, community member and landowner, Salmo
Hans Cunningham, Chairman – Regional District of Central Kootenay, Nelson
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Jacques Dupas, B.C. Ministry of Transportation and Highways, Nelson
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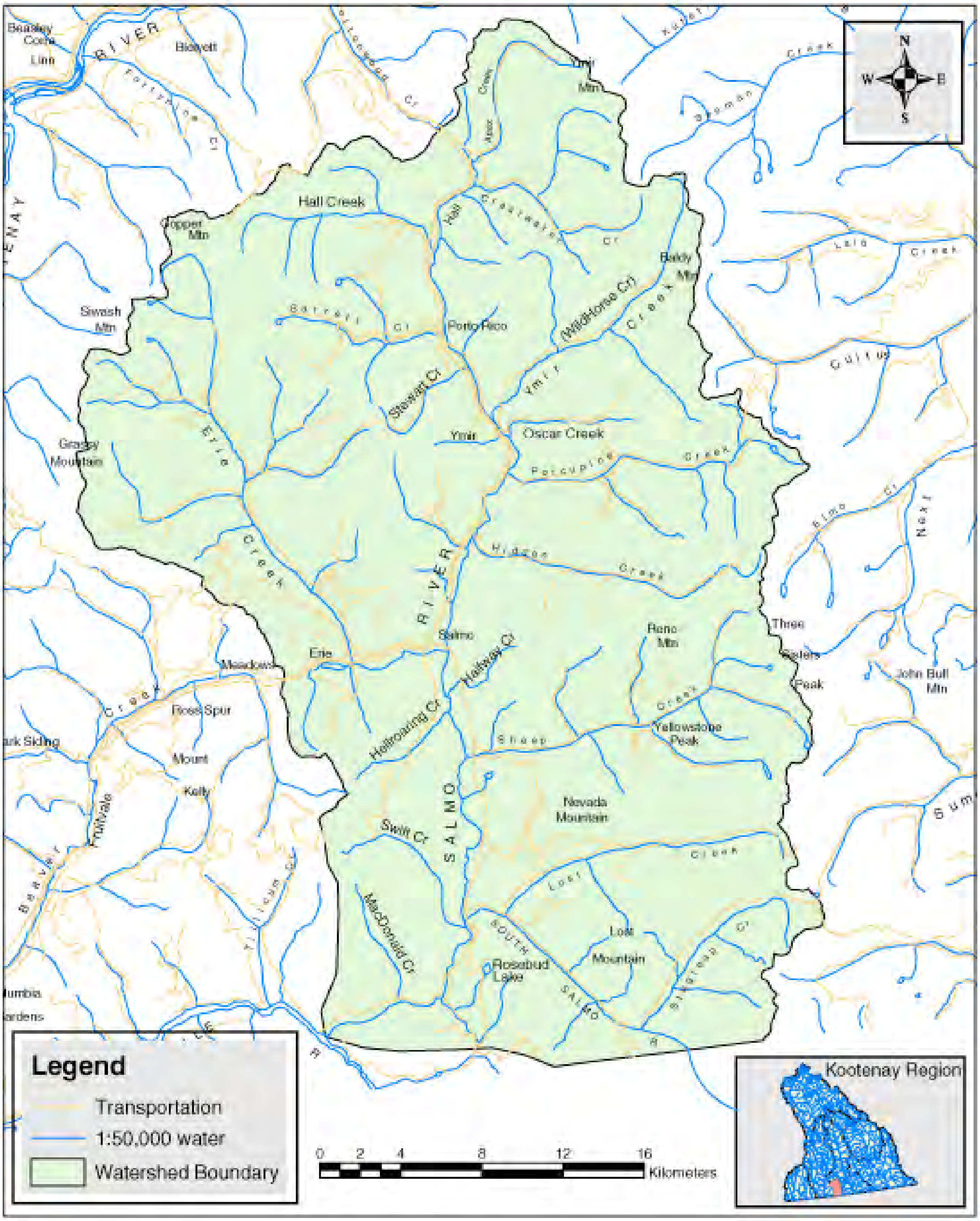

Figure 1. Overview Map of the Salmo River Watershed
1:250,000

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List of Acronyms

CKFRP	Columbia-Kootenay Fisheries Renewal Partnership
DFO	Department of Fisheries and Oceans
MOF	(B.C.) Ministry of Forests
MSRM	(B.C.) Ministry of Sustainable Resource Management
MWLAP	(B.C.) Ministry of Water, Land and Air Protection
SWSS	Salmo Watershed Streamkeepers Society
WFSP	Watershed-based Fish Sustainability Planning
WPT	Watershed Planning Team
WTT	Watershed Technical Team

1. Introduction

1.1 Background

In early 2000, the Salmo Watershed Streamkeepers Society (SWSS) and the Columbia-Kootenay Fisheries Renewal Partnership (CKFRP) undertook a joint process to develop a fisheries strategic plan for the Salmo River watershed. The SWSS was seeking to focus efforts at conservation and restoration of fish populations within the watershed, and to interest and engage watershed residents in these efforts. The CKFRP had completed an "Implementation Strategy" in 1999, which identified watershed or sub-regional strategic fisheries planning as a way to ensure that CKFRP-funded projects (and other initiatives) were biologically effective and responsive to local priorities and concerns.

A community process was initiated in March 2000 and completed in late June of that year. The community process involved a number of elements, including: (i) the formation of a Working Group with representation of a broad cross-section of watershed interests; (ii) three community open houses/information sessions; (iii) distribution of a project newsletter; (iv) newspaper advertising and news releases; and (v) opportunities to submit written comments. The community process concluded in Working Group consensus for immediate conservation and restoration projects, and conditional support for a strategic planning initiative. The conditions related to how the planning should be done.

The recommended habitat conservation and restoration projects implemented in 2000 and 2001 were: (i) construction of bank stabilization and fish habitat restoration works at a number of locations, including adjacent to the Canex tailings; and (ii) completion of design work for bull trout spawning platforms on Sheep Creek. (For more information on the community process that took place during 2000, see section 6 of this report.)

In 2002, the SWSS and CKFRP proposed that the strategic planning initiative adopt the Watershed-based Fish Sustainability Planning (WFSP) framework developed by the governments of British Columbia and Canada. This proposal was endorsed and a Watershed Planning Team (WPT) was formed in June 2002. As a first step in the WFSP process, consultants were selected and contracted to prepare a "Watershed Profile" and a "Riparian Profile." These profiles were completed and adopted by the WPT by the early summer of 2003. To assist with the WFSP process, a facilitator was engaged in the late summer of 2003, and a series of WPT, Watershed Technical Team (WTT) and public meetings were held between September 2003 and March 2004. This Stage II Salmo Watershed-based Fish Sustainability Plan was prepared based on the input and direction provided in these meetings, and was subsequently reviewed and endorsed by participating individuals.

1.2 Study Area

The Salmo River rises from the Selkirk Mountains 12 km southeast of Nelson, B.C., and progresses in a southerly direction for approximately 60 km from its origin to the confluence with the Pend d'Oreille River (Seven Mile Reservoir) (See Figure 1: Overview Map of the Salmo River Watershed, on page iv). Geographic information is summarized in the table below. The system is a 5th order stream, and has a total drainage basin of roughly 123,000 ha (Baxter and Nellestijn 2000).

Elevation in the basin ranges from 564 meters at its confluence to 2,343 meters at the height of land. Within this elevation range, the system comprises two biogeoclimatic zones. At lower elevations, the valley lies within the Interior Cedar-Hemlock zone, while areas in the higher elevations are found within the Englemann Spruce-Subalpine Fir zone. The Salmo River has a total of eight 2nd and 3rd order tributaries (including Apex Creek, Clearwater Creek, Hall Creek, Barrett Creek, Ymir Creek, Porcupine Creek, Erie Creek and Hidden Creek), as well as two 4th order tributaries (Sheep Creek and the South Salmo River). The Water Survey of Canada maintains a gauging station on the Salmo River near the town of Salmo. Mean annual discharge in the Salmo River (1949–1976) was 32.5 m3·sec-1, with mean monthly minimum and maximum values of 7.5 and 128.6 m3·sec-1, respectively. Runoff reaches a peak in May, with high flows between April and July (Baxter and Nellestijn 2000).

Gazetted Name	Stream Length (km)	Area (ha)
Salmo River	**60**	**123,000**
Geographic Information		
Approximate distance and direction to the nearest town, city or landmark	Headwaters – 12 km southeast of Nelson, B.C.	
MELP Region	4	
MELP Management Unit	4–8	
DFO District	B.C. Interior Area Columbia River Section	
Ministry of Forests Regions	Nelson	
Ministry of Forests District	Arrow (primarily) and Kootenay Lake	
NTS Base Map Reference	82 F/3 and 82 F/6	

2. Watershed-based Fish Sustainability Planning (WFSP)

The following information is taken from *Watershed-based Fish Sustainability Planning – Conserving B.C. Fish Populations and their Habitat: A Guidebook for Participants* (B.C. Ministry of Fisheries, B.C. Ministry of Environment, Lands and Parks, Fisheries and Oceans Canada 2001):

> Watershed-based Fish Sustainability Planning is a new approach to the management of fish stocks and fish habitat in British Columbia. Its overall goal is to ensure effective long term conservation of fish and fish habitat – including spawning grounds, and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly. WFSP is based on a standard planning sequence that can be applied to regions and watersheds across the province. By using this planning sequence, a range of parties with an interest in fish conservation can work together more effectively for the benefit of fish and their habitat. A WFSP is a "living document" in that it is meant to be adaptive, that is as time or priority projects move along new priorities may be assessed by the WPT.

2.1 WFSP Stages

The intention of WFSP Stage I is to produce a biophysical and sociopolitical profile of a region (major river basin or sub-basin) and to identify watersheds within the region that are the highest priorities for fish sustainability planning. A Stage I WFSP has not been completed for the Canadian portion of the Columbia River basin. In 1999, however, the CKFRP completed the "Implementation Strategy for Fisheries Renewal Investments in the Kootenay Region" which identified strategic directions for fisheries conservation, restoration and stewardship within the Columbia basin. Subsequent to this, the CKFRP identified the Salmo watershed as a priority for fish sustainability planning based on input from government agencies and others.

Stage II produces a biophysical and sociopolitical profile of each of the priority watershed planning units identified in Stage I and identifies objectives, strategies and targets that must be met to achieve fish sustainability within these watersheds.

During Stage II, WFSP participants focus on the watershed planning units selected in Stage I – such as the Slocan River watershed in the Kootenay basin or, as in this case, the Salmo River Watershed in the Pend d'Oreille Basin. They develop a detailed watershed profile that describes stocks and habitats and identifies factors affecting their health and productivity. In the next step, participants identify management options that are feasible, likely to provide benefits to fish and habitat within the watershed, and are consistent with government legislation and policy. To provide a meaningful context, group members develop a strategic overview that identifies local interests with respect to fish and habitat, and the resources and support available for WFSP within the watershed planning unit. They consider this overview and the information in the watershed profile in establishing strategic directions for management of the watershed planning unit that reflect areas of common ground. Participants also establish management objectives, targets and strategies, as well as a framework for monitoring and assessment. At the end of Stage II, the federal and provincial governments review these desired future conditions and proposed projects to ensure that they are consistent with existing legislation and policy, and that they address government as well as local and regional priorities.

Stage III produces a detailed fish sustainability action plan that spells out how these objectives, strategies and targets will be met and by whom.

Stage IV involves actual implementation of the plan and monitoring of its effectiveness. It also involves revisiting earlier stages of the planning process, and improving the fish sustainability plan based on new information.

2.2 Products of Stage II

The following Stage II products are specified in the WFSP guidelines, and are included in this plan as noted:

- a working protocol between WFSP participants (see Appendix 1)
- a detailed watershed profile (see Appendix 2)
- a strategic overview that identifies local values and resources (see section 6.1)
- strategic management direction(s) (general prescriptions, see section 6.2)
- specific management objectives, targets and strategies (specific prescriptions, see section 6.4)
- a monitoring and assessment framework, including indicators of effectiveness (see section 7)
- a government-approved Stage II plan (this report)

2.3 Watershed Planning Team

The Watershed Planning Team (WPT) was initiated at a public meeting on April 8, 2002 and confirmed with acceptance of a "Working Protocol" at a subsequent meeting on June 3, 2002.
In accordance with the protocol, the responsibilities of the WPT in this phase were to:

- work closely with other parties with an interest in fish and aquatic ecosystem sustainability in the Salmo watershed
- develop a strategic overview of local values and resources
- establish the overall strategic directions for management
- establish specific management objectives, targets and strategies
- develop a monitoring and assessment framework
- bring a proposed Stage II plan to governments for review and approval

The WPT included representation of the following watershed interests:

- Salmo Watershed Streamkeepers Society
- Department of Fisheries and Oceans
- B.C. Ministry of Water, Land and Air Protection
- Columbia-Kootenay Fisheries Renewal Partnership
- Canadian Columbia River Inter-tribal Fisheries Commission
- Village of Salmo
- BC Hydro
- Regional District of Central Kootenay
- Beaumont Timber Co. Ltd.

- Local mining interests/B.C. Chamber of Mines/Placer Miners Association
- Salmo Chamber of Commerce
- B.C. Ministry of Forests
- Atco Lumber
- Columbia Basin Fish and Wildlife Compensation Program
- B.C. Gas (subsequently Terasen Gas)
- residents
- landowners
- Teck Cominco Ltd.

The following table summarizes the activities, meetings and accomplishments of the WPT:

April 8, 2002	• Introduction to and overview of WFSP • Sponsor background information • Discuss participation/membership
June 3, 2002	• Review planning schedule • Review and approve Working Protocol
May 29, 2003	• Review final drafts of Riparian and Watershed Profiles • Revise planning schedule
January 28, 2004	• Review and rank strategic options • Review and revise strategic direction • Brainstorm objectives • Develop strategies and targets for first priority objective
February 2, 2004	• Determine priorities for fiscal year 2004–2005 funding
March 15, 2004	• Review strategies, target and monitoring plan for first priority objective • Complete remaining objectives, strategies and targets

2.4 Watershed Technical Team

A Watershed Technical Team (WTT) was formed in early July 2002 at the direction of the WPT. In accordance with the WFSP guidelines, the responsibilities of the WTT were to:

- coordinate the collection and analysis of data about the watershed
- develop a watershed profile
- identify strategic management options consistent with fish and aquatic ecosystem sustainability
- identify appropriate indicators of effectiveness

The WTT included technical participants from the following organizations:

- B.C. Ministry of Water, Land and Air Protection
- Department of Fisheries and Oceans
- B.C. Ministry of Sustainable Resource Management
- BC Hydro
- Columbia-Kootenay Fisheries Renewal Partnership
- Salmo Watershed Streamkeepers Society
- Teck Cominco Ltd.
- Regional District of Central Kootenay
- Beaumont Timber Ltd.
- Atco Lumber LTD.
- Terrasen Gas
- B.C. Ministry of Forests
- Canadian Columbia River Inter-tribal Fisheries Commission

The WTT completed most of its assigned responsibilities, as summarized in the following table. Other WTT responsibilities were completed in joint WPT/WTT meetings.

July 10, 2002	• Development of a more holistic, ecosystem approach • Riparian vegetation and wildlife • Water quality • Long-term forest harvesting scenarios
November 22, 2002	• Determine mapping requirements and options, including information sources
December 3, 2002	• Review outlines for Watershed and Riparian Profiles • Identify additional information sources
December 8, 2003	• Classify watershed sub-units • Review and amend proposed strategic options • Develop agenda for WPT workshop in January 2004
November 14, 2005	• Make final changes to the WFSP Report

3. Watershed Profile

In October 2002, the firm of Westslope Fisheries was selected through a competitive bidding process to develop a watershed profile of the Salmo River, based on requirements specified in a Request for Proposals and in the Watershed-based Fish Sustainability Planning Guidebook. The WTT was responsible for reviewing the various drafts of the Watershed Profile document, leading up to the final report which was accepted by the WPT in September 2003 (*see Appendix 2 for the complete "Salmo River Watershed Profile"*). The profile concluded with the following recommendations:

> Existing sensitive habitat (i.e., spawning, overwintering) should be protected in concert with provincial Best Management Practices (BMPs) and the promotion of public awareness of ecosystem values within the watershed. Through the development of the fish sustainability plan, the technical and steering committees should continue to work with existing legislative bodies (federal, provincial and municipal) to develop and promote conservation-minded strategies and ensure a pro-active approach to land use changes, development (urban, forestry, mining, infrastructure, agriculture) as part of plan implementation.
>
> Flood protection works should also emphasize natural restoration techniques that accent channel morphometric features rather than creating additional structures. Incorporation of logjams and rootwads within flood control measures would be appropriate techniques. Prior to implementation of potential restoration plans within the Salmo River, the following study recommendations are provided:
>
> 1. Complete the riparian assessment and analysis for the watershed;
> 2. Complete a Level 1 Fish Habitat Assessment on the mainstem Salmo River;
> 3. Assess water quality status and impacts on aquatic invertebrates and fish populations;
> 4. Continue to monitor bull trout and rainbow trout populations and their response to changes in angling regulations;
> 5. Continue to develop a comprehensive understanding of seasonal habitat utilization by target species in the mainstem and tributaries, particularly for rainbow trout;
> 6. Characterize the annual thermal regime of the Salmo River;
> 7. As restoration projects are developed, review channel assessment and preliminary restoration options with a geomorphologist, hydrologist, fish biologist and engineer;
> 8. Continued monitoring of non-sport fish populations within the Salmo, and evaluate their impact on resident fish communities;
> 9. Continue/complete the development of a comprehensive GIS database for the watershed; and
> 10. Complete the subsequent tasks (technical and planning) as outlined in stage 2 of fish sustainability planning.

4. Riparian Profile

The need for a riparian profile of the Salmo River, in addition to a watershed profile, was identified during a WPT meeting in June 2002, as part of a strategy to develop a more holistic and ecosystem-oriented approach to watershed-based fish sustainability planning. Chris Steeger of Pandion Ecological Research Ltd., a local wildlife and riparian ecology expert was contracted to produce this Riparian Profile. Mr. Steeger developed a draft table of contents, information requirements and several drafts of the Riparian Profile with the guidance of the WTT. The final Riparian Profile was reviewed and endorsed by the WPT in September 2003 (*see Appendix 3 for the complete document, "Watershed-based Fish Sustainability Planning for the Salmo River: Riparian Ecosystem Profile"*). The following recommendations were included in the profile:

Stage II completion

1. Complete mapping and GIS analysis for the riparian zone as proposed in the analysis and management framework (Figure 1) and described in Sections 5.1.1 and 5.2.

2. Ground-verify the mapped information. Ground surveys can be designed and coordinated to collect a variety of information. For example, identification of the type, amount, and distribution of structural conditions and habitat elements within the riparian zone can be combined with species inventories. Furthermore, inventories of aquatic habitat characteristics, riparian habitat elements that interface with the aquatic environment and riparian species may be combined during surveys.

3. Extend and/or complete the structural and functional analysis of wildlife/fish-habitat relationships as outlined in this report. Emphasize species-habitat relationships that involve those terrestrial species that have (i) numerous and strong associations with riparian habitat elements and/or significant Key Ecological Functions (Section 4.2.2) and (ii) strong, consistent relationships with fish (Section 4.2.4).

Strategic direction for Stage III

4. The results of the preliminary analysis of wildlife-habitat relationships (Section 4.2.2) indicate a relatively high number of species being dependent on wetlands, marshes, wet meadows, bogs and swamps within the riparian zone. The amount and distribution and possible protection and restoration needs of these habitat elements should be established because extensive channelization and dyking of the river has reduced their availability throughout most of the watershed. Where restoration of riparian wetland components includes restoring some of the river's side arms and channels, fish populations will likely benefit.

5. Several riparian wildlife species feed on and/or compete with fish (Section 4.2.2); however, it is presently unknown whether and to what extent piscivorous species are responsible for the low levels of certain fish populations. Fish hide from predators, to some extent, under large woody debris. As the latter may be in reduced supply, there is a need to establish present levels of these structures and identify areas where restoration efforts should be applied, if needed.

6. Several wildlife species with listed conservation status or ecologically important functions inhabit the riparian zone along the river. Some of these species, for example, Great Blue Heron and Grizzly and Black Bear frequently use the riparian zone and require undisturbed habitat. The requirement for undisturbed *Environmentally Sensitive Areas* (ESAs) therefore has to be considered for all future developments within the riparian zone.

   Of particular significance is the proposal to establish a linear regional park on the Ministry of Transportation property of the railroad right-of-way. Unless ESAs are identified and adequately protected along the railroad, conflicts between the needs of wildlife species and trail users are likely to arise. We therefore recommend the establishment of objectives for the trail that ensure (a) protection of important riparian habitats and fish and wildlife species and (b) minimization of human-wildlife conflicts. In this context, important issues include:

   (i) identification and spatial context of ESAs;

   (ii) impacts on ESAs from different types and seasons of trail use (e.g., motorized, non-motorized; spring, summer, fall, winter);

   (iii) alterations to the rail bed to promote re-establishment of seasonal flooding and enhancement of fish habitat and riverine wetlands;

   (iv) RDCK requirements regarding development and maintenance activities in a linear Regional Park that potentially affect ecosystem values (e.g., snag and wildlife tree removal, access requirements, etc.);

   (v) MOTH requirements regarding ownership of the property that potentially affect ecosystem values;

   (vi) the requirement of “undisturbed” habitat by sensitive species and species at risk vs. encouragement toward human use of the trail – the option of different “use zones” along the trail;

   (vii) human-wildlife interactions such as confrontations with bears or moose, or disturbance of sensitive species such as Bull Trout, Great Blue Heron, Harlequin Duck, Grizzly Bear, among others.

7. Historical mine and mill residue tailings and ponds are impacting the riparian zone (e.g., at the Ymir town site; Section 4.5 and 4.6). Some of contaminated sites in the watershed are in urgent need of restoration. We recommend development of an impact database for these and other impact sites, to guide and prioritize management efforts. This database may include the following fields:

    - File number
    - Impact Type (e.g., recreation, mining, forestry, etc.)
    - Status/Phase (i.e., restoration planning, restoration implementation, restoration monitoring, prevention)
    - Parties (agencies, organizations, individuals) involved, their role and primary contacts
    - Location/Polygon #
    - Available reports, maps, data, and other information
    - Comments

    With respect to the impact of past and potential future mining operations, we recommend continued encouragement for representation of the mining sector in the Salmo WFSP initiative.

8. Due to the large number of private properties within the riparian zone of the watershed, consider development of an incentive-based habitat stewardship program for private landowners. Such a program could include eco-asset investments such as compensation payments for conservation of forest cover or important habitats or the selling and buying of "shares" in vital services of nature (Ellison & Daily 2003). Such new approaches to ecosystem conservation appear to be gaining momentum in numerous jurisdictions and may be feasible for the Salmo River Watershed.

5. Watershed Subdivision

The WPT/WTT has classified mainstem and tributary sub-units within the Salmo watershed (*see Appendix 7: Salmo River Reaches Map*):

1. Mainstem: Seven Mile Reservoir to South Salmo River
2. Mainstem: South Salmo River to Sheep Creek
3. Mainstem: Sheep Creek to Erie Creek
4. Mainstem: Erie Creek to Hidden Creek
5. Mainstem: Hidden Creek to Clearwater Creek
6. South Salmo River
7. Stagleap Creek
8. Lost Creek
9. Sheep Creek
10. Erie Creek
11. Hidden Creek
12. Porcupine Creek
13. Ymir Creek
14. Barrett Creek
15. Hall Creek
16. Clearwater Creek
17. Apex Creek

6. Plan Components

6.1 Strategic Overview

The WFSP guidelines recommend that the WPT develop a local strategic overview that identifies:

- local priorities and concerns with respect to fish and their habitat
- the level of local support for WFSP
- resources and expertise available for WFSP
- existing and proposed programs, processes, plans and commitments that affect the watershed
- regional priorities and other outside factors that may affect the watershed
- general priorities of non-fish interests in the watershed-planning unit

To answer these questions, the WPT relied to a great extent on the document "Salmo & Lower Pend d'Oreille Rivers: Summary of Community Involvement Process & Renewal Recommendations for 2000" (*Betts and Maratta 2000; see Appendix 4*).

In March 2000, the Columbia-Kootenay Fisheries Renewal Partnership engaged Lynn Betts and Joanna Maratta to determine attitudes and preferences within the community towards the development of a strategic plan to help renew fisheries in the Salmo River watershed. Feedback from a community meeting held in March 2000 demonstrated that there was a significant level of community interest in protecting and enhancing the long-term health of the rivers and the fisheries for the benefit of future generations. It became clear at this meeting as well that, from the outset, such a planning process would have to reflect community values and address concerns related to decision making that would be open and transparent. The public involvement process is described fully by Betts and Moratta (2000).

The following strategic themes and highlights were developed through the community process, and are drawn from their report:

- Support for renewal projects was unanimous among participants.
- Enhancing spawning grounds and riparian planting/bank stabilization were identified frequently by participants as viable renewal projects that they would like to see undertaken in 2000.
- People expressed support for the potential renewal projects that were presented, but also identified other renewal opportunities including a "catch and release" fishery, stocking the rivers and cleaning up the tailings.
- Some suggested that a viable (non-native) fishery could be established in the Seven Mile Dam reservoir.
- Local economic benefits and an improved quality of life were cited as the two key benefits that would result from healthy fisheries and rivers.
- Clean water, community pride, establishment of the area as a desirable destination and increased recreational opportunities were other frequently cited benefits of a healthy watershed.
- Participants' long-term vision included a healthy river and a fishery that can be enjoyed by future generations and a watershed that remains wild and in a natural state.
- Support for strategic planning was nearly unanimous, with a few dissenters requesting short-term actions over long-term planning.

- Other issues identified by participants during the community involvement process included:
    - concern that commitments made by BC Hydro during the construction of dams have not been fulfilled;
    - limiting the catch for anglers; and
    - the need for local people to be involved in the planning and delivery of projects.
- Several people expressed appreciation for the community involvement process initiated by the Partnership.

The following key elements of a fisheries-oriented vision for the watershed were identified by participants in the community process:

- The river would remain wild and protected and be home to a healthy fishery.
- The water would be clean and usable for a variety of recreational purposes.
- For some, the future would mean a return of salmon to the river, while for others the vision would involve establishment of a "world class" sport fishery that includes species able to thrive in a reservoir environment.
- Regardless of the fish species, a thriving fishery and a clean river would attract tourism and result in local economic benefits.

"Protecting the rivers" was determined by participants to mean that:

- The rivers would remain wild and natural.
- Renewal activities would focus on natural techniques.
- There would be more protected areas along the rivers.
- This important natural resource would be maintained or improved.
- The rivers would return to the way they were.
- Healthy rivers would be left for future generations.
- Clean water would flow in the rivers.
- A plentiful supply of fish in the rivers would support other species in the ecosystem.
- Enhancement/renewal fees could be collected as part of the fishing license cost and used to fund ongoing renewal activities.

Many participants saw economic activities as a part of the vision for the Salmo watershed – in this case, the outcome of increased tourism activities would be the result of having healthy rivers and fisheries.

The following attributes of "improved" fisheries were identified by participants:

- The bull trout and rainbow trout fisheries would be healthy.
- Spawning channels would be clean and healthy.
- The rivers would be stocked with fish.

For many people, the vision of the future of the Salmo watershed included the restoration of historic salmon runs:

- Fish ladders would be installed at the dam so salmon could be brought back.
- The Salmo River should revert to being called, as it once known, the "Salmon" River as a reminder of what it once was.

The future of the recreational fishery (and other recreational uses) in the river was a key concern for most participants:

- A sport fishery would be developed and trout populations would be increased in order to develop a sport fishery.
- The sport fisheries would not be closed due to declining numbers of fish.
- The rivers would be stocked with bull trout in order to encourage a world-class fishery.
- The single hook ban would be eliminated; single and treble barbless hooks would be used instead.
- The water would be clean for other recreational activities, such as swimming and boating.
- While the river would be used for a variety of recreational uses, it would remain uncrowded.

Some of the goals and objectives as stated in the Official Community Plan of the Village of Salmo also relate to the Salmo watershed:

- Encourage industry of a non-polluting nature.
- Encourage multi-level educational opportunities.
- Protect the quantity and quality of water for recreation, fishery, aesthetic and domestic water supply purposes.
- Encourage development of services to ensure a safe and healthy community.

In addition, Salmo community and watershed residents have been participating in a "Resilience" initiative, from which the following strategic statement is drawn:

> The vision of the residents of Salmo and area includes meeting the needs of all citizens with a resilient economy and a rich quality of life in a healthy and sustainable natural environment. A number of volunteer groups are working with local governments and with the Rural Economic Development program of the Columbia Basin Trust to build the community's capacity to work together to achieve long-term success. These groups are implementing local beautification projects, strengthening the quality and range of services (educational, social, health-related) available to residents, and attempting to set up a workable process for long term economic and community planning. There is considerable interest in improving the communications infrastructure, tying into the Burlington Northern Troup Junction to Salmo Recreation Trail and the Kootenay Loop of the Trans Canada Trail with a dynamic tourism strategy, and developing a light industrial park to attract non-polluting businesses to the area.

In summary, public support for the enhancement of the fisheries, and for environmental and recreational values of the Salmo River appears universal in every area reviewed during the community involvement process.

6.2 Strategic Direction

The following "Strategic Direction" statement was developed based on a brainstorming of key concepts by the WPT, and was subsequently approved by the Team:

> The Salmo River and its tributaries in southeastern British Columbia used to support salmon, as well as bull trout, rainbow trout and other indigenous fish populations. It no longer supports salmon because of the construction of dams on rivers downstream. Recent monitoring of bull trout and rainbow trout suggest these game fish and their habitats are threatened due to the combined impacts of dams, mining, forestry, over harvest and poaching, human settlement and rail and highway corridors.
>
> The communities that exist in the Salmo watershed understand that there is interdependence between healthy communities and healthy watersheds. In 2000, they participated in a process to assess community preferences for fisheries renewal in the Salmo watershed. The process confirmed the communities' desire for the river to remain wild and natural with a plentiful supply of fish for current and future generations. They also expressed the desire for the river to support recreational and economic opportunities while continuing to ensure that it produces clean water and remains uncrowded. The public process identified a widespread commitment to community involvement in developing and implementing a strategic plan to conserve and restore fish habitats and populations.
>
> The Salmo Watershed Fish Sustainability Plan was initiated in 2002. A working protocol has guided the process of a community led strategic plan with support from agencies and other stakeholders. The planning team worked to determine public desires for the watershed, how to achieve them, and how to determine when they have been achieved. This involved the development of strategic options, formulation of key objectives, simple strategies, meaningful targets and a clear set of roles and responsibilities to carry them out through an effective monitoring and reporting framework.
>
> The watershed planning team has agreed that promoting a holistic watershed view with community responsibility and involvement will result in the conservation and restoration of natural wetlands and stream function. Demonstration projects that focus on conservation, education and restoration will build public confidence in redefining our actions to have self sustaining fish populations in the Salmo River. Environmentally sustainable economic development will be achieved through the collaborative involvement of the public, stakeholders, government agencies and landowners. The ability to live harmoniously with each other and within the social, economic and ecological systems is our journey towards sustainability. The difficult task of understanding the relationships and balancing of these systems through community decisions over generations is the vision. We define it as ecosystem-based management.

6.3 Strategic Options

Table 1 summarizes the strategic options that were developed and considered by the WPT (see pages 17–19).

6.4 Objectives

The options presented in Table 1 were reviewed and ranked according to financial cost, degree of biological benefit, technical risk, probability of success, long-term sustainability, sociopolitical feasibility, community support and funding potential. This resulted in the selection of four ***key objectives*** and associated strategies and targets, which are described in order of priority in the following pages. Subsequently, a fifth *key objective* was added at a follow-up meeting.

Underlying all of these strategic options is the support of collaborative community-based stewardship within the Salmo watershed. Two options were determined to be not acceptable to the planning team. The first option, to consider maintaining the status quo, was aborted; while the second option, for aggressive containment of introduced species, was taken off the table by the Ministry of Water, Land and Air Protection because it would favour certain species over others, and their mandate is to conserve all species.

Table 1: Strategic Options

Option One:	**Restore physical functioning of riparian, floodplain and aquatic ecosystems** • aggressive option to restore a natural functioning stream • protection of existing riparian and floodplain habitats through education and voluntary measures • identify and evaluation restoration/protection options at Erie-Salmo confluence • restore wetland areas (e.g., South Salmo, sewage treatment plant) • assist private landowners with riparian replanting • work with RD and municipal governments to establish streamside and floodplain protection
Benefits:	long-term significant improvements in sport fish, other fish and wildlife populations
Comments:	wetland restoration expensive; riparian planting – low cost using volunteers; very low feasibility to achieve on a large scale; variable support among riparian landowners
Option Two:	**Restoration and enhancement of instream habitats** • physical works (e.g., Vector tailings structures) • bank stabilization and fish habitat structures (e.g., log structures) • restoration of side channels
Benefits:	possible short-term (5–20 years) improvements in sport fish populations
Comments:	very high costs if it is to be done everywhere where it is needed; rank and prioritize critical areas (e.g., car body run); structures require maintenance
Option Three:	**Conserve available habitats and restore riparian/floodplain functions as opportunities arise** • voluntary, landowner-driven approach • principally through education and voluntary measures • less aggressive, more opportunistic than Option One
Benefits:	maintenance of existing sport fish, other fish and wildlife populations, possibly small gains
Comments:	requires monitoring; efforts should be focused (rank and prioritize) on valuable/most critical habitats; wildlife benefits as well

Table 1: Strategic Options (continued)

Option Four A	**Restore aquatic ecosystem productivity through stream fertilization** • additional fertilization of tributaries if results of Sheep Creek experiment are encouraging
Benefits:	may lead to increased populations of fish; uncertainty about which species will benefit
Comments:	recurring annual costs for fertilization
Option Four B:	**Restore aquatic ecosystem productivity through water quality mitigation** • continue to investigate water quality, invertebrate and fish population impacts of mine tailings and landfills legacy • reclaim/mitigate mine tailings which have fish population impacts
Benefits:	may lead to increased populations of fish; uncertainty about which species will benefit; road salting issue
Option Five:	**Status quo – Not acceptable to WPT** • some habitat conservation and restoration efforts • continuing incremental development impacts on fish habitat • some compensation activities (e.g., B.C. Hydro, CPC, Terasen)
Benefits:	none, probably continuing long-term decline in fish and wildlife populations
Comments:	not an option – 100% risk!
Option Six:	**Aggressive containment of introduced fish species – Not acceptable to the WPT** • continued monitoring of presence/abundance of introduced species and degree of risk to native fish community • introduced fish removal/harvest program? • liberal catch limits for (e.g.) brook trout
Benefits:	possible maintenance of current levels of abundance of native fish
Comments:	regulatory approval may be a problem; a lot of work to accomplish through technical means; community support for removing coarse fish

Table 1: Strategic Options (continued)

Option Seven:	**Fish harvest management** • continue and, if necessary, increase bull trout and rainbow trout harvest restrictions • ongoing population monitoring
Benefits:	possible maintenance and incremental improvement of current levels of abundance of rainbow and bull trout
Comments:	dependent on Sport Fishery Regulations with rainbow trout; also on enforcement due to poaching problem
Option Eight:	**Tributary habitat conservation and restoration** • work with agencies and forest companies to ensure protection of functional riparian areas through voluntary measures and existing regulations • maintain and restore fish access • minimize sediment impacts • minimize changes to streamflow regimes
Benefits:	maintenance of headwater/resident and mainstem fish and riparian wildlife populations; Crown versus private lands; monitoring and community relations on Crown and managed forest lands possible; voluntary/certification measures on unrestricted private lands and managed forest lands
Option Nine:	**Avoid reductions in summer/fall low streamflows** • identify tributaries with water use impacts on fish habitat/populations • where necessary, avoid licensing of additional consumptive uses • promote water conservation
Benefits:	may be important to maintaining fish populations threatened by climate change impacts
Comments:	restrict future licensing; secure licenses for fish conservation
Option Ten:	**Hatchery stocking** • Stock sport fish into Salmo River from Freshwater Fisheries Society hatcheries
Comments:	River stocking has proven non-productive. Dilutes genetic stock Stocked fish compete with indigenous fish Stocked fish are extremely expensive Work well in an isolated ‘put and take’ fishery like a lake Stocking in a river is used only as the ultimate last resort.

Objective One:
Promote conservation and stewardship action by local residents, businesses and governments

Strategy	Indicator	Initial Targets
Develop a formal Stream Team at Salmo Secondary School	Approval of Stream Team by principal and science teacher	▪ Minimum 10 person stream team ▪ Identification and implementation of one focus project
Educate local and regional residents through radio advertising spots "Watershed Radio" and the Salmo Valley Newsletter	▪ Number and total time of radio advertising spots ▪ Number of newsletters with educational articles	▪ Ten 30 sec. spots on local radio stations ▪ Six newsletter articles per year
Educate elementary and secondary school students about snow and hydrology: "Rivers of Snow"	Number of presentations to Salmo elementary and secondary school classes (with follow-up skiing)	4 presentations
Educate anglers of Salmo River Fish issues by giving gift of Fish ID/Regulations Card	Number of Cards distributed by fish license sellars and SWSS members	50 anglers
Implement Salmo Secondary School Student Scholarship for student interested in water oriented post secondary education	Number of students applying	1 student annually

Objective Two:
Restore the physical functioning of riparian, floodplain and aquatic ecosystems

Strategy	Indicator	Initial Target
Reconnect the river with its floodplain (side and back channels)	Number of hectares rewetted to natural conditions	Two sites totaling 5 ha, one within 1:20 yr. floodplain
Redevelop historic wetlands	Percentage of historic wetlands rewetted	One site in 2004 (size to be determined); 50 percent of historical wetland area by 2025

Objective Three:
Conserve available habitats and restore riparian floodplain functions as opportunities arise

Strategy	Indicator	Initial Target
Map distribution of riparian habitat types – Salmo mainstem and accessible tributary stream reaches	1:20,000 GIS map layers	Two map layers (riparian habitat types; current land uses) produced by March 2005
Educate watershed residents and leaders about riparian habitat values and conservation techniques	Number of newsletters produced	One – spring 2005
	Number of newspaper articles published	One – fall 2004 One – spring 2005
	Number of public meetings held	One – spring 2005
	Meetings with local organizations (on request)	Two – winter 2004–2005
Develop and promote financial incentives for riparian habitat conservation	Proposal to Real Estate Foundation for funding to research options and prepare discussion paper	Completed summer 2005
	Discussion paper on options for financial incentives for riparian habitat conservation	Completed summer 2006

Objective Four:
Restore and enhance instream habitats

Strategy	Indicator	Initial Target
Complete overview of fish habitat assessment	Completed assessment report	January 2005 completion
Complete detailed fish habitat assessments on priority sites	Completed level 2 FHAP assessment reports	1. Salmo/Erie confluence 2. Car body run December 2005
Inform watershed residents about plans	Number of newsletters produced	One – spring 2006
	Number of newspaper articles published	One – fall 2005 One – spring 2006
Confirm agency, corporate and community support and commitment	Number of public meetings held	One – spring 2006
	Number of letters of support	Five agencies and local businesses – spring 2006
	Number of commitments of volunteer or in-kind contributions	Ten written commitments – spring 2006
Seek financial contributions	Number of funding applications made	Two – spring 2006
Complete detailed restoration prescriptions	Number of prescriptions completed	Car body run – 2004 Erie/Salmo confluence – 2005 FHAP identified priorities – 2006
Implement restoration prescriptions	Number of sites restored	Car body run – 2006 Erie/Salmo confluence – 2006 FHAP identified priorities – 2007 and ongoing July 2005 survey completed
Monitor, evaluate and report on accomplishments	Number of annual snorkel surveys completed	Car body run – December 2005 Erie/Salmo confluence – December 2006
	Number of as-built reports completed	Annually after first site completed
	Number of annual post-freshet inspections	Completed 2010
	Overall effectiveness assessment	

Objective Five:
Effectively manage fish harvesting

Strategy	Indicator	Initial Target
Continue existing Sport Fishery Regulations	Existing regulations continued in Freshwater Fishery Regulations	Bull trout release and bait ban – Salmo mainstem and tributaries
		Rainbow trout release zone – Sheep Creek to South Salmo
		Trout/char daily quota of one, minimum 30 cm. – June 15th to October 31st
Continue population monitoring projects	Conduct annual snorkel surveys	Continue in July 2005
Assess population trends and revise regulations as needed	Report on population trends with recommendations	Complete assessment in 2007

7. Implementation and Monitoring

Appendix 5 presents an implementation and monitoring framework based on the five key objectives and associated strategies, indicators and initial targets outlined in section 6.4. As indicated on the preceding pages, each objective may have more than one strategy, and initial targets are only a starting point for evaluation purposes. As the plan evolves over time, targets will change based on evaluation of monitoring results and feedback of those results to the public.

This monitoring framework is the transparent documentation that will show how projects contribute to meeting the proposed strategic direction. The WPT is responsible for monitoring the progress of implementation. For each of the four key objectives, 16 parameters are provided. These should form the basis for a solid evaluation and reporting framework back to the public and government agencies mandated for sustainability. The parameters are:

- Strategy meaning (example: get local knowledge used in planning)
- Measure to be used (example: type and number of public participation opportunities)
- Measurement unit (example: number of local citizens attending meetings or projects)
- Spatial scale (example: Salmo and Ymir residents and local First Nations)
- Monitoring frequency (example: annual)
- Data source (example: minutes from WPT meetings and public meetings)
- Initial target (example: 10 citizens willing to participate in evolution of the plan)
- Knowledge gaps (example: extent of bull trout use in the lower canyon section)
- Monitoring techniques (example: WPT reviews, approves and distributes minutes)
- Tools required (example: stakeholder lists with names, addresses and interests noted)
- Skill sets required (example: willingness to provide knowledge and represent the community)
- Information system (example: electronic file and hard copy of meeting minutes in the Salmo library)
- Who is responsible? (example: WPT to assign responsibility for taking minutes and reporting back to the group on action items generated at meetings)
- Cost (example: physical time to document print and catalogue in the library)
- Funding opportunities (example: Columbia Basin Trust)
- Comments (example: WPT to assign responsibility for Stage III report meetings)

8. Public Outreach

Public outreach and the involvement of the community have been essential elements throughout the Salmo River WFSP process, and have included the following activities:

- Hard copy, e-mail or telephone invitations to participate in the WFSP were sent to appropriate individuals and organizations.
- An invitation to participate in the process was also published in the *Salmo Valley Newsletter*.
- A poster campaign was implemented throughout the watershed to advertise the first public meeting.
- Word-of-mouth information sharing was encouraged.
- A comprehensive e-mail list was developed for the purpose of keeping the WPT, the WTT and other interested parties informed.
- Three letters outlining the approach and status of the WFSP were sent to the owners of property on the mainstem of the Salmo River.
- Four WFSP update articles were published in the *Salmo Valley Newsletter*.
- A public meeting (which was advertised in advance in the *Salmo Valley Newsletter* and in the *Pennywise*) was held on November 17, 2003, to report on progress to date and to request public feedback. Three PowerPoint presentations were given at this meeting. As well there was an information table c/w take home documents outlining all WFSP published information to date. Also there were historical and fish related poster presentations.
- A four-page WFSP newsletter, aptly named *The Flow*, was published, distributed through the *Salmo Valley Newsletter*, and made available online and in hard copy at frequented locations throughout the watershed. (Another newsletter will be distributed near the conclusion of Stage II of the WFSP.)

9. References

B.C. Ministry of Fisheries, B.C. Ministry of Environment, Lands and Parks, Fisheries and Oceans Canada 2001. *Watershed-based Fish Sustainability Planning – Conserving B.C. Fish Populations and their Habitat: A Guidebook for Participants*. Co-published by B.C. Ministry of Environment, Lands and Parks and Fisheries and Oceans Canada. Pages viii, 85.

Baxter, J., and Nellestijn, G., 2000. *Aspects of the Biology of Bull Trout (Salvelinus confluentus) in the Salmo River Watershed as Identified Through Radio Telemetry*. Report prepared for the Columbia-Kootenay Fisheries Renewal Partnership and the Columbia Basin Trust. Page 3.

Working Protocol:
Salmo Watershed Fish Sustainability Plan –
Watershed Planning Team and
Watershed Technical Team

Stages

Four stages are generally recommended for Watershed-based Fish Sustainability Planning. In the case of the Salmo watershed, stage I is not necessary as it is proposed by the Salmo Watershed Streamkeepers' Society (SWSS) and the Columbia-Kootenay Fisheries Renewal Partnership (CKFRP) as a priority watershed within the Columbia-Kootenay region. The remaining 3 stages for the Salmo Watershed Fish Sustainability Plan are:

- Stage II: Establishing Watershed Priorities
- Stage III: Develop an Action Plan
- Stage IV: Implementing and Improving the WFSP

Responsibilities

Watershed Planning Team

The Watershed Planning Team (WPT) is responsible for developing and implementing a detailed fish and aquatic ecosystem sustainability plan for the Salmo watershed. In stage II, the WPT will:

- Work closely with other parties with an interest in fish and aquatic ecosystem sustainability in the Salmo watershed;
- Develop a strategic overview of local values and resources;
- Establish the overall strategic directions for management;
- Establish specific management objectives, targets and strategies;
- Develop a monitoring and assessment framework; and
- Bring a proposed Stage II plan to governments for review and approval.

In stage III, the WPT will:

- Identify ways to achieve the objectives, targets and strategies identified in Stage II, including programs and processes;
- Identify and contact appropriate organizations and individuals to determine their capacity and willingness to assist in implementation and monitoring;
- Work with other stakeholders to establish specific commitments regarding implementation and monitoring, including timelines;
- Develop a detailed, multi-year fish and aquatic ecosystem sustainability action plan based on these commitments; and

During Stage IV, the WPT will:
- Oversee delivery of the fish sustainability action plan;
- Meet annually or more often as needed to review performance and effectiveness, and to identify emerging issues;
- Report annually or more often as needed to the public and governments regarding progress in delivering the plan.

Watershed Technical Team

The Watershed Technical Team (WTT) is responsible for technical tasks related to the development of the Salmo WFSP as directed by the WPT. In stage II, the WTT will:
- Coordinate the collection and analysis of data about the watershed;
- Develop a watershed profile;
- Identify strategic management options consistent with fish and aquatic ecosystem sustainability; and
- Identify appropriate indicators of effectiveness.

In stage III, the WTT will:
- Identify appropriate monitoring and assessment options; and
- Identify appropriate research, data collection, and analytical activities.

During stage IV, the WTT will:
- Assess research and monitoring data; and
- Report new information to the WPT.

Composition

Watershed Planning Team

The Watershed Planning Team (WTT) consists of representatives of organizations and agencies with an interest in, or whose activities affect, fish and aquatic ecosystems within the Salmo watershed.

The Watershed Technical Team is appointed by the WPT and consists of individuals with technical or local knowledge of fish and aquatic ecosystems within the Salmo watershed. WPT members and others may be appointed to the WTT.

Principles for Salmo WFSP Collaboration, Consensus-Building and Outreach

1. Decisions of the WPT and WTT will be made by consensus.
2. Consensus is defined as: (preferred): unanimous agreement among all WPT or WTT members; or (required): general agreement by all members on a package of decisions, recognizing that some members may not agree with some decisions but that they can support the entire package. Members may stand aside on specific decisions to avoid blocking consensus.
3. WPT co-chairs will be appointed by the CKFRP and the SWSS and will be responsible for the orderly running of meetings and ensuring that all the views of all participants are heard and considered.
4. All WPT and WTT members are responsible for attending a minimum of 75% of all meetings. WPT members are responsible for reporting on WFSP progress to their respective organizations/constituencies.
5. A CKFRP Stewardship Coordinator (or other staff) will record WPT and WTT action items and decisions. This record (minutes) will be distributed in draft form within 14 days of each meeting.
6. WPT and WTT members are committed to sharing information and addressing problems that may arise in a respectful manner.
7. WPT and WTT members are committed to resolving issues through interest-based discussion and negotiation.
8. The WPT may delegate resolution of specific issues to small task or working groups.
9. The WPT may engage the services of a facilitator if needed.
10. The WPT will use a range of mechanisms to seek input from the general public and First Nations.

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Salmo, B.C.

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June 2003

Executive Summary

The Salmo Watershed Profile was initiated In November of 2002 with funding from the Columbia-Kootenay Fisheries Renewal Partnership (CKFRP) and the Salmo Watershed Streamkeepers Society (SWSS). The goal was to summarize current fish and fish habitat information for the watershed. Our study area was defined as the Salmo River and tributaries from the headwaters to the confluence with the Pend D'Oreille River, as well as the Pend D'Oreille River between Boundary and Seven Mile dams.

It is currently unknown whether fish stocks are declining, stable, or increasing over historic population levels; however it is likely they are depressed from past levels. Currently, the Salmo River has two provincially Blue Listed species (i.e. species of special concern – bull trout and Westslope cutthroat trout). Salmonid species documented in the watershed include chinook salmon, steelhead, rainbow trout, bull trout, brook trout, and Westslope cutthroat trout, mountain whitefish, and kokanee. Kokanee were stocked as eyed eggs in 1940-41, and have not been documented in the watershed in recent years. Chinook salmon and steelhead were extirpated with the construction of dams on the lower Columbia River. Rainbow trout provide the majority of the current sport fishery, while brook trout, bull trout, and mountain whitefish also provide limited angling opportunities.

Key bull trout spawning locations have been documented in five areas in the watershed. Key rainbow trout spawning areas have also been recently identified, and radio telemetry studies have indicated that spawning populations of both species are near minimum conservation requirements. Telemetry studies have suggested that the bull trout population in the Salmo River is likely fluvial. Rainbow trout in the mainstem Salmo River and tributaries may be genetically distinct populations (based on preliminary DNA analysis); however further study of the rainbow trout population is required to further identify spawning areas and delineate partitioning between the mainstem and tributary populations.

Conservative angling regulations were implemented in 1999 for bull trout (catch and release only). Rainbow trout regulations were recently changed (from an allowed harvest of 2 fish per day larger than 30cm previously, to release of all trout in the mainstem from Sheep Creek to the South Salmo River; in the remainder of the mainstem, the daily quota is one fish (none under 30cm - 2003). The Salmo River has the potential to provide a high quality recreational fishery; however current population levels are low, and previous reports have suggested that fish habitat

is presently under-utilized; however this has not been confirmed with subsequent field studies. A Level 1 Fish Habitat Assessment Procedure (FHAP) should be completed to confirm or refute this hypothesis. Prior to implementation of potential restoration plans within the Salmo River Watershed, the following study recommendations are provided:

1. Complete the riparian assessment and analysis for the watershed;
2. Complete a Level 1 Fish Habitat Assessment for reaches 1-7 on the mainstem Salmo River;
3. Assess water quality status and impacts on aquatic invertebrates and fish population;
4. Monitor bull trout and rainbow trout populations and their response to changes in angling regulations and habitat improvement;
5. Continue to develop a comprehensive understanding of seasonal habitat utilization by target species in the mainstem and tributaries, particularly for rainbow trout;
6. Characterize the annual thermal regime of the Salmo River;
7. As restoration projects are developed, review channel assessment and preliminary restoration options with a geomorphologist, hydrologist, and engineer;
8. Investigate and monitor non-sport fish populations within the Salmo River, as well as those migrating from the Pend d'Oreille River and evaluate their role in the resident fish communities;
9. Continue/complete the development of a comprehensive GIS database for the watershed; and,
10. Complete the subsequent tasks (technical and planning) as outlined in stage 2 of fish sustainability planning.

Fish population and riverine habitat assessments (Level 1 and 2) will quantify existing habitat resources (depth, velocity, substrate and cover criteria). Habitat utilization data can be collected seasonally using a variety of sample techniques designed for different life-stages (electrofishing, G-traps, hoop nets, snorkeling). Habitat preference data and the relative importance of habitat types can then be used to help design a fisheries management plan. Long-term monitoring stations (fish populations, fish habitat, water temperature, water quality, benthic invertebrates) should be developed based in part on previous studies to establish baseline conditions throughout the watershed, and develop long-term targets for evaluating the relative success of conservation and restoration efforts.

Acknowledgements

The Salmo Watershed Streamkeepers Society (SWSS) and the Columbia-Kootenay Fisheries Renewal Partnership (CKFRP) provided funding for this project. The authors wish to acknowledge all the individuals that have contributed to completion of this project. Gerry Nellestijn (SWSS), Les Brazier and Bill Green (CKFRP) provided continual enthusiasm and support for the project. José Galdámez (Purcell Resources Inc.) provided drafting and mapping support. Jakob Dulisse provided the Harlequin duck photo. Historic photos of logging activity are from the Bernarine Stedile family collection. Their contributions are greatly appreciated. In addition the following groups and individuals have also provided support for this project:

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Albert Chirico, Biologist

B.C. Hydro

James Baxter, Biologist; Dean den Biesen, Technician

Salmo Watershed Technical Committee (in addition to those mentioned above)

Steve Arndt (CBFWCP)	Bill Duncan (Teck-Cominco)
Ian Parfitt (CBFWCP)	Brian Ferguson (DFO-HEB)
Bruce McDonald (DFO-HEB)	Jacqueline Herodek (Beaumont Timber)
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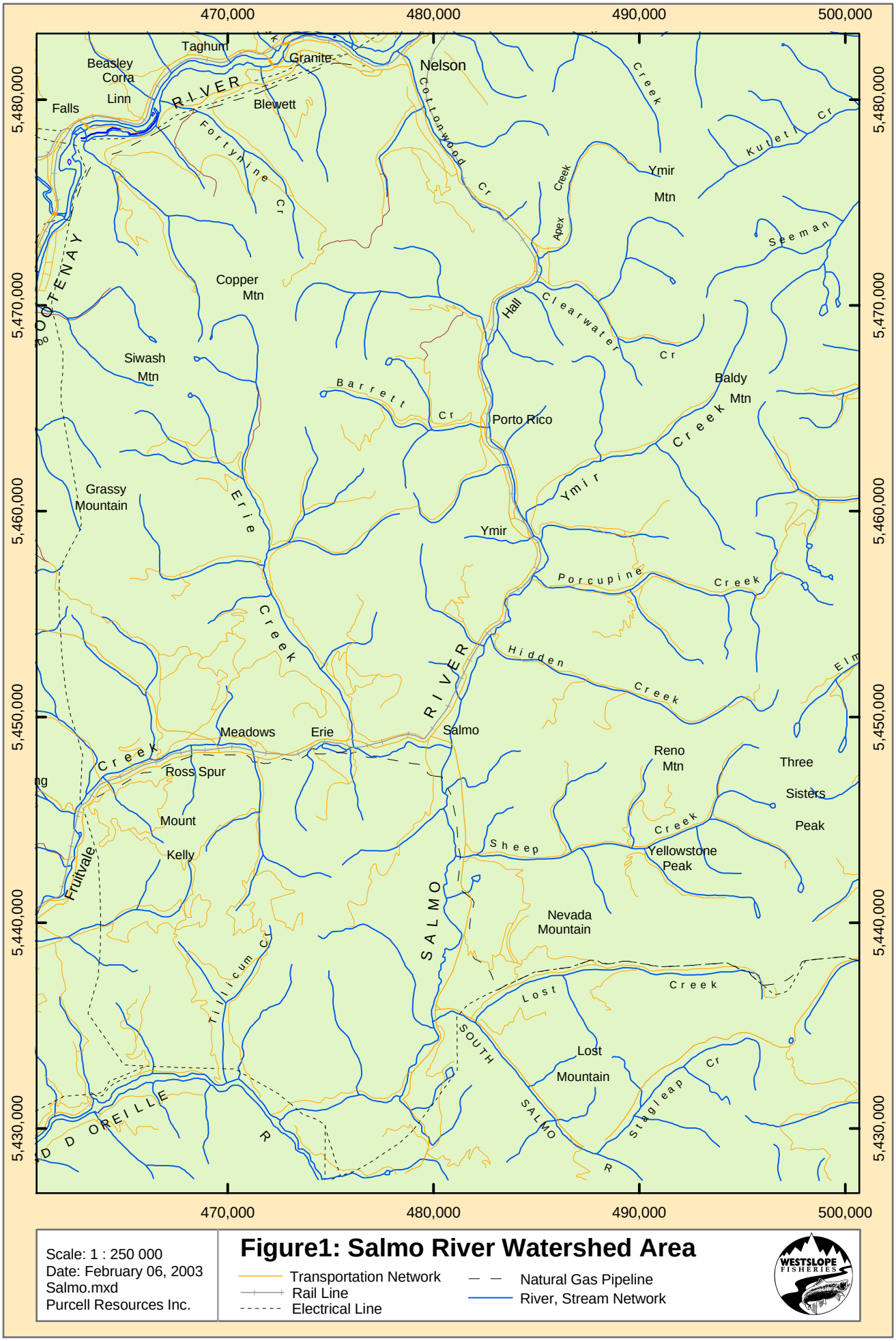
1.0 Introduction

Fish populations and fish habitat are fundamental components of ecosystems in British Columbia. Historically, resident and migratory fish populations provided significant food and cultural features for First Nations communities. While fisheries resources continue to provide important cultural, economic, and social benefits to the province of British Columbia and its residents, increasing concern has been expressed about the decline in fish populations throughout B.C. as a result of over habitat destruction/alteration, fishing, industrial (mining, forestry), residential (urban development), and agricultural activities, as well as numerous other factors. Standard procedures have been developed to inventory, assess, and restore fish populations in B.C. (1:20,000 Reconnaissance Fish and Fish Habitat Inventories (RFFHI) Anonymous 1997; the Fish Habitat Assessment Procedure (FHAP), Johnson and Slaney 1996). These procedures provide a standardized approach to identifying historical impacts to fish and fish habitat, and opportunities for restoration of riverine habitat and fish populations following land development. The Salmo River is located in southeastern B.C., near the city of Nelson and the Community of Salmo (Figure 1). The Salmo River is tributary to the Pend D'Oreille River.

"Watershed-based Fish Sustainability Planning (WFSP) is a new approach to the management of fish populations and fish habitat in British Columbia" (B.C. Ministry of Fisheries et al. 2001). While the RFFHI and FHAP procedures provide repeatable and scientifically defensible methodologies for data collection and evaluation, the concept of WFSP provides a planning framework to integrate fisheries assessment and management activities into landuse planning. As identified in the WFSP technical guidelines, WFSP complements existing management initiatives by:

- Reflecting a joint federal-provincial government mandate;
- Encouraging partnerships between governments and other parties with an interest in conservation;
- Coordinating other ongoing fish and habitat conservation initiatives; and,
- Introducing a consistent approach to planning.

WFSP is based on a four-stage planning sequence as identified in Figure 2. The Salmo Watershed Profile was initiated in November of 2002 with funding from the Columbia-Kootenay Fisheries Renewal Partnership (CKFRP) and the Salmo Watershed Streamkeepers Society (SWSS) to summarize current fish and fish habitat information for the watershed.



Scale: 1 : 250 000
Date: February 06, 2003
Salmo.mxd
Purcell Resources Inc.

Figure1: Salmo River Watershed Area

Transportation Network
Rail Line
Electrical Line
Natural Gas Pipeline
River, Stream Network

WESTSLOPE FISHERIES

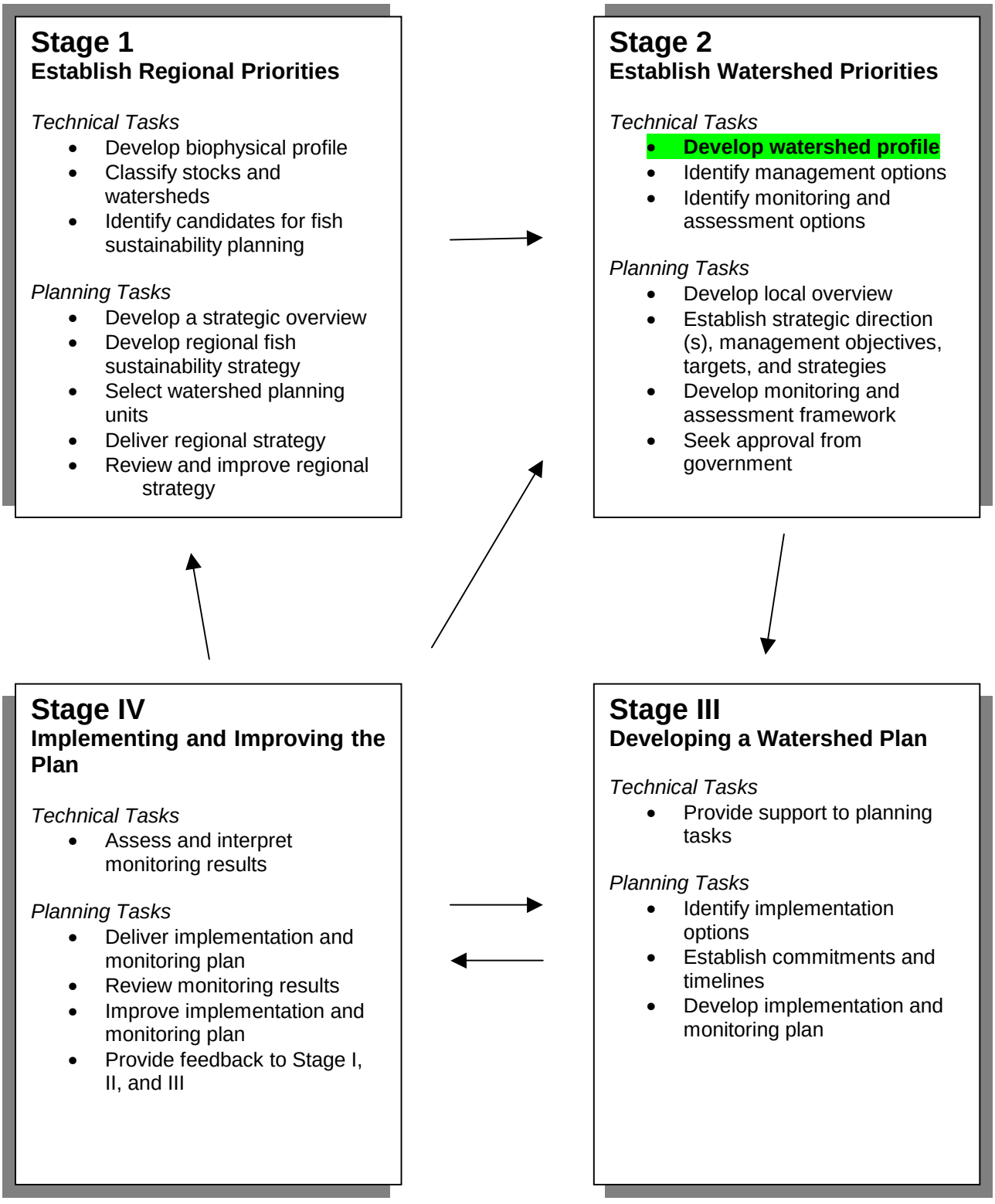


Figure 2. The WFSP Sequence. Source: Watershed-Based Fish Sustainability Planning. Conserving B.C. Fish Populations and their Habitat. A Guidebook for Participants. B.C. Ministry of Fisheries et al. 2001 (Page 13, Figure 1).

The initial stage of the WFSP process (Stage I) establishes regional priorities, which will take time for each of the eight sub-regions in British Columbia. The Salmo River had been identified by the Ministry of Water, Land, and Air Protection (MWLAP) as a regional priority. In many areas, such as the Salmo River Watershed, stewardship groups are already active, and the WFSP process can help the groups to develop fish sustainability plans that address priorities and are consistent with government legislation. For this reason, although WFSP is designed to be initiated at the regional level (Stage I) it can also be started at the watershed planning unit level (Stage II) (B.C. Ministry of Fisheries 2001). Development of the watershed profile is the initial technical task identified in Stage II of the WFSP sequence (Figure 2).

The development of a watershed profile mirrors the approach outlined for completing an Overview FHAP in many ways. Briefly, the Overview FHAP identifies fish species at risk. Once identified, the appropriate data known to affect the production/survivorship of individual life-history stages can be collected for these species. Recognizing that fish differ in life-history strategies and habitat use, target species selection increases the efficiency of the overview assessment by focusing subsequent fieldwork on the determination of fish habitat associations. Given the extent and nature of disturbance, activities to improve riverine habitat and fish populations are then recommended on a site, stream, and watershed basis (Johnston and Slaney 1996).

The broad intent of the program is to develop a better understanding of existing conditions and the ongoing hydrologic and morphologic processes in the Salmo River, especially as they relate to fish habitat. A preliminary comparison between historical and current conditions enables researchers to document the extent and degree of disturbance before fieldwork begins. In addition, documentation of habitat condition within affected sites provides the basis for prescription(s) to stabilize and restore riverine habitat and improve productivity of site, reach, and stream and target species. These data are then used to rank sites based on the extent of riverine habitat damage relative to the requirements of target species. Ultimately, alternative prescriptions will be recommended to restore/enhance affected sites and stream reaches.

1.1 Objectives

The objectives of a watershed profile are to assess the status of fish populations and fish habitat, and identify factors affecting their health and productivity. The following specific objectives were identified:

- Gather all relevant maps and aerial photographs (historical and current);

- Review and assess the status of fish populations and presence of known key/critical habitats for individual species within the study area;
- Identify areas of concern and key data gaps that need to be examined in quantitative field surveys; and,
- Recommend preliminary mitigative and restorative measures that could increase availability of spawning, rearing, and wintering areas for fish.

This watershed profile follows the approach outlined in the Watershed-based fish sustainability Planning Guidelines (B.C. Ministry of Fisheries 2001) and incorporates information (where available) as outlined on page 31 of the guidelines.

1.2 Study Area

Following discussions with CKFRP and the Salmo Streamkeepers, the core study area was defined as the Salmo River and tributaries to the confluence, and the Pend D'Oreille River between the Boundary and Seven Mile dams. A more detailed description of the study area is described in subsequent sections. The reader is encouraged to refer to the reference publications described in Appendix A for more detailed descriptions of specific components of the watershed. Copies of those reference materials can be obtained through the SWSS, or the Salmo library.

2.0 Methods

The watershed profile of the Salmo River was initiated with a review of relevant information pertaining to the study area. Information about fish species composition, relative abundance, distribution, and identification of data gaps and areas of special concern within the watershed were reviewed. Information was gathered from the following sources:

- BC Hydro;
- MSRM;
- Salmo Watershed Streamkeepers Society (SWSS);
- Stream Inventory Summary System (SISS);
- Fish Inventory Summary System (FISS);
- Ministry of Water, Land, and Air Protection (MWLAP), Ministry of Fisheries;
- Department of Fisheries and Oceans (DFO);
- Ministry of Forests (MOF) library and files;
- Conservation Data Center (red and blue listings);

- Other reports from industry or consultants;
- Anecdotal information from local residents and first nations;
- 1: 50 000 NTS maps; and,
- Land use information (Forest Tenure Licensee, Creston, RDCK, etc…).

Historical information and aerial photography were used to provide a qualitative description of riverine and riparian habitats where possible.

2.1 Fish Populations

An initial review of relevant ministry databases (FISS, SISS, ministry stocking records) was completed to identify fish species documented within the Salmo River Watershed. Westslope staff also completed a review of available publications, and relevant literature to characterize fish populations and fish communities in the study area. Based on a review of available information, target fish species for the Salmo River were identified. Trends in abundance were summarized and distributions of fish populations were described by life-history stage (fry, juvenile, adult, and spawning). In addition, known critical habitats and areas of concern that have the potential to affect production of target fish were identified.

2.2 Habitat Assessment

The scope of this project precluded completion of fieldwork to document habitat conditions in the watershed. Various studies completed in the watershed have included habitat assessment components completed to varying degrees of intensity (i.e. Overview, Level 1 FHAP standards). Habitat assessments completed as part of previous studies in the watershed were identified and summarized. This report provides a qualitative description of preliminary habitat assessment for the Salmo River Watershed based on those reports.

2.3 Identification of Habitat Disturbance

The following effects of anthropogenic activity and natural processes on riverine and riparian habitat were identified from the literature and information review, and aerial photography:

- Bank erosion and sources of sediment and/or debris;
- Accumulation of sediment;
- Channelization and dyking;
- Problems associated with stream crossings;
- Loss of riparian vegetation; and,
- Low habitat complexity, and possibly low amounts of large woody debris (LWD).

Each effect was rated on its frequency and associated risk to fish populations downstream, relative importance of fish populations present, and extent of effort required to rehabilitate disturbed sites within budgetary constraints.

2.4 Preliminary Restoration and Enhancement Measures

Sites that could benefit from rehabilitation and/or enhancement measures were identified from information synthesized in the literature review and interview process. The following types of reclamation and enhancement activity were considered:

- Habitat Conservation;
- Conservative angling regulations;
- Bank stabilization, repair and re-vegetation;
- Stream fertilization; and,
- Habitat complexing.

3.0 Watershed Status

Scope and timing of this project precluded completion of any fieldwork during this study and this review is primarily derived from previous reports. Specific information describing fish populations, fish habitat, water quality, and hydrology are provided in the following sections. The reader is encouraged to read materials summarized in the list of publications (Appendix B) to obtain more detailed descriptions of specific components.

3.1 Physical Characteristics

The Salmo River is a 5th order stream that originates in the Selkirk Mountains approximately 12 km southeast of Nelson, B.C. and flows south to its confluence with the Pend D'Oreille River at the Seven Mile Reservoir (Figure 2). The river is 60 km long and has a drainage area of 1230 km^2 (Table 1). The elevation at its mouth is 564 m above sea level and rises to 2,343 m in the headwaters near Ymir Mountain. Major tributaries to the Salmo River are Apex, Clearwater, Hall, Barrett, Ymir, Porcupine, Hidden, Boulder Mill, Erie, and Sheep creeks, and the South Salmo River. There are no major lakes or reservoirs in the river system to attenuate flood flows. There are several small headwater lakes in the watershed including Barrett, Lost, Panther, Curtis, Rosebud, and Waldie (Wulf). Basic physical information is provided in Table 1.

Table 1. Summary of Geographic Information for the Salmo Watershed (FISS 2002, 2003).

Geographic Information	
Stream Order	Fifth Order
Gazetteer Name	Salmo River
Watershed Code	330-092600
Water Body Identifier	00000LARL
MWLAP Region	4
DFO District	Habitat and Enhancement Branch, Columbia River Section
Approximate Distance to Nearest Town	12 km from Nelson; flows through Salmo, B.C.
Ministry of Forests Region	Nelson
Ministry of Forests District	Arrow
Number of tributaries	2^{nd} and 3^{rd} order - 8
	4^{th} order – 2
Water Quality Stations	None identified
Water Survey of Canada Stations	08NE074 (Salmo); 1949-2002
	08NE044 (Waneta); 1936-1946
Management Objectives – Inland River	1. Angler Use
	2. Wild
Drainage Area	1230 km^2
Stream Length (mainstem)	60 km
Mean annual discharge	31.5 m^3/s
NTS Map Sheets	082F/3, 082F/6
UTM (confluence)	471999E 5430261N

The Salmo River Watershed lies within two biogeoclimatic zones:

- The Interior Cedar-Hemlock (ICH) sub-zone (lower elevations), and
- The Englemann Spruce Sub-alpine Fir (ESSF) sub-zone (Braumandl and Curran 1992).

Riparian vegetation has been further characterized under separate cover (Steeger 2003).

3.2 Fish populations

The Salmo River and its tributaries support important fisheries resources. Historically, chinook salmon and steelhead were found in the watershed, and were important species for First Nations. Currently, rainbow trout, and to a lesser extent bull trout, brook trout, and mountain whitefish currently provide important recreational fisheries. Recent studies have characterized fish population status and distribution in the Salmo River Watershed (Sigma 1996; Baxter et al.1998; Baxter 2001a, b, c, 2002a, b; 2003; Hagen and Baxter 2002, 2003).

Bull Trout

Bull trout are a blue-listed species in British Columbia. Blue listed species are any indigenous species, which are considered vulnerable in British Columbia. Vulnerable taxa are of special concern because of characteristics that make them particularly sensitive to human activities or natural disturbances. Bull trout are not found in streams where maximum monthly water temperatures exceed 18^{o}C and are most abundant where water temperatures are 12^{o}C or less (Goetz 1989, Ford et al. 1995, McPhail and Baxter 1996, Buchanan and Gregory 1997). This preference for cooler water manifests in the frequent association of bull trout with cold perennial springs (Oliver 1979, Goetz 1989, McPhail and Baxter 1996, Buchanan and Gregory 1997). In general, the species does not occur in high densities, a tendency that is partly due its life-history and the environment in which they live. Low population densities, slow growth, delayed maturation and high quality habitat requirements (water temperatures < 14^{o}C, spawning gravel with low % fines) make bull trout sensitive to habitat degradation and over-harvesting (Goetz 1989, Fraley and Shepard 1989, Ratliff *et. al.* 1996, Ford *et. al.* 1995, McPhail and Baxter 1996).

Recent radio telemetry studies have characterized bull trout populations and identified the distribution of the species in the Salmo River Watershed (Figure 3). Population studies indicate that bull trout population densities are low; further, adult bull trout populations are at or near values considered to be the minimum required for conserving fish populations in the Salmo River and tributaries (Baxter 2001c.).

Figure 3. Gerry Nellestijn holding captured Salmo River adult bull trout (SWSS photo).

Five key spawning areas have been identified in the Salmo Watershed. Primary spawning areas include the upper Salmo mainstem, Clearwater Creek, Sheep Creek, Stagleap Creek, and the South Salmo River. The operation of an adult capture fish fence on the South Salmo River further demonstrated the importance of the South Salmo River and tributaries for spawning bull trout (Figure 4; Baxter 2001b). Results of the telemetry studies and biological sampling suggest that bull trout populations are likely fluvial (i.e. they spend their entire lifecycle in the river), with the largest individuals reaching approximately 3-3.5 kg in size (Baxter, pers. comm.). While the spawning population has fluctuated in recent years, there is an abundance of available spawning habitat that is unused in some years. Bull trout also appear to exhibit high spawner fidelity. There is presently suitable rearing and overwintering habitat within the watershed for the bull trout population.

Figure 4. Adult bull trout fish capture fence located on the South Salmo River (SWSS photo).

Rainbow Trout

Rainbow trout are the key target species for anglers in the Salmo River Watershed. Recent radio telemetry studies have characterized components of the life-history of rainbow trout in the watershed (Figure 5). Those studies have identified primary foraging and overwintering areas. Current studies are ongoing, but it is known that rainbow trout spawn primarily in the mainstem Salmo River. It is expected that adult rainbow trout spawn in moderate gradient riffle areas comprised of small to medium sized gravels. Preliminary DNA analysis suggests that above barriers, tributary rainbow trout populations may be genetically distinct from those found in the main Salmo River (Baxter, pers. comm.), but the status of below barrier tributary rainbow trout relative to the mainstem population is currently unknown. Similar to the bull trout population, the abundance of adult rainbow trout is near minimum conservation requirements. Population numbers in the mainstem Salmo River in general are considered low (Hagen and Baxter 2002, 2003).

Figure 5. Adult rainbow trout following surgical implant of radio transmitter. Note the floy tag behind the dorsal fin, and sutures ahead of the pelvic fin (Gerry Nellestijn photo).

Table 2. Known fish species composition and distribution within the Salmo River and Pend D'Oreille Watersheds (FISS 2002, 2003; Sigma 1996; Baxter et al. 1998).

Species	Scientific Name	Distribution
Chinook Salmon	*Oncorhynchus tschawytscha*	Extirpated
Steelhead	*Oncorhynchus mykiss*	Extirpated
White Sturgeon	*Acipenser transmountanus*	Unknown
Kokanee	*Oncorhynchus nerka*	Unknown
Rainbow Trout	*Oncorhynchus mykiss*	Present
Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi*	Present
Bull Trout	*Salvelinus confluentus*	Present
Brook Trout	*Salvelinus fontinalis*	Present
Mountain Whitefish	*Prosopium williamsoni*	Present
Sculpin sp.	*Cottus sp.*	Present
Slimy Sculpin	*Cottus cognatus*	Present
Largescale Sucker	*Catostomus macrocheilus*	Present
Longnose Dace	*Rhinichthys cataractae*	Present
Northern Pikeminnow	*Ptychocheilus oregonensis*	Present
Redside Shiner	*Richardsonius balteatus*	Present

Fish species documented in the watershed are summarized in Table 2. Several species found in the Pend d'Oreille River are not found in the Salmo River. Those species include: brown trout (*Salmo trutta*), lake whitefish (*Coregonus clupeaformis*), pygmy whitefish (*P. coulteri*), Arctic grayling (*Thymalus arcticus*), black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), yellow perch (*Perca flavescens*), walleye (*Stizostedion vitreum*), tench (*Tinca tinca*), burbot (*Lota lota*), brown bullhead (*Ictaluris nebulosis*), peamouth chub (*Mylocheilus caurilus*), and carp (*Cyprinus carpio*).

Several fish species have been stocked in the watershed (in both lakes and streams), and include rainbow trout, brook trout, cutthroat trout, and kokanee. Stocking history of the Salmo River and lakes, and tributaries in the watershed is summarized in Table 3.

Table 3. Stocking History of the Salmo River Watershed (FISS 2002, 2003).

Species	Stock/Type	Stocking Dates	Number of Fish	Life cycle stage
Salmo River and tributaries				
Rainbow Trout	Swalwell, Boundary, Lardeau R., Pennask, Rosebud, Meadow Cr., Pinantan, Cottonwood	1931-1934; 1936-1953	25,000 Fingerlings; 461,000 Fry; 379,000 Eyed Egg	Fingerling; Fry; Eyed Egg;
Kokanee	Meadow Cr.	1940, 1941	170,000	Eyed egg
Brook Trout	Boundary, Spokane–HRY. –USA	1924-1930; 1940, 1942, 1945, 1949	Fry – 108,227; Eyed Egg – 80,000; Unknown – 50,000	Fry; Eyed Egg; Unknown;
Cutthroat Trout	CRH	1924	6000	Eyed egg
Barrett and Rosebud Lake (no stocking histories for Lost Lake Panther, Curtis, or Waldie (Wulf) Lake)				
Rainbow Trout (Barrett Lake)	Pennask-Premier, Pennask, Tunkwa, NRT Premier, 6 Mile, Badger, Lardeau R., Cottonwood	1935-1939; 1970; 1978; 1982; 1984-1992; 1994, 1996, 1998, 2000, 2002	Fall Fry – 23,400 Unknown – 25,280 Eyed Egg – 35,000	Fall Fry, Unknown, Eyed Egg
Rainbow Trout (Rosebud Lake)	Gerrard, Fraser Valley, NRT Premier, Pennask, Swalwell, Tunkwa, McLeary, Boundary, Loon Creek, Kiakho, Rosebud, Lardeau, Pinantan, Mineral, Six-Mile	1995-2003; 1989-1993; 1971-1987; 1967-1969; 1953-1965; 1937-1951; 1926; 1932;	Yearling – 37,980 Fingerling – 146,054 Fry – 535,045 Unknown – 108,600	Yearling, Fingerling, Fry, Unknown

3.3 Fish Habitat

Preliminary reach breaks have previously been identified on the mainstem Salmo River and some tributaries (Sigma 1996), and fish habitat assessments have been completed as part of a number of ongoing studies in the watershed. The locations, dates, and brief descriptions are summarized in Table 4. Preliminary review of available studies indicate that the mainstem and

tributaries provide reasonably good instream habitat for salmonids; percentage instream cover ranged from 18-90% in reaches 1 to 7 of the mainstem; however further comprehensive habitat assessment is required for the mainstem and several tributaries (Sigma 1996). Habitat assessment data should be interpreted with caution. While efforts have been made to standardize fish habitat assessment techniques (Slaney and Zaldokas 1997), criteria for determination of habitat quality are primarily based on coastal streams. Broad interpretation or interpolation of ranking criteria for interior B.C. streams may or may not be valid. It is hoped that recent habitat studies completed in the Kootenays will assist with the development of regional standards and ranking criteria. Further, current evaluation criteria are based on streams which have a wetted width of less than 15 m; the mean wetted width of the mainstem Salmo River ranges from 4.3 m to 33.0 m. Photographs of typical reaches of the lower mainstem Salmo River are shown in Figures 6 and 7.

The Salmo River mainstem and tributaries provide a variety of riffle, pool, run, and glide habitats. While spawning, rearing, and overwintering habitat appear to be adequate for existing population levels, it is unknown if pool frequency and the amount of LWD in the channel is adequate for higher population levels. Reduced water levels and low seasonal flows may limit functional habitat within the watershed; however previous studies indicate that fish habitat in the watershed is under-utilized (Sigma 1996). While spawning habitat may not be limiting for current rainbow and bull trout populations (Baxter 2002a; Hagen and Baxter 2003), late summer and winter overwintering habitat for larger fish may be limiting at higher population levels (Hagen 2003). As a result a quantitative assessment (i.e. Level 1 or Level 2 FHAP) should be considered. Dams on the Pend d'Oreille River downstream of the Salmo have also isolated Salmo River fish populations from the historic connections to the Pend d'Oreille and Columbia Rivers, and are discussed further in section 4.1.3 of this report. Instream cover (LWD) and typical spawning habitat are shown in Figures 8 and 9.

Table 4. Summary of reach breaks, fish population, and fish habitat assessments completed in the Salmo River Watershed.

	Number of Reaches	Fish Population	Fish Habitat	Water Quality	Water Temperature	Comments
Salmo River (mainstem)	7 (1)	1, 2, 4	1, 2, 3, 4	1, 2, - pH, turbidity;	1, 2, 5	Reach breaks identified in Sigma study; several population estimates completed in mainstem; sampling methods included electrofishing, snorkel surveys
South Salmo River	N/a	1, 2, 3 – 27 sites	1, 2, 3	1,2,3	1,2,3, 5	Decker et.al. Refer to two sample reaches; however these are not identified as consecutive reaches;1-one site sampled; 3-numerous sites; intensive sampling;
Stagleap Creek	N/a	1, 2, 3	1,2,3		-	Fish population estimates/ fish habitat completed at one site
Sheep Creek	N/a	2; 3-24 sites			1, 3	Fish population estimates/ fish habitat completed at one site
Erie Creek	N/a	2	N/a	N/a	1	IWAP completed by Atco; primarily an assessment of mass wasting, erosion, and buffer conditions;
Clearwater Creek	N/a	2, 3, 4	2, 4		1	Fish population estimates/ fish habitat completed at one site
Boulder Mill Creek	N/a	2	2, 4	2	2	Fish population estimates/fish habitat completed at one site
Porcupine Creek	N/a	2	2	2	2	Fish population estimates/ fish habitat completed at one site
Ymir Creek	N/a	2	2	2	2	Fish population estimates/fish habitat completed at one site
Hall Creek	N/a	2	2	2	2	Fish population estimates/ fish habitat completed at one site
Apex Creek	N/a	2	2	2	2	Fish population estimates/fish habitat completed at one site

1 – Sigma 1996; 2 – Baxter 2001a, b, c, 2002 a, b; 3- Decker et. al. 2002; 4 – Machmer 2001; 5 - Arndt 1998; 6 – Kokanee 1997;

Figure 6. Lower Salmo River – typical habitat. Photo taken January 20, 2003.

Figure 7. Lower Salmo River along Highway 6. Photo taken January 20, 2003.

Figure 8. South Salmo River near Highway 6. Note pool habitat and large boulder cover. Photo taken February 4, 2003

Figure 9. Typical LWD cover in the South Salmo River near Highway 6. Photo taken February 4, 2003

3.4 Water Quality

Historic effects on water quality in the Salmo watershed include mining (drainage from tailing ponds) and forestry. Mining activities can affect water quality in a number of ways: land clearing/excavation can affect surface drainage and overland flow into tributary streams; removal of vegetative cover can directly impact channel morphology, water temperature, and water quality, and drainage (surface or subsurface) from tailing ponds can provide chronic point-source pollution (Mining activities can expose rock and release materials such as metals into adjacent watercourses). There are a large number of inactive and abandoned mines in the Salmo River Watershed. Initial monitoring and restoration efforts should focus on those sites with the highest potential for surface water/groundwater contamination. A detailed description of mining activity in the watershed is provided in other documents listed in Appendix B (Heinbuch and Nellestijn 2000). The reader is encouraged to review this document for a more detailed summary of mining activity in the watershed.

The effects of forestry activities on streams are also well documented. Harvesting activities and road construction can result in elevated water temperatures, increased suspended solids resulting from road drainage, and changes in hydrology as a result of loss of forest cover. Other landuse activities in the Salmo River Watershed, which may affect water quality, include: agriculture, urbanization, infrastructure (forestry roads, highways, gas pipelines) and recreational activity (snowmobiling, skiing).

Primary impacts on water quality resulting from agricultural activities may include increases in nutrients (particularly phosphorous and nitrogen compounds), herbicides, and pesticides. Agricultural activities can also result in increased surface water/sediment runoff and changes in drainage patterns within a watershed. Urbanization typically results in an increase in impervious surface and subsequent overland flows, loss of recharge to groundwater, and stormwater runoff. Urban stormwater runoff can affect water quality by acting as a point source for lawn fertilizers, herbicides, and pesticides, as well as hydrocarbons and metals from road surfaces and parking lots. Water withdrawals for agricultural and domestic uses may also affect water quality, by reducing total volume (discharge and increasing concentration of pollutants. Stormwater runoff may also contribute fine sediments (sand) to watercourses. Additional impacts from urbanization include stream channelization and dyking to control flooding, and loss of floodplain/riparian areas. Infrastructure associated with urbanization (roads, highways, pipelines) affects physical features in the watershed through removal of riparian vegetation and forested corridors, and changes in surface and groundwater drainage/movement patterns.

Roads, highways, and developed corridors (hydro, railways, pipelines) can also act as point sources of pollution (sediments, road sand and salt, herbicides to control noxious weeds). Sanitary and stormwater outfalls from urban areas such as Salmo and Ymir (i.e. sewage treatment facilities, septic systems) can act as point sources for pollution including nutrients (phosphorous, nitrogen), hydrocarbons (fuels, automobiles), herbicides, and pesticides.

Most studies undertaken in the Salmo River included basic water quality evaluation (water temperature, pH, turbidity); however few comprehensive water quality studies have been undertaken in the watershed. The exception to this statement was a pre-fertilization monitoring study of the South Salmo River and Sheep Creek, initiated in 2001. This study collected baseline fish population and fish habitat information, and developed a scientific approach to evaluating the potential effects of stream fertilization on fish and fish habitat in the South Salmo River and Sheep Creek (Decker *et al.* 2002). Pre-fertilization studies continue in 2002, and are planned for 2003. The loss of anadramous salmonid populations, and resulting loss of marine nutrients, may have had significant impacts on water quality and productive capacity in the watershed.

3.5 Water Temperature

There are no year-round temperature monitors in the Salmo River Watershed. Seasonal temperature records for the Salmo River are available from CBFWCP; however the available data set is small (vandalism/loss of thermographs). Many of the studies have obtained spot (instantaneous) water temperature readings as components of their water quality sampling protocol. Effective temperature studies have been hampered by loss of thermographs (Arndt 1997; Baxter and Nellestijn 2000). While water temperatures currently appear to be adequate for trout populations, salmonids in general, and bull trout in particular, are extremely sensitive to changes in the temperature profile in a given watershed. With the historic loss of the riparian vegetation around much of the Salmo River, reduced flows resulting from water licenses, and the shallow braided nature of the stream channel, maximum summer temperatures may exceed historical values and should be further investigated. Global climate changes may further affect the viability of some fish populations.

3.6 Hydrology

Water Survey of Canada (WSC) has recorded flow data for the Salmo River from 1936 to 2003. Two WSC gauge stations were maintained in the Salmo Watershed. The first gauging station (Station No. 08NE044) near Waneta (Latitude 49.02.49N, Longitude 117.17.37W) operated from 1936-1946 (Figure 10), while the second gauge station (Station No. 08NE074) at km 7.9

on the mainstem Salmo River near Salmo, B.C. (Latitude 49.01.49N, Longitude 117.22.26W) was operated from 1949-2003 (Figure 11).

Historical flow data (1914-1995) was summarized to provide mean monthly and mean annual discharge of the Salmo River including annual extremes (Table 5; Appendix D). The Salmo River has a snow-dominated runoff with high flows between April and July, which peak in May typically, and low flows in January and February (Figure 10). Mean annual discharge ranged from 17.7 m^3/s in 1977 to 40.4 m^3/s in 1972 (Figure 11). Average flows at Salmo, during the low flow period from August to October, and January - February, are less than or equal to 10 m^3/s (Figure 11). The top five maximum daily discharge records were obtained from the WSC database and summarized in Table 5 for comparison with the five lowest records for the period 1949 to 1995.

Table 5. Extreme (Top 5) discharge records for the past 52 years on the Salmo River (WSC 2003).

Date (mm/dd/yy)	Five Lowest Maximum Daily Flow (m^3/s)	Five Highest Maximum Daily Flow (m^3/s)
December 26, 1952	1.64	-
February 6, 1975	2.40	-
December 4, 1972	2.61	-
January 7, 1953	2.66	-
September 30, 1967	2.72	-
May 21, 1956	-	309
June 2, 1968	-	334
May 19, 1954	-	337
June 16, 1974	-	351
April 29, 1990		382

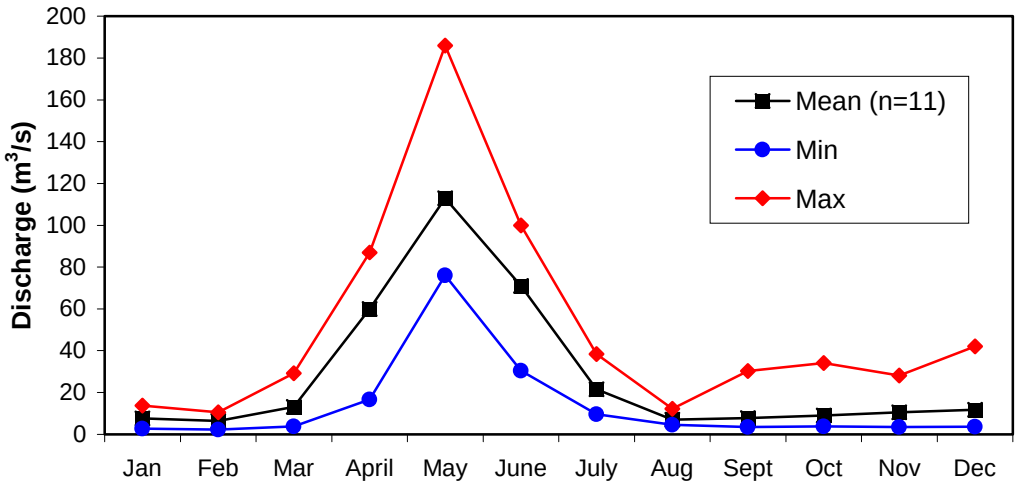


Figure 10. Mean monthly discharge (m^3/s) for the Salmon River at Waneta (Station ID 08NE044) for the period of record 1936-1946).

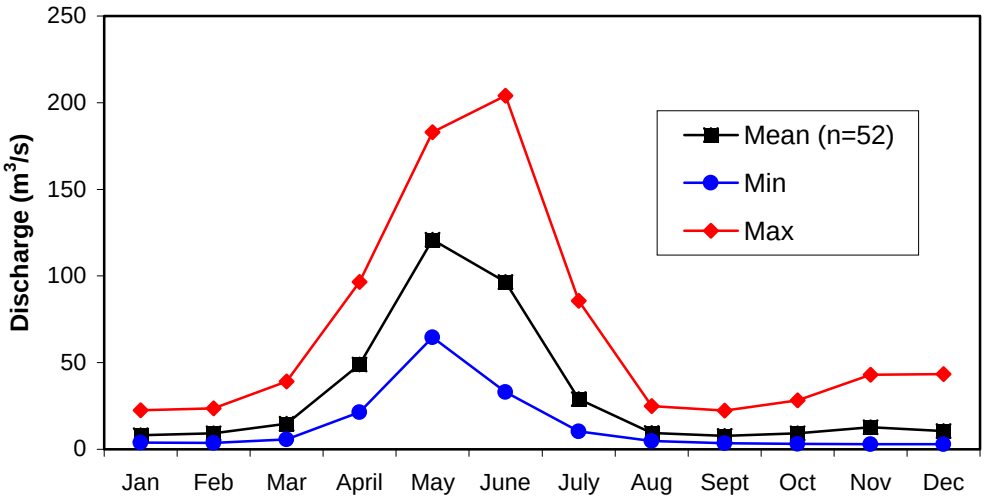


Figure 11. Mean monthly discharge (m^3/s) for the Salmon River at Salmo (Station ID 08NE074) for the period of record 1949-1995.

3.7 Riparian Systems

Riparian vegetation plays a critical role in maintaining the form and function of stream channels. Rooted vegetation also provides significant nutrient uptake (phosphorous, nitrogen), helps to moderate stream flows and the hydrologic regime, and stabilizes sediment transport/erosion rates along the water/land interface. Riparian corridors can also provide important buffers to adjacent landuse activity. Further, LWD recruitment to the active stream channel is critical in formation of the stream channel and the provision of instream cover. Riparian vegetation also plays a critical role in nutrient cycling for the stream, by providing continuous nutrient input for primary production. Leaf litter (allocthanous supply) falling into the stream provides food for phytoplankton, zooplankton, and aquatic (benthic) invertebrates, which form the basis of the food chain.

Healthy riparian systems are integral components of health aquatic (and terrestrial) ecosystems. Historically large cedar and hemlock forests were found in the Salmo Watershed (Figures 12 and 13); most of the old growth forest is gone (less than one percent left - C. Steeger, pers. comm.), and the current riparian/upland areas consist of primarily 2nd growth – much of the remaining riparian area along the mainstem was burned off in 1930's, both as a result of forest fires, and to expose rock for mines (Sigma 1996). The existing riparian vegetation is relatively contiguous today; however the form and ecological functions have been dramatically changed. The riparian component of the watershed profile is described in detail under separate cover (Steeger 2003).

Figure 12. Riparian Structure typical of historic Salmo Watershed (photo source: Bernarine Stedile Family collection).

Figure 13. Old growth stump from the Salmo Watershed (photo source: Bernarine Stedile Family collection).

4.0 Effects on Fish Habitat/Populations

4.1 Land Use

4.1.1 Forest Harvesting Activities

Historic forest activities in the watershed were concentrated in the tributary valleys. Early logging activity was undertaken using horse logging crews to remove cedar and white pine, which supplied local sawmills. Sawmills were located in the Salmo area, as well as Clearwater, Lost, and Erie Creeks. There were numerous small to medium sized forest companies harvesting within the Salmo River Watershed in the late 1800' and early 1900's, and most of the harvested timber was used to produce boards/cedar planks and shingles.

The primary impact to the Salmo River as a result of early forestry activities is the loss of riparian habitat. The loss of the large cedar (8' diameter) and hemlock forest has significantly altered the ecosystem and may contribute to channel instability, and substantially reduce the amount of pool habitat and LWD complexes. Today, these same areas are dominated by cottonwood species, as well as smaller coniferous plots (second growth – lodgepole pine, cedar, hemlock, spruce, sub-alpine fur). With expansion of the forest industry in the 1940's, road networks also placed increasing pressure on forest (and stream) resources and allowed increased recreational use in potentially sensitive areas of the watershed,

Although the upland areas of the watershed are not the focus of this research, prior to instream restoration works, this assessment should be completed. More than one stakeholder and/or agency representative has expressed concern that upstream activities such as forest harvesting may be adversely impacting the Salmo River.

4.1.2 Land Development: Agriculture, Transportation, and Mining

Agriculture and urbanization appear to have had minor impacts in the Salmo River Watershed, relative to other landuse activities; however, these developments (dyking of the main Salmo near Salmo, and Erie Creek) have had localized impacts on fish habitat and fish communities. Several major infrastructure projects (i.e. pipeline construction, BNR Railway) traverse the mainstem river valley and tributaries; Provincial Highways parallel the Salmo and South Salmo rivers for a long distance. Probably one of the most significant landuse activities in the watershed, from the 1800's to the present day, has been the extensive mining activity throughout the watershed. Mining activity within the watershed is described in great detail

(Heinbuch and Nellestijn 2000) in separate reports; the reader is encouraged to obtain copies of those publications for further reading.

Land-use activities can also have significant impacts on surface water and groundwater conditions in the watershed. In particular, forest harvest and related activities (road building), mining (exploration, tunneling, tailing ponds) have the potential to significantly alter surface water and groundwater movement (collection, storage, and release) patterns as well as ambient water quality (i.e. potential for elevated metals from mining activities).

4.1.3 Hydro-electric Development

There are no hydroelectric facilities on the mainstem Salmo River and its tributaries. Several hydroelectric facilities are located on the Pend d'Oreille and Columbia Rivers further downstream. Both dams on the Pend d'Oreille system are barriers to all species (FISS 2003). Migratory salmonids have been extirpated from many sections of the Columbia River and tributaries (including the Salmo River) because of the construction of dams. The dam that formed Seven Mile Reservoir, was constructed in 1979, and the reservoir reached full pool in 1988. The dams on the Pend d'Oreille River have eliminated access to the larger tributaries (on the Columbia and Pend d'Oreille Rivers downstream). Theses tributaries may have been very important to the bull trout and rainbow trout populations in the Salmo Watershed. The Salmo drainage is now isolated.

Fish habitat mitigation and compensation opportunities were identified in environmental studies completed prior to construction of the dam. A weir was constructed on the lower Salmo River in an attempt to prevent non-sportfish species from migrating into the lower Salmo River from the Pend d'Oreille River, and possibly competing with resident species. A recent radio telemetry study identified that the barrier currently does not function in its intended design (Baxter 2001a); however, it may act as a seasonal barrier. Anecdotal reports from anglers have suggested higher population levels for non-sport species such as northern pikeminnow and sucker species in the lower river; however recent studies have suggested that those populations have limited impact on sport species (Baxter and Nellestijn 2000). Continued monitoring of non-sport fish populations should be included as part of larger long-term monitoring programs. B.C. Hydro has also provided funding for numerous studies of fish populations in the Salmo River, including those completed for bull trout and rainbow trout populations, as part of the requirements for the Unit Four upgrade of the Seven Mile Dam.

4.1.4 Traditional Use

There were no settlement sites for first nations people in the Salmo River valley. The Kalispell and Sinixt First Nations Bands historically depended on Salmo River chinook salmon and steelhead, and to a lesser extent resident trout as a food source; however those bands would follow other significant food sources/species (i.e. bison, caribou, sturgeon), but also relied on Columbia River (and Salmo River) salmon and trout as important food sources (Salmo Watershed Streamkeepers Society 1999). There is currently ongoing discussion to determine the role and history of first nations in the watershed, specifically as they related to salmonid populations.

4.2 Harvest/Recreation

The Salmo River is an important recreation area to local residents. Much of the river and its tributaries are accessible to recreational users (including anglers, boaters, kayakers, and rafters) due to the extensive road network and highway infrastructure (Highways 3 and 6 parallel the mainstem, South Salmo River, and Stagleap Creek for extensive sections). Snowmobiling, and increased traffic on valley logging roads also have potential to negatively affect water quality and water quantity. Ski hill development may also have localized recreational impacts (i.e. water quality, sediment) in the watershed. In addition, the Ministry of Forests historically maintained day-use sites at Erie, Clearwater, and Sheep creeks as well as Wulf and Panther lakes (Arrow and Kootenay lake Forest District Recreation Map).

Expansion of the Rails-to-Trails program, and increased use of motorized vehicles along the BNR railway line may also have localized recreational impacts (i.e. water quality, sediment, increased harvest, and poaching activity) in the watershed. Angling on the Salmo River historically targeted chinook salmon, steelhead, and resident trout as sustenance fisheries. Today, local residents have indicated that they are disappointed with the sport fishery in the Salmo River. Reasons are attributed to a lack of salmonids and an increase in the presence of non-sportfish in the lower river.

4.3 Migration Barriers

There are currently no significant permanent barriers to fish migration in the mainstem Salmo River, but there are several barriers on its larger tributaries. The BC hydro weir may also act as a seasonal barrier for some fish species. There is an impassable falls on the lower section of Ymir Creek; however the impact of this barrier is limited to local fish populations, and does not appear to have a significant impact on either rainbow trout or bull trout populations. Other

barriers are also found on lower Stewart Creek, upper Clearwater Creek, lower Hidden Creek, and upper Swift Creek. There was a natural log jam on Sheep Creek which was reported to have prevented the upstream migration of bull trout in recent years; however natural logjams and barriers are frequently encountered on streams throughout the Kootenays, and caution should be exercised when contemplating their removal. Removal of such natural barriers may have other adverse effects (i.e. channel stability), which may negate any potential benefits. Biodiversity issues, species at risk, and genetic diversity are important considerations in any potential removal/alteration. Qualified engineering/biology personnel prior to removal/alteration should carefully review all such activities.

5.0 Conservation

5.1 Fish Populations and Fish Habitat

This section provides a summary of overall fish habitat conditions within the Salmo River based on review of the previous studies. More detailed habitat assessment and fish distribution information is normally collected through Level 1 and 2 Field Assessments based on recommendations from an Overview FHAP.

Recent bull trout and rainbow trout radio telemetry studies have provided important information about spawning and overwintering habitat, particularly for bull trout, in the watershed. Key spawning and overwintering areas may require special consideration for protection, if populations of those species are to be protected and restored. The interactions between mainstem and tributary populations also needs to be further understood. Study results may have important implications for angling regulation changes and fish habitat protection.

All indications are that sport fish stocks are at low levels in the Salmo River, but there is no “pre”-study (i.e. historic) data. In addition, despite restrictive fishing regulations over the last four years aimed at protecting Salmo River bull trout, adult populations have not yet shown a significant increase. In contrast, other East Kootenay streams with similar conservative regulations have resulted in significantly improved fisheries over a short period of time (B. Westover pers. comm.). The East Kootenay stocks are primarily adfluvial whereas Salmo River bull trout are fluvial. There may be several reasons for this difference in the other streams:

- Higher overall habitat quality or access to more suitable spawning, rearing, foraging habitats (e.g. kokanee in Lake Koocanusa);

- Higher nutrient levels which result in increased productivity;
- Higher baseflow levels; and,
- Higher initial population levels prior to implementation of regulations.

While the above list is not complete, it provides some initial discussion point for subsequent evaluation. The Salmo River has been identified as the only stream tributary to the Canadian portion of the Pend d'Oreille River with viable bull trout populations.

Rainbow Trout

Previous studies have identified that adult rainbow trout population densities are currently at or near minimum levels required for conservation of the species (Hagen and Baxter 2002); however angling regulations currently allow for the harvest of 2 trout over 30 cm in the watershed (BC Ministry of Fisheries 2003). Conservative angling regulations that will restrict harvest for rainbow trout are to be implemented in 2003/2004. Conservative angling regulations have been effective in restoring and maintaining fish populations (primarily westslope cutthroat trout and bull trout) in the East Kootenay (B. Westover, pers. comm.); however, complete closure of the Slocan River to angling since 1994 has not resulted in an increase in adult rainbow trout (Oliver 2001).

Bull Trout

Complete catch and release angling regulations for bull trout were implemented in 1999 in the entire Salmo River Watershed. Bull trout populations were at very low levels (Baxter, 2003) and although population numbers have fluctuated in recent years, they continue to be at or below levels required for species conservation (Baxter, pers. comm.). While some fish populations respond quickly to changes in angling regulations, population responses may take several generations without additional stimulus. For many trout and char species, that reach sexual maturity at 3-5 years of age, population responses (i.e. increases) to conservative angling regulations may not be observed for 5-10 years, particularly if the existing population densities are very low. Also, if habitat conditions are limiting, reduced harvest will have little or no effect (e.g. Slocan River). Continued monitoring of the recovery of bull trout populations should therefore be considered to be a priority.

Other Species

Quantitative fish inventories in the watershed have focused primarily on bull and rainbow trout; however these population surveys have also documented relative numbers for non-sport species (i.e. largescale sucker, sculpins, mountain whitefish, northern pikeminnow) at specific

sample sites. Further, an inventory of sucker and pikeminnow populations was completed as part of the evaluation of the non-sportfish barrier on the lower Salmo River. While there is a public perception that these non-sportfish populations have increased significantly in the lower river and have impacted sport fish, recent studies suggest this is not the case. Recent population surveys and tracking studies have documented that non-sportfish are primarily distributed in the lower mainstem of the Salmo River, while spawning and juvenile rearing habitat for trout and char is concentrated in the upper mainstem and tributaries. As a result competition between sport and non-sport fish is likely limited (Baxter and Nellestijn 2000; Baxter 2001a).

While fisheries inventories have been conducted in the upper watershed where forest harvesting has occurred (Kokanee 1997; Masse 2000), detailed fisheries information for the Salmo River is generally lacking. The fish distribution and abundance information presented in this section is based on information found in the FISS database and reference materials listed in Appendix B. The data consists primarily of presence/absence and provincial stocking reports, with some relative abundance data. At present, there is very little information concerning species assemblage, management status or key habitats within the system. The Salmo River currently has two provincial blue-listed species (bull trout and Westslope cutthroat trout). "Blue-listed" is a species of special concern while "red-listed" species are likely to become endangered if limiting factors are not reversed. There are currently unique populations (likely small) of Westslope cutthroat trout in the watershed.

5.2 Wildlife

While all wildlife within the watershed play a significant ecological role (fish are also considered 'wildlife'), this section specifically refers to Harlequin ducks for two reasons. Harlequin ducks are directly connected to riverine habitat during the breeding period (foraging and rearing broods), and may compete with resident fish species. Harlequin ducks are also very sensitive to disturbance/habitat alteration, and can be considered a keystone species to the ecology of some watersheds. For these reasons, they are the only wildlife species identified in this report. Many other species (i.e. bears, piscivorous birds, otters, and other predators) rely directly or indirectly on the aquatic ecosystem to sustain part or all of their life-history.

Harlequin Ducks

The Harlequin duck (*Histrionicus histrionicus*) is a sea duck that migrates to undisturbed, turbulent mountain rivers and streams to breed (Figure 14). Harlequin ducks feed primarily on

aquatic invertebrates (mayflies, stoneflies, caddis flies), and are found on the Salmo River mainstem (Clearwater to Wallack Creek) as well as the lower sections of Clearwater, Erie, and Sheep creeks, and the South Salmo River. Recent studies have been undertaken in the watershed to determine the status, and distribution of the bird, and to assess available brood habitat. Populations in the watershed appear stable, although the relative population in Sheep Creek has declined (Machmer 2001). Harlequin ducks are sensitive to disturbance, and are therefore excellent indicators of ecosystem health. Harlequin ducks are currently being considered for yellow listing in B.C.

Figure 14. Harlequin Ducks in the Salmo River (Jakob Dulisse photo).

6.0 Limiting Factors

Previous studies have indicated that habitat for fish in the mainstem and tributaries is currently under-utilized (Sigma 1996). Key factors limiting the level of fish sustainability in the watershed likely include the following:

- Small human population and limited industrial economic base to develop funding for subsequent studies, restoration, and implementation of subsequent plans;
- Remote areas for data collection and monitoring;

- Study and information requirements can be expensive to undertake; and,
- Low population abundance of key fish species (i.e. bull trout, rainbow trout, harlequin ducks).

There are, however, opportunities within the watershed that can facilitate the development and completion of a fish sustainability plan. Those opportunities include:

- A strong and committed watershed stewardship group (SWSS);
- An enthusiastic and supportive community (First Nations, public, industry, regional district, forest licensees, municipal government, BC Hydro, provincial and federal agencies);
- The foundations (physical, chemical, biological components) for healthy, viable fish populations appear to still be present in the system; and,
- Recent studies have provided some very good information describing life-history and habitat requirements for keystone species (bull trout, rainbow trout).

7.0 Discussion

Extensive mining and exploration has likely had broad impacts on water quality, aquatic habitat, and landuse throughout the watershed. In the 1930's riparian vegetation along many sections of the mainstem river was burned to expose bedrock for mine exploration, and most of the original old growth forest was harvested and removed. There is currently less than one percent of the original old growth cedar forest remaining, and second growth conifer and cottonwood forest dominates the watershed.

While the current forest is contiguous throughout much of the watershed, and will provide long-term channel stability and LWD recruitment to the stream channel (important for channel forming and maintenance functions), the historic ecological function of the original watershed has been significantly altered/lost. In particular, it is likely that the amount of LWD and associated deep water habitat has been substantially reduced from historic levels.

Channelization of the lower section of Erie Creek, and the mainstem Salmo rear through the town of Salmo has had significant impacts on channel stability. Confined flows and resulting increases in stream energy restrict the ability to establish LWD and a 'dynamically stable' channel form through those reaches. Lack of stable LWD in those reaches reduces the fish

habitat available, as well as the potential for habitat development/creation, particularly for foraging/overwintering adult salmonids.

In addition, the loss of salmon runs have undoubtedly altered the present fish community in the Salmo River; further, the loss of their nutrients to the riparian system and watershed in general likely also have had detrimental impacts on the productivity in the watershed. Since pre-logging and mining data describing fish (and wildlife) populations for the Salmo River watershed is non-existent (other than anecdotal information and presence/absence), it is extremely difficult to assess the ultimate level of impact.

In some cases fish populations and communities were completely wiped out. Remnant populations for some species are present in the watershed, however historic population levels are unknown. Targets for fish populations and communities in the Salmo River Watershed need to be developed and evaluated, and compared to similar watersheds in the Kootenays; however population/community targets have not been developed or established for other watersheds in the Kootenays. Further, habitat evaluation criteria (i.e. percentage pools, LWD) have not been developed for interior streams; predictive models for fish population densities and fish habitat are based on coastal streams. These targets can be very useful tools in developing and evaluating stream/watershed restoration programs. Unfortunately, while a significant database is available for streams in the interior, the data has not been analysed to develop rating criteria. Typically population targets are based on establishing sustainable fisheries for commercial or recreational species such as trout and salmon (i.e. number of fry per m^2, number of out migrating fry, etc.). While the target may or may not be achievable, it provides a reference point for evaluation of restoration programs, and the targets can be revised as better statistical tools become developed.

While it may be possible to restore/develop some fish populations to viable levels that can support recreational fisheries; other populations may be more difficult to restore, and may not be capable of supporting a recreational fishery. Targets and benchmarks for keystone species (i.e. bull trout, rainbow trout) will have to be developed during the completion of the watershed plan.

7.1 Preliminary Restoration Alternatives

It is premature to assign prescriptions and restoration alternatives for the Salmo River before species composition, relative abundance, distribution, habitat use and life-history requirements of its resident fish populations have been determined. It is also important to note that *whole watersheds* are the units which overview assessments and restoration plans should be developed. Nevertheless, channelization on Erie Creek and the mainstem Salmo River,

seasonal low flows, low nutrient levels, low fish population levels for key species (rainbow trout, bull trout), aggradation (bedload transport capability), and riparian loss are five potential problems which have been identified in background reports compiled as part of this watershed profile.

Sites that could benefit from rehabilitation and/or enhancement measures have not yet been clearly identified and/or totally evaluated. More detailed habitat assessments need to be undertaken in order to identify specific restoration measures. The following types of reclamation and enhancement activity could be considered:

- Bank stabilization (where appropriate), existing works repair (e.g. mine site, mine tailings removal) and riparian restoration;
- Habitat complexing;
- Side-channel flow augmentation; and,
- Stream Fertilization (South Salmo River/Sheep Creek).

Habitat complexing enhances species diversity by creating a variety of habitats within stream reaches. Habitats are partitioned among individual species and life-history stages have different tolerances for velocity, depth, and cover. By increasing habitat heterogeneity within a reach, one can indirectly improve fish stocks by increasing channel carrying capacity. Flow augmentation and habitat complexing may improve carrying capacity and provide some flood relief. In addition, creation of off-channel and/or side channel habitat, particularly in previously channelized sections of river (i.e. Erie Creek), may improve productivity for juvenile salmonids.

Large woody debris should not be removed or circumnavigated until fish use of individual reaches has been determined. Natural barriers should be left intact since their role in shaping fish species composition and distribution is essential within watersheds. Fish population and riverine habitat inventories (Level 1 and II FHAPs) will determine the relative importance of individual reaches and help assign future reclamation and enhancement priorities.

7.2 Recommendations

Existing sensitive habitat (i.e. spawning, overwintering) should be protected in concert with provincial Best Management Practices (BMP's) and the promotion of public awareness of ecosystem values within the watershed. Through the development of the fish sustainability plan, the technical and steering committees should continue to work with existing legislative bodies (federal, provincial, and municipal) to develop and promote conservation-minded

strategies and ensure a pro-active approach to landuse changes, development (urban, forestry, mining, infrastructure, agriculture) as part of plan implementation.

Flood protection works should also emphasize natural restoration techniques that accent channel morphometric features rather than creating additional structures. Incorporation of logjams and rootwads within flood control measures would be appropriate techniques. Prior to implementation of potential restoration plans within the Salmo River, the following study recommendations are provided:

1. Complete the riparian assessment and analysis for the watershed;
2. Complete a Level 1 Fish Habitat Assessment on the mainstem Salmo River;
3. Assess water quality status and impacts on aquatic invertebrates and fish populations;
4. Continue to monitor bull trout and rainbow trout populations and their response to changes in angling regulations;
5. Continue to develop a comprehensive understanding of seasonal habitat utilization by target species in the mainstem and tributaries, particularly for rainbow trout;
6. Characterize the annual thermal regime of the Salmo River;
7. As restoration projects are developed, review channel assessment and preliminary restoration options with a geomorphologist, hydrologist, fish biologist, and engineer;
8. Continued monitoring of non-sport fish populations within the Salmo, and evaluate their impact on resident fish communities;
9. Continue/complete the development of a comprehensive GIS database for the watershed; and,
10. complete the subsequent tasks (technical and planning) as outlined in stage 2 of fish sustainability planning.

Fish population and riverine habitat assessments (Level 1 and 2) can be used to quantify existing habitat resources (depth, velocity, substrate and cover criteria). Habitat utilization data can be collected seasonally using a variety of sample techniques designed for different life-stages (electrofishing, G-traps, hoop nets, snorkeling). Habitat preference data and the relative importance of habitat types can then be used to help design a fisheries management plan. Population specific habitat data can then be incorporated into future Salmo River reclamation and enhancement projects. Long-term monitoring stations (fish populations, fish habitat, water

temperature, water quality, benthic invertebrates) should be developed based in part on previous studies to establish baseline conditions throughout the watershed, and develop long-term targets for evaluating the relative success of conservation and restoration efforts.

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Appendix A

GIS Mapping/Remote Imagery Information Sources

Salmo WFSP - Information Resources

GIS / Mapping / Remote Imagery

Mapping/Imagery Resource	Scale	Description/Comments
Forest Cover Covering the Salmo mainstem ?	1:20,000	082F.034 082F.025 082F.024 082F.014 **Still Need**: 082F.045 (Koot L) 082F.044 (Koot L) 082F.035 (Koot L ?) 082F.004 (Arrow)
Air photos	~1:15,000	South Salmo: 30BCB90127 No.75 30BCB90127 No.183 30BCB90127 No.185 30BCB90127 No.269 30BCB90127 No.271 Koot Lake: 30BCB00020:71-74 115-117, 148-149 30BCB00021: 200-201, 223-224 **Still Need**: Arrow Lake: flight Line: B99011 Photos: 12,13,96,97,127,128,211,212, 246, 247 (from the map B-018-FI-99_82f.) B99021: 127,128 (B-018-FI-99_82f.) B99032: 202,203,228,229 (B-018-FI-99_82f.) B99033: 54,55,77,78,183,184,214,215 (B-018-FI-99_82f.) B99034: 40,41,74,75,76,77,78,79 (B-018-FI-99_82f)
Orthophotos	1:20,000	Have hard copy but not very useful as orthophotos due to lack of clarity 082F.034 082F.025 082F.024 082F.014 082F.004
TRIM wetland		
TEM (South Salmo)	1:20,000	Airphotos have TEM delineation on them
PEM		Kootenay Lake F.D.: …….

		Arrow F.D.: …….
RDCK info layers: **Floodplain** **Zoning** **Cadastral**	1:20,000	Floodplain: 082F.025 082f.024 082F.014 (not complete set) Zoning: none yet Cadastral: none yet
Cottonwood distribution	1:20,000	082F.034 (South of Elise Creek) 082f.024 (South of Porcupine) 082f.014

Appendix B

Bibliography of Available Publications on the Salmo River Watershed

Acres International Ltd. 1990. Floodplain Mapping Salmo River – Design Brief, prepared for Environment Canada – Inland Waters Directorate and BC Environment – Water Management Division. Prepared by Acres International Ltd.

Design brief describing floodplain mapping for the Salmo River.

Arndt, S.K. 1998. Slocan and Salmo Rivers temperature monitoring summer 1997. Columbia Basin Fish and Wildlife Compensation report, File No. 1433-28. 19p. Rec. #: 20984.

Provides a summary of a water temperature monitoring program undertaken in the Slocan and Salmo Rivers by CBFWCP in the summer of 1997. Three sites were sampled in the Salmo River; however the temperature recorder (Ryan Instruments) placed at the initial site (near Salmo) was moved to the Slocan, to replace a missing recorder there. The second recorder was moved further downstream part-way into the study, as water levels receded. Vandalism was identified as a problem with deployment of the tempmentors. As a result, the available temperature data for the Salmo River component of the study is limited.

Baxter, James and Baxter Environmental. 2003. Bull trout studies in the Salmo River Watershed: 2002. Report Prepared for B.C. Hydro. Report prepared by Baxter Environmental.

The report summarizes the results of bull trout monitoring in the Salmo River Watershed in 2002 by B.C. Hydro. Work conducted in 2002 included index swims within the mainstem Salmo River, and spawner and redd counts in known headwater and tributary areas. The report summarizes results of field studies and provides analysis. The report also standardizes estimates of escapement over the past five years in order to allow annual comparisons of escapement.

Baxter, J. 2002. Bull trout studies in the Salmo River Watershed: 2001. Report prepared for B.C. Hydro. Prepared by Baxter Environmental. 10 p. + appendices. Rec. #: 21466.

Summarizes bull trout studies completed in the Salmo River Watershed in 2001.

Baxter, J. 2002. Summary of the third year of bull trout (*Salvelinus confluentus*) radio telemetry in the Salmo River Watershed. Prepared for Columbia-Kootenay Fisheries Renewal Partnership and B.C. Hydro. Prepared by Baxter Environmental. 13p. + references. Rec. #: 21467.

Summarizes the third year of bull trout radio telemetry in the Salmo River Watershed.

Baxter, J. 2001a. Bull trout studies in the Salmo River Watershed: 2000. Report prepared for B.C. Hydro. Report prepared by Baxter Environmental. 16 p. + 3 appendices. Rec. #: .

The report summarizes the results of studies undertaken by B.C. Hydro in 2000. The report focuses on documenting the status of the bull trout population in the watershed, and collecting data that can be used for habitat enhancement purposes. Provides some recommendations for stream fertilization, Barrier/Log Jam removal, and additional studies.

Baxter, J. 2001b. Summary of the South Salmo River bull trout enumeration project (2000). Report prepared for the Columbia-Kootenay Fisheries Renewal Partnership. Report prepared by Baxter Environmental.15 p. Rec. #:

An enumeration fence and traps were installed on the South Salmo River from September 11th to October 24th to enable the capture of post-spawning bull trout emigrating out of the watershed, and to capture five additional bull trout for the ongoing radio telemetry project. In total, seven males and eight females were processed through the fence. The project was also used as an educational tool for local elementary and high school students.

Baxter, J. 2001c. Aspects of the biology of bull trout in the Salmo River Watershed as identified through radio telemetry (2000/2001 data) and a watershed management plan for the species. Report prepared for the Columbia-Kootenay Fisheries Renewal Partnership, and B.C. Hydro. Report prepared by Baxter Environmental.75 p. + 1 appendix. Rec. #: 20961.

Over two years (1999-2001) a total of twenty bull trout were implanted with radio tags in the Salmo River watershed to determine life-history and habitat use of the population. The specific objectives of the project were to identify major spawning, summering and overwintering areas, as well as to provide data on migration and spawning timing. A secondary objective was to determine if there was a migration to, or from, Seven Mile Reservoir by radio tagged bull trout. The report also summarizes the current status of the Salmo River bull trout population, and makes recommendations as to future management requirements.

Baxter, J. and G. Nellestijn. 2000. Aspects of the biology of bull trout in the Salmo River Watershed as identified through radio telemetry. Report prepared for the Columbia-Kootenay Fisheries Renewal Partnership. Report Prepared by Baxter Environmental and the Salmo Watershed Streamkeepers Society. 47p. + 1 appendix. Rec. #: 20961.

A total of ten bull trout (eight females and two males) were implanted with radio tags in the Salmo River watershed (nine in the mainstem Salmo River and one in Clearwater Creek). Bull trout were tracked during migrations to spawning areas and overwintering areas in the Salmo watershed. The report documents migration patterns and spawning/overwintering habitat for the bull trout tracked during the study.

Baxter, J., and G. Nellestijn. 2000. Report on non-sportfish abundance and migration patterns in the Salmo River. Prepared for Columbia-Kootenay Fisheries Renewal Partnership and Columbia Basin Trust. Prepared by Baxter Environmental and the Salmo Watershed Streamkeepers Society. 15p. Rec. #: 21319.

Documents the seasonal abundance and migration patterns of non-sportfish species (suckers and northern pikeminnow) in the Salmo River below the town of Salmo. Discusses movement and distribution of those species in relation to the constructed fish barrier, and effects on sportfish populations.

Baxter, J. and Baxter Environmental. 1999. Bull trout studies in the Salmo River Watershed: 1998 and 1999. Report prepared for B.C. Hydro. Prepared by Baxter Environmental. 16p. + 9 appendices. Rec. #: 21266.

The report summarizes the results of studies that have been undertaken in the Salmo River watershed by B.C. Hydro in 1998 and 1999. The work focused on documenting the status of bull trout population in the watershed, and on collecting data that can be used for habitat enhancement purposes. Specific components of the work included redd counts, snorkel surveys, water quality and temperature monitoring, and juvenile assessments.

Baxter, J. and Baxter Environmental. 1999. Summary of bull trout studies in the Salmo River Watershed 1997, 1998, 1999 (overhead presentation). Rec. #: 21239.

Overhead presentation summarizing results of bull trout studies completed in the Salmo River Watershed, 1997-1999.

Baxter, J.S., W.D. Coughlin, B.M. Pennington, and G.G. Oliver. 1998. Synoptic bioreconnaissance of bull trout distribution and abundance in the Salmo River Watershed. Report to B.C. Hydro, Environmental Department, Castlegar, B.C. Report by Interior Reforestation Co. Ltd., Cranbrook, B.C. xii + 119 p. + 7 appendices. Rec. #: 21258 (note – the draft report is Rec. # 20939)

Study was commission by B.C. Hydro to determine the distribution and population status of the bull trout population in the Salmo River drainage. Specific objectives of the study included: 1) habitat and population assessment at index sites throughout the watershed; 2) identification of bull trout spawning locations; and 3) recommendation of possible habitat enhancement sites for consideration. The report documented the results of the study and provided preliminary recommendations.

Baxter, J. 2001. Assessment of a constructed non-sportfish migration barrier on the Salmo River using radio telemetry and floy tagging. Prepared for B.C. Hydro. Prepared by Baxter Environmental. 31p + appendices.

Provides an evaluation of the effectiveness of the constructed non-sportfish barrier on the lower Salmo River. Northern pikeminnow and adult suckers were observed to identify the effectiveness of the barrier. The report summarized the field studies and identified that currently the barrier was ineffective. The report provided a good discussion and evaluation of non-sportfish issues in the Salmo River Watershed.

B.C. Hydro. (1989). Seven Mile Generating Station: Salmo River fish barrier: task completion report. 6p. plus appendices. Rec. #: 20103

Discusses the design and construction (including photographs) of the coarse fish barrier on the lower Salmo River.

B.C. Hydro. 1996. Seven Mile Unit 4 Mitigation and Compensation Plan for the installation and operation of Unit 4 at the Seven Mile Generating Station. 17p. Rec. #: 20562.

Describes the mitigation and compensation plan developed to address fish and fish habitat concerns as a required component for the installation and operation of a fourth turbine at the

Seven Mile dam. Identifies off-site compensation projects for two species in the reservoir: rainbow trout and bull trout. Off-site compensation for rainbow trout consisted primarily of habitat/fish passage restoration in Tillicum Creek (not the Salmo). Off-site compensation for bull trout included undertaking a synoptic bioreconnaissance of bull trout in the Salmo River, and upgrade the coarse fish barrier. Provides summary of potential impacts and cost estimates for recommendations.

Decker, S., D. Quamme, and J. Baxter. 2002. Pre-fertilization monitoring of the South Salmo River and Sheep Creek, 2001 Draft (Unpubl. Report). Report Prepared for B.C. Hydro, Burnaby, B.C.. Report prepared by Scott Decker and Associates, Kamloops B.C., Integrated Ecological Research, Nelson, B.C., and Baxter Environmental, Nelson, B.C.. 76 p. + app.

Comprehensive study of fish populations (abundance), fish habitat, periphyton, macro invertebrates, and water quality in Sheep Creek and the South Salmo River completed to identify baseline conditions in the South Salmo prior to fertilization experiments. Summarizes field data collected, provides analysis of fish population data, calibrates models, and provides recommendations for subsequent evaluation of the effectiveness of fertilization in test and control areas.

Envirocon Ltd. and Pearse Bowden Economic Consultants Ltd. 1975. Environmental and Resource Management Studies: Seven Mile Project. Vancouver, B.C. Prepared for B.C. Hydro. Pages 116-158.

Provides a general pre-construction summary and evaluation of fishery resources in the Pend d'Oreille River section to be impounded by construction of the Seven Mile dam. Includes a summary of fish species and brief discussion of the Salmo River. Snorkel fish counts were completed for the lower 10 miles of the mainstem Salmo River.

Envirocon Ltd. 1973. Environmental Impact Report Seven Mile Project. Prepared for B.C. Hydro. 48 p. + appendices.

Technical report prepared for B.C. Hydro to identify potential environmental impacts of the proposed facility.

Gebhardt, D.J. 1998. Seven Mile Reservoir: tributary access. Aquatic Resources Ltd. 5p. Rec. #: 20973.

Very brief (5 pages) discussion of tributary access (including the Salmo River) for fish species found in the reservoir. Limited discussion regarding the Salmo Watershed, other than to identify it as an important tributary with access for fish from the reservoir.

Golder Associates Ltd. 2001. Field report for may 2001 fish assessment of watercourses adjacent to the Salmo River. 2001. Rec. #: 21399.

Report provides a summary of FDIS data and reports (site cards, fish cards) for a number of small tributaries downstream of the village of Salmo. Each of the identified tributaries was considered fish bearing, and there were no barriers to fish passage.

Hagen, J. and J. Baxter. 2003. Conservation status of the mainstem Salmo River rainbow trout population. Report prepared for Columbia-Kootenay Fisheries Renewal Partnership/Columbia Basin Trust, Columbia Basin Fish and Wildlife Compensation Program, BC Hydro, Salmo Watershed Streamkeepers Society, Beaumont Timber, BC Ministry of Water, Land and Air Protection, and the West Kootenay Fly Fishing Club. Report prepared by J. Hagen and Associates, and Baxter Environmental. 52pp. + 9 appendices.

Summarizes the results of radio telemetry and population studies of rainbow trout (Oncorhynchus mykiss) in the Salmo River watershed initiated in 2001. Rainbow trout were radio tagged in the mainstem Salmo River and tracked over several seasons. Critical habitats (spawning, rearing, overwintering) were identified for the mainstem rainbow trout. Population estimates were derived through a repetitive mark-recapture estimate in an index section over the summer and winter periods.

Hagen, J. and J. Baxter. 2002. Salmo River rainbow trout (Oncorhynchus mykiss): Population size and habitat use-interim report-. Report prepared for The Columbia-Kootenay Fisheries Renewal Partnership and Columbia Basin Trust, B.C. Hydro, The Columbia Basin Fish and Wildlife Compensation Program, the B.C. Ministry of Water, Land and Air Protection, Beaumont Timber, and the Salmo Watershed Streamkeepers Society. Prepared by Baxter Environmental. 28 p. + 3 appendices.

Summarizes the initial field work and data collection of a project on the rainbow trout (Oncorhynchus mykiss) population of the Salmo River watershed. A total of 30 rainbow trout were radio tagged in the mainstem Salmo River in proportion to the abundance of rainbow trout >30cm throughout the system. The radio tagged rainbow trout were used to derive a population estimate through a repetitive mark-recapture estimate in an index section over the summer and winter.

Hagen, J. and J. Baxter. 2001. Sheep Creek bull trout spawning platforms: feasibility study. Report prepared for the Columbia-Kootenay Fisheries Renewal Partnership. Report prepared by Baxter Environmental. 9 p. + appendices.

The report provides a review and assessment of bull trout spawning habitat in Sheep Creek, and reviews the feasibility of constructing spawning platforms and the placement of spawning gravel in Sheep Creek. Provides recommendations for potential placement sites and recommends additional assessment by a fluvial geomorphologist or hydrological engineer prior to construction.

Heinbuch, L. and G. Nellestijn. 2000. Inventory of mine tailings and ponds in the Salmo Watershed. Report prepared for the Salmo Watershed Streamkeepers Society. 38 p. + 1 Appendix.

Compiles an inventory and brief history of the historical mines, tailing piles, and ponds in the Salmo River Watershed. Provides a brief description of the location of mines and tailings throughout the watershed, and prioritizes them based on their size and proximity to watercourses. Provides recommendations for mitigation activities.

Kokanee Forests Consulting Ltd. 1997. Erie/Beaverdale IWAP (Interior Watershed Assessment Procedure). Prepared for Atco Timber Ltd. Prepared by Kokanee Forests Consulting Ltd. 13p. + 4 app.

An IWAP was completed for portions of the Erie Creek and Beaverdale Creek watershed to assess the potential for impacts to both watersheds of mass wasting, surface erosion, and peak flows on riparian buffers and stream systems. Several tributaries were rated for high potential impacts (Beaverdale Creek, Craigtown, Grassy), while overall the Erie Creek watershed was rated as moderate.

Machmer, M. 2001. Salmo River Harlequin Duck Inventory, Monitoring and Brood Habitat Assessment. Prepared for Columbia Basin Fish and Wildlife Compensation Program. Prepared by Pandion Ecological Research Ltd. 26 p. + 9 appendices.

Pandion Ecological Research Ltd. conducted pre-incubation and brood inventories for harlequin ducks (*Histrionicus histrionicus*) in the Salmo River Valley from May to August 2000. The report documents the methodology and data collection for completion of the study, and summarizes life history information for harlequin ducks within the Salmo River watershed, and provides recommendations for future monitoring, preservation, and enhancement activities.

Machmer, M. 1999. Pre-incubation Inventory of Harlequin Ducks in the Salmo River Valley. Prepared for Columbia Basin Fish and Wildlife Compensation Program. Prepared by Pandion Ecological Research Ltd. p. + appendices.

Pandion Ecological Research Ltd. conducted pre-incubation and brood inventories for harlequin ducks (*Histrionicus histrionicus*) in the Salmo River Valley in 1999. The report documents the methodology and data collection for completion of the study, and summarizes life history information for harlequin ducks within the Salmo River Watershed, and provides recommendations for future monitoring, preservation, and enhancement activities.

Masse, Sylvie. 2000. Reconnaissance fish and fish habitat inventory Salmo River tributaries phase 1-3. 10 p. + Appendices and maps. Rec. #: 21440.

Provides Phases 1-3 (pre-field planning activities) for completion of a 1:20,000 Reconnaissance Fish and Fish Habitat Inventory (RFFHI) for several tributaries to the Salmo River.

Northcote, T.G. 1969. Lakeward migration of young rainbow trout (Salmo gairdneri) in the Upper Lardeau River, British Columbia. J. Fish. Res. Bd. Can. 26(1969): 33 to 45. Rec. #: 20118

Provides a description of the life history characteristics and biology of the Gerard strain of rainbow trout in the Upper Lardeau River.

Salmo Watershed Streamkeepers Society. 1999. The Place where we live. Looking back to looking forward. 106 p. +1 appendix.

Provides an overview of the watershed, including history of first nations, mining, and forestry in the watershed. Also describes fish and wildlife in the watershed.

Sigma Engineering Ltd. 1996. Salmo River Inventory and Assessment. Prepared for the Columbia Basin Fish and Wildlife Compensation Program. Prepared by Sigma Engineering Ltd., Vancouver, B.C. 79 p. + 10 appendices. Rec. #: 20563

Sigma completed an inventory and assessment of the mainstem and major tributaries to the Salmo River in 1995. The study also included an evaluation of the coarse fish barrier, a cursory assessment of the sport fishery, documentation of existing and projected land uses, and identification of limiting factors and enhancement opportunities in the watershed. The report summarizes the study findings and provides preliminary recommendations for the watershed, including the following topics: enhancement opportunities, coarse fish barrier effectiveness, angling regulations, stewardship and education, boulder creek fish stranding, and the South Salmo River fertilization study.

Timberland Consultants Ltd. 1999. Fish Stream identification on tributaries to the Salmo River and Big Sheep Creek. 10 p. Rec. #: 21130.

Timberland consultants completed fish sampling as part of a fish stream identification on three tributaries to the Salmo. No Fish were captured at two of the sites. The 'report' is essentially the FDIS site cards, fish cards, and summaries (no maps).

Zimmer, M. 2001. Salmo River Sites 1 and 2. Fish habitat and erosion protection works construction and monitoring 2000. Report prepared for the Salmo River Protection Committee, Columbia-Kootenay Fisheries Renewal Partnership, and B.C. Hydro. Report prepared by Michael Zimmer. 8 p. + 3 appendices.

Summarizes river bank protection and restoration works completed at two locations in the Salmo River Watershed in September and October 2000. Eleven structures were constructed using graded rock and large wood material. The structures were designed to minimize bank erosion and reduce the risk of erosion on adjacent lands; additionally the works were designed to increase available fish habitat. As-built, the structures were stable and provided high fish habitat value. Further monitoring was recommended.

Watershed-based Fish Sustainability Planning for the Salmo River: Riparian Ecosystem Profile

Prepared for:

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June 23, 2003

EXECUTIVE SUMMARY

The Salmo Watershed has been selected for an environmental analysis that uses a four-stage process of "Watershed-based Fish Sustainability Planning" (WFSP) to conserve fish populations and their habitat The four stages of this planning process are (i) establishing regional priorities, (ii) establishing watershed priorities, (iii) developing a watershed plan, and (iv) implementing and improving the plan. As part of Stage II of this initiative, this *Riparian Ecosystem Profile* was developed to document past and current ecosystem values, identify information resources and gaps relevant to Stage III of the WFSP process, and address environmental impacts that either have or may in the future compromise the ecological integrity of the Salmo River riparian zone.

A preliminary analysis of wildlife-habitat relationships was conducted to focus further information gathering and management efforts. This analysis addressed the relationship of 135 terrestrial vertebrate wildlife species to riparian habitat elements and included a compilation of their key ecological functions, especially with respect to wildlife-fish interrelationships. The results of the analysis indicate that habitat elements in need of management focus include riparian wetland components (i.e., wetlands, marshes, wet meadows, bogs, and swamps), coarse woody debris, snags, and large-sized mature trees, among others.

Recommendations are provided to fill remaining information gaps, set strategic management direction, and address management and conservation of the large amount of private land present in the riparian zone. Specific recommendations for completing the Salmo Watershed Plan address:

- identification of site-specific management needs through a comprehensive GIS analysis;
- identification, protection, and restoration of riparian wetland components;
- inventory of current and potential future levels of riparian and in-stream *Coarse Woody Debris* and identification of restoration efforts where appropriate;
- conservation and recovery of *Species at Risk (i.e.* rare, sensitive, threatened and endangered species);
- identification, mapping, and protection of *Environmentally Sensitive Areas* within the aquatic, riparian, and upland zones;
- integration of environmental conservation objectives with the local *Rails To Trails* initiative;
- development of an "Impact Database" to restore historical environmental contamination sites and to prevent future contamination events; and
- identification of an appropriate approach to habitat stewardship on private and public lands in the Salmo River Watershed.

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ACKNOWLEDGEMENTS

The Columbia-Kootenay Fisheries Renewal Partnership (CKFRP) funded this project. The following people and agencies provided support and technical input in a variety of ways: Bill Green and Les Brazier (CKFRP) project administration and coordination; Gerry Nellestijn and Kim Klassen (Salmo Watershed Streamkeepers Society) additional coordination and assistance; Ian Parfitt and Tasha Kirby (Columbia Basin Fish and Wildlife Compensation Program) mapping and GIS resources; Jon Bisset (Westslope Fisheries) collaboration with the Salmo Watershed Profile project; Alice Nellestijn (Frank Communications) production of plan area map; and Marlene Machmer (Pandion Ecological Research) assistance with wildlife analysis.

Additional support and/or technical review was provided by the project's Technical Committee members: Steve Arndt (CBFWCP), James Baxter (BC Hydro), Albert Chirico and John Bell (MWLAP), Bruce McDonald and Brian Ferguson (Dept. of Fisheries and Oceans), Bill Duncan (Teck-Cominco), Bruce Gunn and Dave Wahn (Regional District of Central Kootenay), Ron Ozanne (Atco Lumber), Jacqueline Herodek (Beaumont Timber) Norm DeVerney (BC Gas), Jim Guido and Ted Evans (MOF), Dan Palesch (MOTH), and Rick Heinrichs (MSRM), and Craig Herman.

All contributions were greatly appreciated.

1.0 INTRODUCTION

1.1 Background

The Salmo Watershed has been selected for an environmental analysis that uses the four-stage process of "Watershed-based Fish Sustainability Planning" (WFSP) to conserve fish populations and their habitat in British Columbia (BC Ministry of Fisheries, Ministry of Environment, Lands and Parks, and Fisheries and Oceans Canada 2001). The four stages of this planning process are:

I. Establishing Regional Priorities
II. Establishing Watershed Priorities
III. Developing a Watershed Plan
IV. Implementing and Improving the Plan

As part of Stage II of this initiative (i.e., establishing watershed priorities), development of a *Riparian Ecosystem Profile* was proposed at a planning workshop held in Salmo on July 10th, 2002. The goal of this riparian analysis is to contribute essential background information for a strategic sustainability plan that includes both the aquatic and riparian habitats along the main stem and lower tributaries of the Salmo River. In addition to this riparian analysis, a *Watershed Profile*, describing fish populations and their habitat has been produced as part of the Salmo WFSP process (Bisset & Cope 2003).

1.2 Project Objectives

The specific objectives of this riparian project are to:

1. conduct an inventory of riparian habitats along the Salmo River;
2. highlight important fish-wildlife-habitat relationships;
3. identify riparian habitat components (i.e., patches and elements) and ecological functions important for the sustainability of fish and wildlife populations;
4. identify past and present impacts and potential future threats to riparian habitats;
5. identify information resources and gaps; and
6. provide recommendations for management options and a monitoring framework.

1.3 Scope & Limitations

This riparian profile extends the aquatic profile developed by Bisset & Cope (2003) and describes the ecological conditions and human-induced impacts of the floodplain of the river's main stem and major tributaries. It includes the water-land interface from the stream bank interface to the water table / aerated soil interface. The following definition describes the focal area for this riparian profile.

> *Riparian zones are defined as the three-dimensional zones of direct physical and biotic interactions between terrestrial and aquatic ecosystems; boundaries of the riparian zone extend outward to the limits of flooding and upward into the canopy of streamside vegetation* (Kauffman et al. 2001).

This project does not make reference to any factors affecting the riparian and aquatic ecosystems that originate in upland areas. Due to limited resources, an analysis of upland terrestrial conditions has also not been included in the Watershed Profile; however several important factors and current or potential impacts (e.g., excessive logging in the Porcupine drainage and numerous mine tailings) have been identified as requiring more detailed analysis (Bisset & Cope 2003).

In order to provide a baseline information layer of the current ecological conditions of the riparian zone, a preliminary riparian mapping component was included in this project. Due to a number of constraints, riparian mapping results should only be viewed as a starting point (or working hypothesis) that requires completion and further refinement.

Also due to resource limitations, a comprehensive GIS component that provides information layers on, for example, land tenures, types of land use, land use impacts on the riparian and aquatic system, and the resulting ecological integrity (stratified by individual polygon or groups of polygons) could not be included in this project.

2.0 APPROACH & METHODOLOGY

In general, the analysis includes information gathering through literature review, limited map and air photo interpretation, and collaboration and consultation with experts and practitioners. Pertinent habitat types, habitat elements, wildlife-habitat relationships and key ecological functions of riparian species are defined and classified, and important interactions between the riparian and aquatic system are described. An inventory of structural conditions within the riparian zone could not be performed at this time. Additional information needs and management recommendations for Stages III (development of a watershed plan) and IV (implementation and adaptive management) of the Salmo River WFSP process are presented.

The ecological analysis includes pertinent information from the *Columbia Basin Database for Wildlife-Habitat Relationships*[1] (Steeger et al. 2001). This comprehensive, state-of-knowledge database describes the wildlife-habitat relationships of 447 wildlife species in the BC portion of the Basin. The BC database is an extension of the wildlife-habitat classification methodology outlined in "Wildlife-Habitat Relationships in Oregon and Washington" (Johnson and O'Neil 2001)[2]. Both the US and BC databases feature a list of vertebrate wildlife species occurring in the respective portions of the Basin and sets of digital matrices that relate these species to *Wildlife Habitat Types*, *Structural Conditions*, *Habitat Elements*, selected *Life History* parameters, and *Key Ecological Functions*. It was developed to provide biologists, resource managers and other users with baseline information for modelling and monitoring possible effects of resource development on wildlife species and their habitat. The US database also includes a matrix about *Salmon-Wildlife Relationships* that is, to some extent, applicable to this project.

2.1 Terminology and Concepts

Definitions of terms and concepts used in this project are based on the Columbia Basin Database (CBD) for Wildlife-Habitat Relationships (Johnson & O'Neil 2001, Steeger et al. 2001). Brief descriptions are given below while detailed definitions are given in the appendices. Although an analysis of structural conditions within the riparian zone could not be included in this report, we present brief definitions here, to provide context for the recommendation to assemble this information in the future.

[1] http://habitat.cbt.org
[2] http://osu.orst.edu/dept/press/WildlifeHabitat.html

Species-habitat: refers to the association of species with three spatial scales of habitats: *broad habitat types*; *structural conditions for agriculture, forest, shrub/grass, and urban;* and *habitat elements*.

Species list: refers to subsets of vertebrate wildlife species that are associated with particular habitat types, structural conditions and habitat elements and potentially occur in selected plan areas within the Columbia River Basin. The list for the BC portion of the basin contains 447 species.

Wildlife-habitat types: These are groups of vegetation cover types (or land use/land cover types) that are broadly based on wildlife-habitat relationships. The habitat type for the Salmo River riparian zone is *Eastside [Interior] Riparian-Wetlands* (Appendix 1). For this habitat type, 249 species are listed in the database.

Structural conditions - Agriculture: Agriculture Land Use/Land Cover conditions include: (1) cultivated cropland, (2) improved pasture, (3) orchards/vineyards/nursery, (4) modified grassland, and (5) unimproved pasture.

Structural conditions - Forest: Structural conditions are plant succession stages (*i.e.*, grass/forb to old-growth). Definitions are based on tree size (diameter at breast height; dbh), percent canopy cover, and number of canopy layers. The CBD defines a total of 26 forest structural conditions.

Structural conditions – Shrub/Grass: The shrubland and grassland structural conditions are based on the following attributes: (1) shrub height, (2) percent shrub or grass/forb cover, and (3) shrub age class. The CBD defines a total of 20 shrub/grass structural conditions.

Structural conditions – Urban: Structural conditions are defined as percent surface cover with impervious material. Three classes are defined as: low density = 10-29% cover (e.g., rural residential areas, suburban housing with large lots <= 1 ha); medium density = 30-59% cover (e.g., single family housing areas with lots > 1 ha, suburban development); and high density = 60-100% (e.g., industrial areas, transportation corridors).

Level of association between wildlife and habitat type or structural condition: Three categories describe the degree of association between wildlife species and structural conditions:

- *Closely Associated*. A species is widely known to depend on a habitat or structural condition for part or all of its life history requirements. It has an essential need for this habitat or structural condition for its maintenance and viability. Salmo River example: Beaver.
- *Generally Associated*. A species exhibits a high degree of adaptability and may be supported by a number of habitats or structural conditions. The habitats or structural conditions play a supportive role for its maintenance and viability. Salmo River example: Grizzly Bear.
- *Present*. A species demonstrates occasional use of a habitat or structural condition. The habitat or structural condition provides marginal support to the species for its maintenance and viability. Salmo River example: Three-toed Woodpecker.

Habitat Elements: These are components of the environment believed to most influence wildlife species' distribution, abundance, fitness, and viability. Habitat elements include natural attributes, both biological and physical (*e.g.*, large trees, woody debris, emergent vegetation, or riverine wetlands). The CBD defines 233 habitat elements. For the purpose of this profile, we only used the 36 habitat elements that directly relate to riparian zones.

Key Ecological Functions (KEFs): This is the principal set of ecological roles performed by each species in its ecosystem. Key ecological functions refer to the main ways organisms use,

influence, and alter their biotic and abiotic environments. The classification system developed for the US part of the basin (but also applicable in BC) includes 85 categories of KEFs, including major headings and subheadings (Marcot & Vander Heyden 2001).

Salmon-Wildlife Relationships: The strength of the relationships is classified in six categories: (1) strong consistent, (2) recurrent, (3) indirect, (4) rare, (5) unknown, and (6) no relationship. These relationships are with respect to five Salmon Life Stages: 0 = not known or none; 1 = incubation (eggs or alevin); 2 = freshwater rearing (fry, fingerling, and parr); 3 = saltwater (smolts, immature adults, and adults); 4 = spawning (freshwater); and 5 = carcasses.

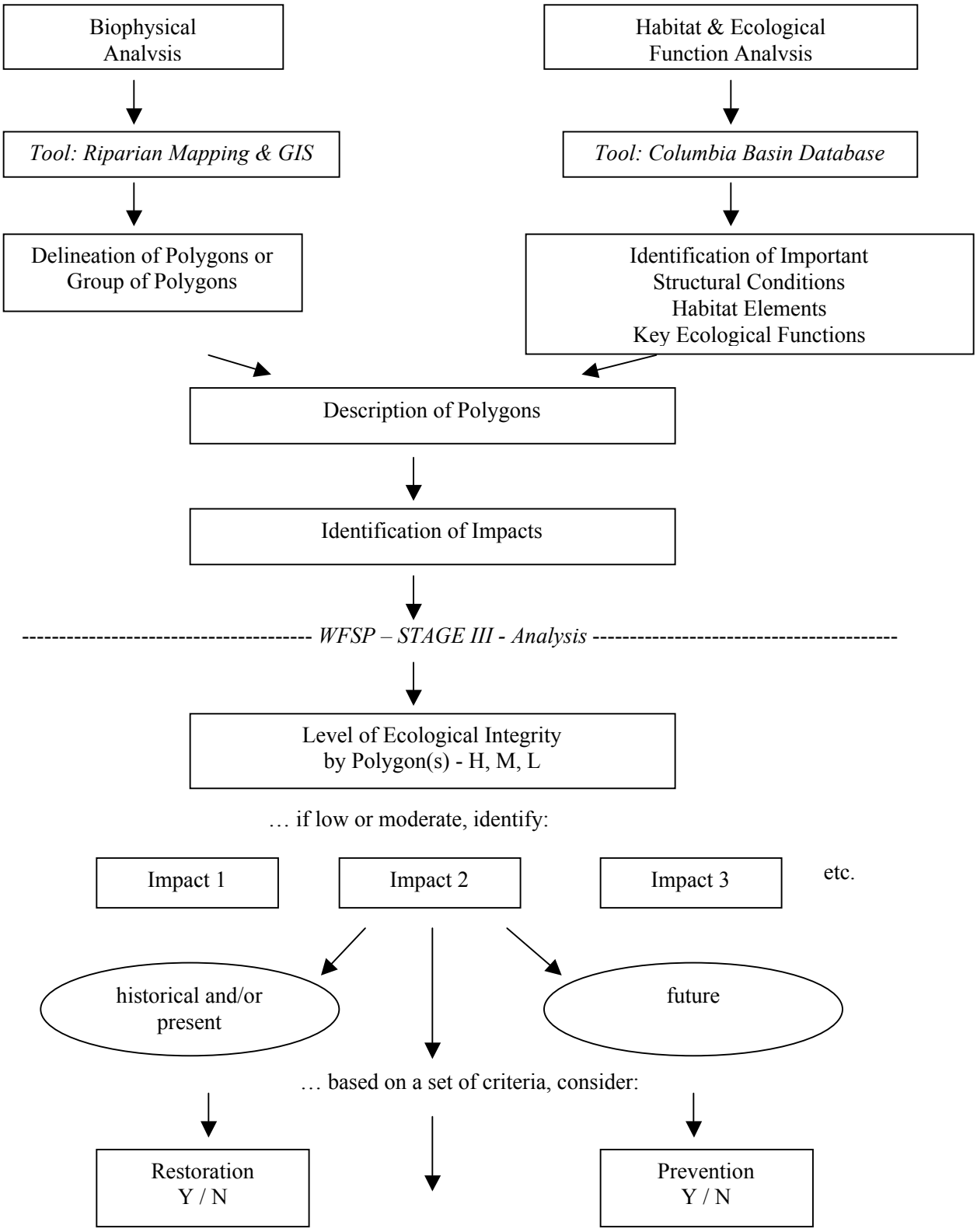
Note that this matrix has not been reviewed and adjusted for BC nor has it been extended to include other fish species. Although all anadromous salmon species have been extirpated in the Salmo River, many associations in this matrix can be extrapolated to the fish species that do occur in the Salmo River system, particularly the bull trout (*Salvelinus confluentus*) and rainbow trout (*Oncorhynchus mykiss*).

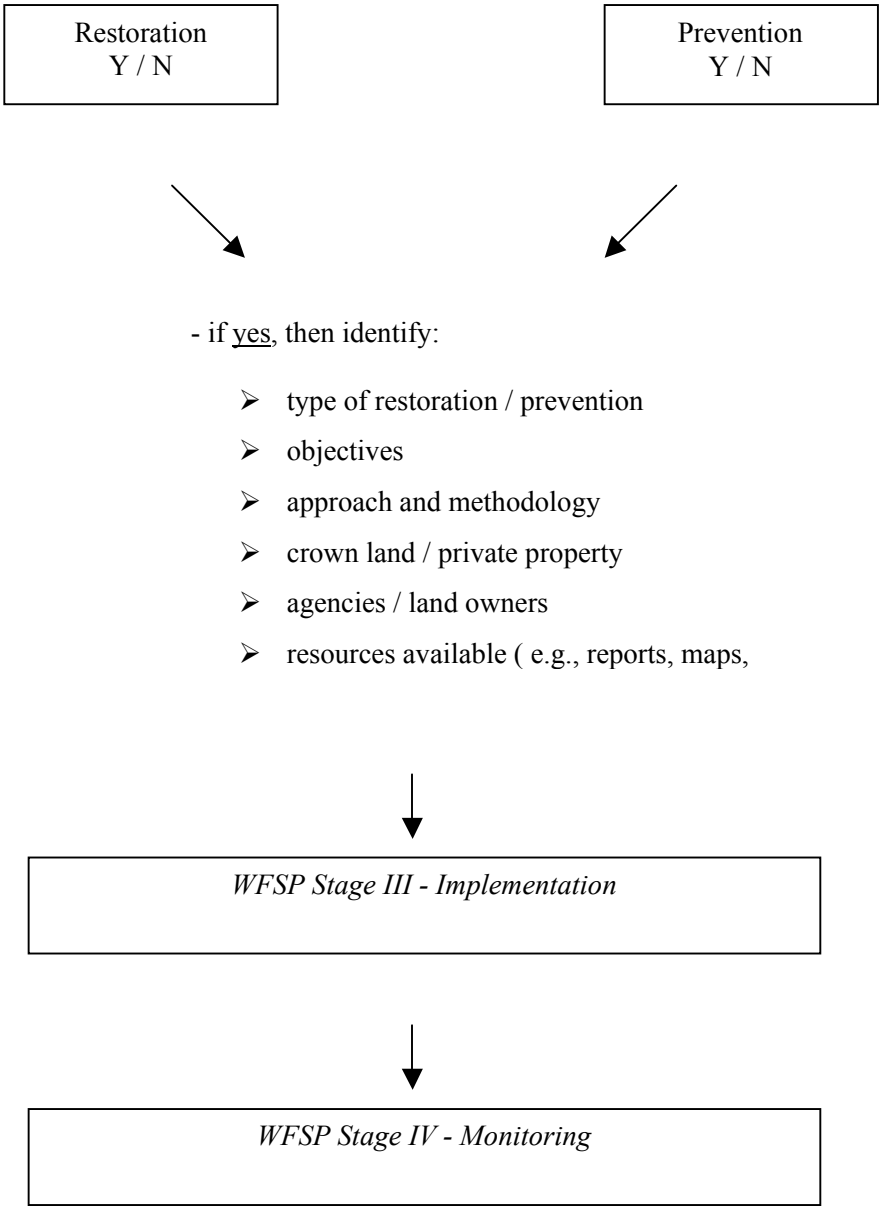
2.3 Riparian Profiling and Management Framework

The following flow chart (Figure 1) illustrates an analysis and management framework for the riparian zone of the Salmo Watershed. Within the context of Stages II-IV of the WFSP process, the allocation of activities to different stages is based on current progress in completing Stage II and the associated baseline information requirements.

The initial information compilation is divided into a project-specific biophysical analysis and habitat & ecological function analysis, using the selected analysis tools. Following development of baseline GIS map layers and delineation of different riparian polygons, polygons and specific sites can be described in a variety of ways including tenure, ecological integrity, restoration needs, etc. The results of periodic updates and GIS analyses can help direct the identification of priority conservation and restoration projects.

Figure 1. Analysis and management framework for the riparian zone of the Salmo Watershed.

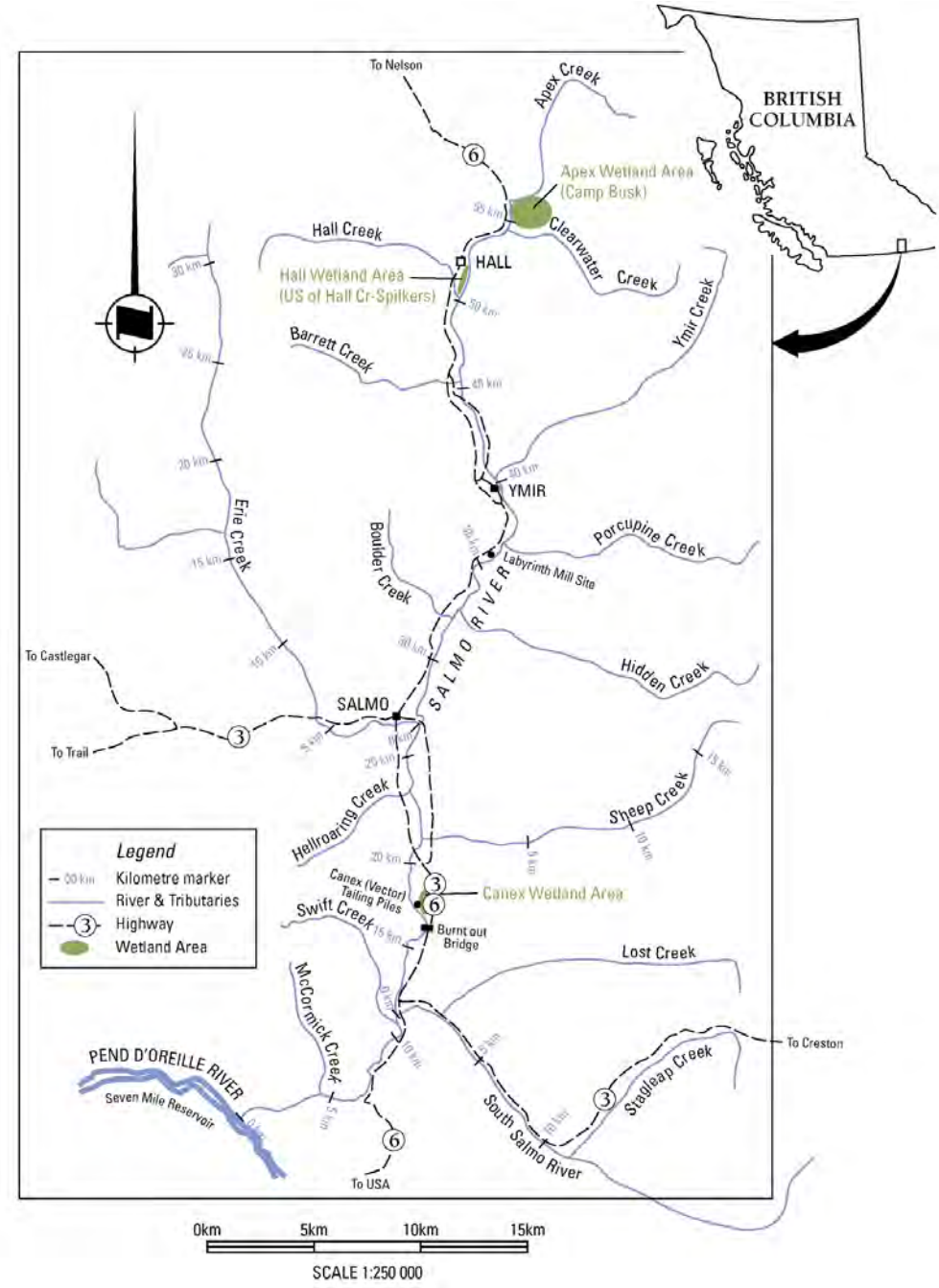



Restoration
Y / N
Prevention
Y / N
- if yes, then identify:
type of restoration / prevention
objectives
approach and methodology
crown land / private property
agencies / land owners
resources available (e.g., reports, maps,
WFSP Stage III - Implementation
WFSP Stage IV - Monitoring

3.0 PLAN AREA

The plan area covered in this document is the riparian zone of the Salmo River main stem and its major tributaries (Figure 2). The river is a tributary to the Pend d'Oreille River which drains into the Columbia River south of Trail at the international border. The plan area is described by Bisset & Cope (2003) in more detail.

Figure 2. Plan area for the Salmo Watershed-based Fish Sustainability Planning project.



4.0 RIPARIAN PROFILE

4.1 Vegetation Resources

Most significantly, the riparian zone of the Salmo River contains an abundance of black cottonwood/willow habitats, which are becoming increasingly rarer throughout the Pacific Northwest. While cottonwoods were likely always present to varying proportions in the watershed, historical accounts suggest a relatively high abundance of old-growth western redcedar forests before the arrival of European people. Aside from a very few remnant patches, these old-growth riparian conifer stands have been eliminated from the watershed. Presently, much of the coniferous component in the riparian zone consists of the typical "Kootenay mix" of tree species such as Douglas-fir, hybrid spruce, lodgepole pine, western redcedar, western hemlock, western larch and the broadleaved species paper birch, trembling aspen and black cottonwood. These mid-successional forests are approximately 60-100 years old.

The elimination of the old growth structural condition affects the ecology of the riparian zone in a variety of ways, including elimination of giant-sized standing live and dead trees, coarse woody debris, and large woody in-stream debris. Consequently, understorey tree and shrub conditions have changed to more early and mid-successional plants such as willow species and a variety of berried shrubs.

4.2 Wildlife Resources

4.2.1 Species Richness

Terrestrial Vertebrates – The Columbia Basin Database lists 249 terrestrial vertebrate species that potentially occur in the *Eastside [Interior] Riparian-Wetlands* Habitat Type. This list contains more species than do locally occur in this habitat type (i.e., it contains all the species occurring in this habitat type throughout the entire BC Columbia River Basin). For the Salmo River riparian zone, a preliminary list of confirmed species totals 135 species (Appendix 2). While this list is certainly incomplete (no systematic wildlife surveys have ever been conducted in the plan area), it provides a starting point for establishing wildlife-habitat relationships for the Salmo riparian zone.

4.2.2 Wildlife-Habitat Relationships and Ecological Functions

Wildlife - Of the 135 species known to occur in the riparian zone, 51 are *closely associated* with the *Eastside [Interior] Riparian-Wetlands* Habitat Type, while 67 are *generally associated* and 17 are classified as *present* (Appendix 2). This group of species *associated* with riparian habitat includes 100 bird, 29 mammal, 3 amphibian and 3 reptile species.

Habitat Elements – For the analysis of habitat elements required by the riparian species, we only used relevant riparian elements (total of 36, see Appendix 3) and those species that were associated with them. The latter accounted for 75 out of the 135 species (i.e., 60 species, although riparian, are not directly associated with the selected habitat elements). The total number of riparian habitat elements associated with each of the 75 species is given in Table 1. The species that require the most habitat elements are Northern River Otter (28 elements), followed by

Yellow-headed (22) and Red-winged (21) Blackbirds, Spotted Sandpiper (21), Moose (19), and American Dipper (19). A proportional breakdown of the habitat elements required by the 75 species is provided in Table 2. This analysis indicates that of those species

- 88% are associated with wetlands, marshes, wet meadows, bogs and swamps within the riparian zone;
- 67% are associated directly with the river and its tributaries; and
- 23% are associated with seasonal flooding events.

More specific habitat elements (i.e., they are in lower sub-groups of the database), required by a relatively large proportion of species (Table 2) and therefore important for the ecology and management of the Salmo riparian zone include:

- oxbows;
- lower perennial streams and rivers;
- open water and shoreline zones;
- pools, banks, seeps and springs;
- forested and non-forested riverine wetlands, and
- marshes and wet meadows.

Key Ecological Functions (KEFs) – The number of KEFs performed by the 135 confirmed riparian species are given in Appendix 1. With respect to the KEFs that are most relevant to the aquatic zone of the Salmo River, those with the greatest overlap across species (i.e., a measure of ecological resiliency) include:

- aquatic macroinvertebrate eaters (26 species),
- piscivorous or fish eaters (24 species), and
- aquatic herbivores (11 species).

Key ecological functions relevant to the ecology of the riparian zone and performed by a relatively small number of species and therefore rare within the Salmo riparian zone include:

- impoundment of water by creating diversions or dams (American Beaver),
- creation of ponds or wetlands through wallowing (Elk),
- creation of aquatic structures (Muskrat, American Beaver), and
- freshwater zooplankton eater (Wood Frog).

Listed Species – To our knowledge, a minimum of three listed vertebrate species has been observed in the plan area. Two species frequently observed along the Salmo River and listed as vulnerable/sensitive by the BC Conservation Data Centre are the blue-listed Great Blue Heron and Grizzly Bear. One threatened/endangered (i.e., red listed) species, the Western Screech-Owl (*O. k. macfarlanei* subspecies), has been previously collected as a dead specimen near the river. The blue-listed Townsend's big-eared bat has been found in the Pend d'Oreille valley near the

Table 1. Total number of riparian habitat elements associated with 75 species known to inhabit the Salmo River riparian zone.

Species Name	No. of Riparian Habitat Elements[1]	Habitat Elements Comments/Qualifiers
American Beaver	16	Bank dens are important in seasonally flooded rivers. Open water used for security and travel.
American Crow	2	
American Dipper	19	Species uses fast-flowing, clear, unpolluted streams with cascades, riffles, and waterfalls. Streams selected for breeding rarely exceed 15 m in width or 2 m in depth.
American Marten	4	
American Redstart	3	
American Wigeon	13	Sanctuary in open water.
Bald Eagle	13	Uses ephemeral pools where fish or waterfowl are present. Forages and perches on sand and gravel bars
Bank Swallow	7	Open water is primarily feeding habitat
Barn Swallow	1	Collect mud for nests.
Barred Owl	8	
Belted Kingfisher	12	Often nests in oxbows. Creates burrows in river banks.
Black Bear	5	Riparian forests are seasonally important.
Black-capped Chickadee	3	
Bufflehead	12	Sand/mud are foraging substrates. Uses water impoundments.
Calliope Hummingbird	2	
Canada Goose	12	Uses open water as a sanctuary. Sand bars are source of grit. Gravel bars are used for loafing and resting.
Cliff Swallow	3	Collect mud for nests.
Columbia Spotted Frog	15	Banks in lakes and ponds are important as basking and feeding sites. Shorelines of rivers and streams provide additional foraging areas.
Common Garter Snake	5	
Common Goldeneye	12	Sand/mud are foraging substrates. Uses water impoundments. May feed or breed in riparian forests.
Common Loon	4	Nests are floating mats of vegetation in open water. Uses water impoundments.
Common Merganser	11	Use shorelines, sand and gravel bars for loafing and resting.
Common Snipe	12	Associated with ponds (<2ha) but only for shallow water.
Cooper's Hawk	3	
Coyote	2	Use marshes for hunting.
Eastern Kingbird	3	
Elk	6	Travel in winter along lower elevation rivers. Riparian forests important for wallows.
Great Blue Heron	11	Use islands for foraging and nesting, if suitable trees. Seasonal floods maintain herbacious wetlands for herons.
Great Horned Owl	3	
Green-winged Teal	10	Use shorelines with cover for nesting. Seasonal floods maintain herbacious wetlands for green-winged teals.
Grizzly Bear	1	Wetlands/marshes/wet meadows/bogs and swamps may be seasonally important.
Harlequin Duck	15	Nest on top of steep stream banks. Use submerged/benthic habitats including rocks, cobble and gravel for feeding.
Hoary Bat	9	
Hooded Merganser	11	Ducklings require fresh water.
Killdeer	16	Uses shallow, slow-moving or still water for feeding. Feeds and breeds on edges of oxbow lakes.
Little Brown Myotis	10	

Table 1 continued

Species Name	No. of Riparian Habitat Elements[1]	Habitat Elements Comments/Qualifiers
Mallard	13	Uses open water for resting and sanctuary, sand bars as source of grit, shorelines for feeding, and islands for roosting and nesting.
Merlin	5	
Mink	7	Uses coarse woody debris in streams and rivers as primary feeding and denning sites.
Moose	19	Uses lakes, ponds and reservoirs, at least 100 square feet and 1 to 6 feet deep; larger areas are preferred. Optimal conditions have a hiding cover zone around its perimeter.
Mule Deer	5	Riparian forested and non-forested areas important for fawn rearing.
Muskrat	16	Open water used for security and travel.
Northern Goshawk	4	
Northern Harrier	7	
Northern Pocket Gopher	5	Uses wet meadows.
Northern River Otter	28	
Northern Rough-winged Swallow	7	
Northern Saw-whet Owl	3	
Northern Waterthrush	8	Uses exposed tangle or roots for nests along banks.
Olive-sided Flycatcher	1	Open bogs are favored, plus other wetland habitats where tall, remnant live trees and snags are present.
Osprey	9	Seasonal flooding of riparian areas may create snags for nesting.
Raccoon	6	
Red-eyed Vireo	3	
Red-naped Sapsucker	3	
Red-tailed Hawk	3	
Red-winged Blackbird	21	
Ruffed Grouse	6	Seeps and springs are important habitats.
Sharp-shinned Hawk	3	
Silver-haired Bat	12	Still, open water for drinking; foraging over aquatic systems.
Solitary Sandpiper	11	Uses open water less than three centimeters deep.
Song Sparrow	7	
Spotted Sandpiper	21	Uses sand and gravel bars for nesting.
Striped Skunk	5	
Townsend's Big-eared Bat	10	Uses open water for drinking.
Tree Swallow	5	
Violet-green Swallow	6	
Western Screech-owl	3	
Western Terrestrial Garter Snake	4	Over the majority of the range, there is a strong positive correlation with surface water (wetlands, streams, ponds, lakes).
Western Toad	15	Sand and gravel bars along big rivers, sand bars provide breeding areas. Vegetation provides food supply for tadpoles; detritus on bottom.
White-tailed Deer	9	Uses riverine islands.
Wild Turkey	2	
Wood Duck	14	Ducklings require fresh water. Uses water impoundments.
Wood Frog	6	Uses vernal pools in riparian forests.
Yellow-headed Blackbird	22	
Yellow-pine Chipmunk	3	Associated with riparian habitat elements but they are not required.

[1]Description of habitat elements are given in Appendix 3. For specific species-habitat element associations see the MS Access database (under Resources) at http://habitat.cbt.org

Table 2. Summary of Riparian Habitat Elements required by 75 Species known to inhabit the Salmo River Riparian Zone.

Database Reference	Habitat Element Description	Species (n)	%
4.2	rivers and streams	50	67
4.2.1	oxbows	29	39
4.2.2	order and class	29	39
4.2.2.1	intermittent	2	3
4.2.2.2	upper perennial	11	15
4.2.2.3	lower perennial	27	36
4.2.3	zone	32	43
4.2.3.1	open water	29	39
4.2.3.2	submerged/benthic	5	7
4.2.3.3	shoreline	23	31
4.2.4	in-stream substrate	10	13
4.2.4.1	rocks	4	5
4.2.4.2	cobble/gravel	4	5
4.2.4.3	sand/mud	8	11
4.2.5	vegetation	10	13
4.2.5.1	submergent vegetation	5	7
4.2.5.2	emergent vegetation	6	8
4.2.5.3	floating mats	3	4
4.2.6	coarse woody debris in stream and rivers	4	5
4.2.7	pools	14	19
4.2.8	riffles	4	5
4.2.9	runs/glides	8	11
4.2.10	overhanging vegetation	6	8
4.2.11	waterfalls	1	1
4.2.12	banks	12	16
4.2.13	seeps or springs	13	17
4.7	wetlands/marshes/wet meadows/bogs and swamps	66	88
4.7.1	riverine wetlands	43	57
4.7.2	context	38	51
4.7.2.1	forest	35	47
4.7.2.2	non-forest	17	23
4.7.3	size	5	7
4.7.4	marshes	33	44
4.7.5	wet meadows	14	19
4.8	islands	12	16
4.9	seasonal flooding	17	23

confluence of the Salmo River and Pend d'Oreille reservoir. It is therefore possible that this species forages along the riparian zone along the lower Salmo.

Management Implications - With respect to their dependence on a variety of riparian habitat elements and/or total KEFs, the following species are of special significance for the ecology and management of the Salmo riparian zone:

Birds

- American Dipper
- Harlequin Duck
- Mallard
- Great Blue Heron
- Yellow-headed Blackbird
- Red-winged Blackbird
- Spotted Sandpiper
- Killdeer
- Wood Duck
- American Crow

Mammals

- Northern River Otter
- American Beaver
- Back Bear
- Grizzly Bear
- Muskrat
- Moose
- Elk
- Mink
- Striped Skunk
- Raccoon

Amphibians

- Columbia Spotted Frog
- Wood Frog

With respect to listed species, Grizzly Bear use of the riparian zone has been observed annually (C. Steeger, pers. obs.); however, riparian habitat is only one part of the habitat types used by grizzlies and they are classed as being *generally associated* with this habitat type. Great Blue Herons and Western Screech-owl are *closely associated* with riparian habitats and are highly dependent on large-sized, old cottonwoods (Houde et al. 2001, Machmer 2003). Both species frequently nest in old cottonwoods, the owls in cavities and the herons in open stick nests. It is therefore likely that any resource developments and management actions that impact, positively or negatively, cottonwood habitat will in turn impact these listed bird species.

It is interesting to note that the Black Bear performs by far the most KEFs (33) and the blue-listed Grizzly Bear also performs a large number (22) of KEFs (Appendix 1). With respect to single species management, the two bear species should therefore receive special consideration. Other riparian species appropriate for management focus include (i) American Beaver, due to their keystone role in aquatic/riparian ecosystems (Kauffman et al. 2001), especially with respect to their unique ability to impound water, (ii) Great Blue Heron, due to their blue-listed status and dependence on mature cottonwoods (Machmer 2003) and fish, and (iii) Harlequin Ducks, due to their vulnerable (S3N) subnational (BC) status (see BC Conservation Data Centre http://srmwww.gov.bc.ca/cdc) and provincially important breeding population on the Salmo River system (Machmer 1999, 2000).

4.2.3 Fish-Riparian Habitat Relationships

Riparian areas and associated habitat elements clearly influence rivers and streams and therefore fish habitat in a variety of ways (Cederholm et al. 2001), which includes shading, sediment control, nutrient, litter and large woody debris input, and creation of microclimates. The extent to which fish influence riparian systems is less obvious, although the local disappearance of anadromous salmon populations would be expected to result in much reduced nutrient input via

fish carcasses in the Salmo riparian zone. Loss of riparian ecosystem components has been identified as one of five principal problems facing the Salmo River fish populations (Bisset & Cope 2003).

4.2.4 Wildlife-Fish Relationships

Generally, a strong relationship exists between certain vertebrate wildlife species and fish. With respect to salmon-wildlife relationships, Cederholm et al. (2001) identified nine wildlife species as having (or historically had) a strong, consistent relationship with salmon. This relationship, which primarily relates to predation, scavenging, and competition, may hold for other fish species as well. In the past, salmon-wildlife relationships on the Salmo River would have involved the Chinook salmon and steelhead.

Seven of the nine species with the strong, consistent relationships to fish (Cederholm et al. 2001) are known to be present in the Salmo riparian area. These include:

- Common Merganser
- Bald Eagle
- Northern River Otter
- Harlequin Ducks
- Black Bear
- Osprey
- Grizzly Bear

4.3 Historical Ecological Conditions

This section presents a general overview of historical ecological conditions within the riparian zone of the Salmo River. The information is primarily anecdotal and qualitative, although quantitative estimates of the extent of habitat alterations are provided for some sections of the river. Most locations mentioned below are identified in Figure 2.

<u>Extent of Riparian Zone / Floodplain</u>

- Apex area: extensive wetland; west side affected by BNR; riparian logging; possible 10% reduction.

- Hall Siding between the mouth of Hall Creek and Spilker's property: extensive permanent and ephemeral wetland (approx. 4 ha); compromised by BNR and some bank stabilization.

- Barrett Creek from the mouth upstream: permanent and ephemeral wetlands compromised by BNR (approx. 5 ha) and channelization of Barrett Creek; down stream ephemeral wetland compromised by channelization of Barrett Creek.

- Ymir area: ephemeral (remnants still existing) and permanent wetland; compromised by BNR and bank stabilization and channelization of Quartz Creek and west side of river (approx. 2 ha).

- Labyrinth Mill site: ephemeral and permanent wetland; compromised by bank stabilization, BNR and road building (present Hwy 6); possibly as much as 6 ha.

- Hidden Creek, slightly upstream, east and west side of river: ephemeral (remnants still existing); compromised by BNR, Hidden Creek Road and bank stabilization (2-3 ha).

- Area between Village of Salmo and BNR – Hwy 6 crossing: formerly a patchy ephemeral wetland; compromised by BNR, road building (Hwy 6) and rural development. Apparently Boulder Creek and the Salmo River would flood this area from time to time.

- Erie Creek/Village of Salmo area and extending up and downstream: course of Erie Creek changed approx. 0.5 km to south; Salmo River used to be much wider in this area, with extensive wetlands and periodic flooding events. Downstream from the Erie Creek-Salmo River confluence, extensive wetlands covered both sides of the river to about 1 km downstream of Hell Roaring Creek. Productive wetlands still exist just upstream of Hell Roaring, off the west side of Salmo River. This whole area has been compromised by dyking, from about 1.5 km upstream of Salmo west side to about 2 km south on both sides of river. Wetlands have also been compromised by road building, and rural, industrial, and recreational developments (e.g., residential homes, former airport, golf course, etc.).

- Canex site: the Canex mine tailings covers a wetland area of approx. 3-4 ha; some remnant wetland patches stills exist in this area.

- Burnt out bridge area south of Canex site: channelization of east side of the river downstream of the burnt out bridge for approximately 400 m.

Forest Structural Conditions

- An abundance of old-seral structural conditions, possibly as much as 50-70% of the river's length, existed within the riparian zone. There are remnant old growth cedar groves at: Stagleap Ranch; Spring Board Park (confluence of Erie Creek and Salmo River); just upstream of Stockdale's place, west side of the Salmo; and just upstream of the south Porto Rico Ymir-Road bridge, east side of the Salmo. Other individual and isolated old growth trees remaining in the riparian zone are infrequent. According to Ed John (pers. comm.), "there were many cedar, fir, pine, and larch old growth patches down toward Nelway, even in the 1920s. Before settlement by the white man, forests were composed mostly of cedar, pine, hemlock, balsam and larch. Some pioneers have said that the timber between Salmo and Nelson was so thick that sunlight hardly reached the ground. Trees back then could be found 14' in diameter and over 60 m tall" (Torrans, not dated).

4.4 Land Tenures

Land Tenures such as Crown land (federal, provincial, regional, municipal), private properties, mineral titles, forest licences, recreation licences, trapping licences need to be mapped as part of a watershed-wide mapping and GIS analysis. Mapping resources known to be available or needed for further analyses are listed under Section 5 below. In general, the Salmo Watershed contains a relatively large amount of private properties within the riparian zone. Riparian management, therefore, will have to include programs that encourage private landowners to practise ecosystem-based management or development.

4.5 Past and Present Impacts

Mining:

- Past: Planned but uncontrolled burns to provide easy access to bedrock. Timber harvest for support structures, flumes, etc. Huge road and trail building effort that may have affected

natural hydrology. Metals/minerals removal process had no waste management component - concentrated heavy metals were directly released onto land and into water.

- "From 1903 to 1905 we lived at the Hunter V mine at Ymir. The mine was at about 5000' elevation and connected to the railway by tram. From here an excellent view was obtained of the Salmon River Valley, and I still remember seeing the great Northern trains looking like tiny toys working their way up and down the valley. Also the Ymir mill, Porto Rico and Fern mills were all operating and the tailings entering the River had the result that it appeared as a white ribbon in the distance."(D.H. Norcross, pers. comm. in Heinbuch and Nellestijn 2000)

- Present: Unknown hydrological impacts from mining access roads. Forty-six tailing piles and ponds have been identified in the Salmo Watershed (Heinbuch & Nellestijn 2000) Inventory of Mine Tailings Piles and Ponds in the Salmo Watershed: Lisa Heinbuch/Gerry Nellestijn. SWSS). These sites range in size from 40 m^2 to several hectares (Canex tailings). Many directly impact riparian areas and the river.

- "This preliminary information indicates a potential for the Yankee Girl tailings (and by transference, other tailings) to impact the aquatic ecosystem of the Salmo River, downstream water users, recreational users of the site and the community of Ymir" (Roome 2000).

Railroad Roads/Highways:

- Past: Railroad and highways building had a significant impact on the quantity and quality of wetlands in the Salmon River system. Natural hydrological patterns were disrupted.

- Present: Flood control compromised by reduction of wetland. Freshet refuge sites minimized by reductions of wetlands/off channel/side channel habitat. Potential direct runoff impacts, water/ sediment/salt/other ice retardants loading into rivers. Associated culvert and other fish and aquatic life barriers.

Hydro/Flood/Irrigation Dams:

- Past: Largest single impact was the extirpation of anadramous Chinook salmon and steelhead. These species were integral parts of the aquatic-riparian ecosystem (see Section 4.2.4).

- Present: Salmo River fish populations are isolated from historical connections to river habitats in the Pend d'Oreille and Columbia Rivers. Unknown genetic adaptations due to extreme reformation of species community and of riparian profile. Lower 2+ kms of the Salmo River has been transformed into a reservoir and water temperatures have increased. Extreme aquatic species changes at the mouth of the river, i.e. in Seven Mile Reservoir formerly the Pend d'Oreille River. Possible increased populations of non-sport fish, i.e. northern pikeminnow and (predominantly) longnose suckers. Migration of these species past B.C. Hydro 'barrier' has been confirmed (Baxter & Nellestijn 2000).

Agriculture:

- Past: The Salmo Valley and some tributary valleys all contained small family run dairy farms (at one time a total of eight in the Salmo area). Small market garden and hay/cattle/horse

operations existed as well. Dyking to protect farm and other lands from floods has possibly had the greatest effects on the natural complexity of the aquatic-riparian ecosystem.

- Present: Limited hay, horses and cattle operations characterize current agriculture in the watrshed. Conversion of land to pasture may still affect the riparian zone on private properties. There are issues of cattle entering the Salmo River, which may lead to increases in fecal coliform and bank destabilization, erosion and increased water turbidity.

Trapping:

- Past/Present: Several trap lines have been maintained throughout the Salmo Watershed (Guy Woods, pers. comm.). In general trapping, especially trapping of beavers, is known to have had a significant effect on watershed profiles (Outwater (1997). Beaver lodge and dam building encourage rivers to meander as well as formation of wetlands and shallow reservoirs that provide habitat for a wide number of animal and plant species. The ecological processes performed by beavers also enhance water quality and aquifer recruitment. Beaver 'control' and trapping probably have a profound effect on the habitat and biodiversity of riparian and aquatic ecosystems. Outwater (1997) claims that beaver populations in North America are probably 5% of what they were pre European contact. The size of the beaver population in the Salmo River riparian zone is presently unknown.

Rural Residential/Urban Development:

- Past/Present: Extensive areas, especially at Sheep Creek and Erie Creek were heavily populated. Impacts by this rural but transient development were probably minimal and certainly difficult to evaluate at this point. The Village of Salmo area has seen extensive elimination of wetlands, which lasted into the 1960s.

Recreation:

- Past: Recreation, apart from fishing, likely had negligible impacts in the past. Historical angling practices may have had a significant impact on Salmo River populations. Until the 1960's there were fishery bag limits of 15-fish/per day. All informants confirmed that bag limits were consistently met until the 1960s. Soon after, ministry officials began a long and steady reduction of these limits.

- Present: Recreation may become the most significant impact for aquatic-riparian ecosystem health in the Salmo Watershed. Activities that are steadily increasing include: angling, and recreational boating in the form of kayaking, canoeing and rafting.

- ATV, dirt bike and snowmobile use in riparian areas has increased significantly since removal of rails and ties from the BNR right-of-way in the late 1990s. These activities may have profound effects on the riparian zone, unless they are included in a local recreation management plan.

Refuse Sites:

- Past: A number of unmanaged refuse and landfill sites existed and may still exist in the Salmo watershed. Apart from mining waste sites already noted, human use waste sites exist in various locations and may contribute to contamination of the ecosystem.

- Present: Currently there are two operations handling waste in the Salmo Watershed: the Ymir transfer site and the regional landfill at the former Canex tailings pond site at Sheep Creek. The regional landfill has been operational since 1983, a study conducted by Thurber Consultants Ltd (1984) indicated 'the present site was questionable and recommended use for one year to allow for time to search for another appropriate site'. Uma (1994) and Klohn–Crippen (1997) were commissioned to evaluate landfill impacts and all reports expressed concern about the site and the observable stream of leachate, which continues at the site (G. Nellestijn, pers. obs.).

Channalization/Dyking:

- Past/Present: Extensive channelization/dyking has occurred between the 1930s and 1960s. Impacts on the mainstem Salmo are frequent from approx. 1 km upstream of the Airport Road bridge to Hell Roaring Creek. Other areas of channelization occur upstream and downstream of the Canex (also known as Vector) tailings, and at Ymir. Varying lengths of channelization has also occurred, usually from the confluence (with the Salmo mainstem) upstream, on Erie, Porcupine, Barrett, Swift and Hall Creeks.

4.6 Potential Future Impacts

- Mining – We propose to use the SWSS 'Inventory of Mine Tailings and Ponds in the Salmo Watershed' (Heinbuch and Nellestijn 2000) to identify which sites constitute primary environmental impacts to the Salmo River. The sites featured in the SWSS report may be useful as a starting point and include:

Erie Creek Drainage
Arlington Mine
Second Relief Mine

Iron Mountain
Emerald-Jersey Mines

Sheep Creek Drainage
Yellowstone Mill
Queen Mine
Motherload Mine
Nugget Mine
Reno Mine
Kootenay Belle Mine
HB Tailing Pond

Wildhorse Creek Drainage
Yankee Girl/Dundee Mines
Ymir Mine
Center Star Mine
Wilcox Mine

Other Locations
Hall Creek Fern Mine
Barrett Creek Porto Rico Mine

- Railroad – The Burlington Northern Santa-Fe Railway Right-of-Way, which runs through much of the Salmo River riparian zone north of the Village of Salmo, was recently purchased by the province and is currently under the jurisdiction of the Ministry of Transportation and Highways. The intention is to have the railway corridor be developed for human recreation activities (Betts 2003). Future impacts to the riparian ecosystems are possible and include, for example: increased use by motorized recreationists, increased access to the river, increased disturbance of terrestrial and aquatic wildlife. Recognition of riparian Environmentally Sensitive Areas (ESAs) and important wildlife habitats (see Section 4.2) is needed to encourage proactive management planning.

- Roads/Highway – Continued construction of backcountry roads for logging and other industrial purposes will impact the hydrology of upland areas in the watershed and ultimately the water regime of the river. Effective drainage from highways and sediment input from highway sanding and erosion are concerns for the integrity of the river.

- Agriculture – While agricultural activities in the riparian zone is of minor concern at this time, possible changes to the provincial Agricultural Land Reserve (ALR) program might

increase development in protected areas. The consequences of these changes on the riparian zone are unknown.

- Residential/Urban Development – Logging and other land use activities within the riparian zone of private properties may have detrimental impacts on the riparian ecology. A particular concern is the continued cutting of mature cottonwoods, which has been encouraged by commercial interests in the area.

- Recreation – Of primary concern is the development of the railroad line for recreational activities. While much interest in this initiative has been expressed during previous workshops (Betts 2003), current proposals have not adequately addressed the ecological values and their protection along the corridor.

- Climate Change – Climate models are predicting increased temperatures over the next 100 years, which will affect rivers in the Pacific Northwest (Hamlet 2003). While the exact consequences of rising temperatures are unclear, Green (2003) advocates mitigation measures that include protection and restoration of riparian areas to maintain and increase shading.

- Logging – In addition to logging on private land, which is not currently regulated by government policy, crown land within the watershed is managed under the BC Timber Sales program. Relaxation of restrictions to operate within riparian zones (see Section 4.7 below) will likely have negative effects on the ecology of the riparian and ultimately the aquatic zones.

4.7 Government Regulations and Policies relevant to Riparian Zones

The most pertinent government regulations and policy directions that apply to the riparian zone of the Salmo River, or parts thereof, include:

Federal

Species At Risk Act - The Government of Canada recently adopted the Species At Risk Act (SARA) to protect rare and endangered species. Species are assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and given a status designation such as, for example, *threatened*, *endangered*, or *special concern*. Species designated as threatened or endangered come under the purview of the National Recovery Program, which is responsible for developing recovery strategies and action plans, and their implementation. Presently, COSEWIC-listed terrestrial vertebrate species known to occur along the Salmo River include the Western Screech-owl *macfarlanei* subspecies (endangered) and Grizzly Bear (special concern). Other listed species may occur in the plan area; however this information is not currently available.

Provincial

Forest Practices Code Riparian Management Area Guidebook – According to the riparian guidelines of the Forest Practices Code, riparian areas on public lands consist of *reserve zones* (adjacent to the stream) plus *management zones* (adjacent to the reserve zone), which together make up *riparian management zones*. The Salmo River is classified as a Riparian Class S2 stream (i.e., it is a fish-bearing stream of >5 – 20 m average width). This S2 classification requires a reserve zone width of 30 m (where harvesting is not permitted), a management zone width of 20 m (where site-specific constraints to harvesting apply) and an overall riparian management zone of 50 m.

Forest Practices Code Revisions- The latest regulations regarding forestry practices within riparian areas can be found under the Timber Harvesting and Silviculture Practices Regulations of the Forest Practices Code of BC Act, Part 3 - Timber Harvesting and Related Forest Practices, Division 2 - Protection of Streams and Riparian Areas.

Regional District of Central Kootenay

Rural Land Use Bylaw No. 1335 - Residential and urban development in the northern part of the watershed (Regional District Area G) is regulated by Rural Land Use Bylaw No. 1335, 1998. With respect to minimum site area for permitted land uses, the bylaw states that for Country Residential (R2) and Rural Residential (R3) the minimum area for permitted land uses is one and two hectares, respectively. These development regulations limit residential development in privately owned riparian areas.

Floodplain Management Bylaw 1000 - For the Salmo River, the Floodplain Hazard Maps – Salmo River (Schedule C) form part of Bylaw 1000 and restrict development in the riparian zone.

5.0 INFORMATION RESOURCES AND GAPS

5.1 Information Resources

5.1.1 GIS / Mapping / Remote Imagery

Mapping/Imagery Resources Available	**Description/Comments**
Forest Cover Scale: 1:20,000	Covering the Salmo mainstem 082F.004/14/24/34 (Arrow) 35/44/45 (Kootenay Lake)
Air photos Scale: 1: ~15,000	South Salmo: 30BCB90127 No.75 30BCB90127 No.183, 185, 269, 271 Kootnay Lake: 30BCB00020: 71-74 115-117, 148-149 30BCB00021: 200-201, 223-224
Orthophotos Scale: 1:20,000	082F.004/014/024/025/034 – All of Arrow Forest District
TRIM wetland	Available for all map sheets in BC
PEM	Kootenay Lake Forest District - not available Arrow Forest District – available Atco Lumber - available

RDCK **GIS information layers** Scale: 1:20,000	Available from RDCK: floodplain, zoning, cadastral, alluvial fan and ALR boundaries
Cottonwood distribution Scale: 1:20,000	Available for all forest cover map sheets.
Harlequin Duck distribution	see report by Marlene Machmer (2001)
Tenure Licences **Recreation** **Mining** **Forestry** **Trapping**	Recreation: presently none that include the riparian zone Mining: have GPS points of tailings sites from "Inventory of Mine Tailings and Ponds in the Salmo Watershed" report Forestry: have BC Timber Sales tenures and future plans for Kootenay Lake For. Dist. Trapping: maps of licence areas and numbers available from MWLAP
ROW Corridors **BC Gas** **Hydro** **Highways**	BC Gas: physical maps available. ROW, Hydro, Highways can be obtained from RDCK.
Others	Need all levels of forestry, i.e., private, crown, BC Timber Sales; including past, present and future plans.

5.1.2 Literature Resources

Document Title and Agency	**Author(s)/Year**	**Summary**
Barrett Creek Refuse Site Geotechnical Investigation RDCK, Nelson	Thurber Consultants Ltd. 1981.	- The report indicates that there are many coarse fragments in soil, the water may reach up to ground level, and the adjacent higher terrain is possibly unstable. - Barrett Creek was rejected as a site for a Level A solid waste landfill operation.
Burlington Northern Santa-Fe Railway Right-of-Way - Trail Stewardship Workshop #2 Final Report MOT, Nelson	Betts 2003.	- The report summarizes results and discussion from a workshop on the future management of the rail bed - The trail is owned by the BC Ministry of Transportation and Highways and is considered for management under the RDCK.
Canex Landfill Hydrogeological Impact Assessment RDCK, Nelson	Klohn-Krippen Consultants Ltd. 2000.	- The report characterizes the hydrological and geological pathways and descriptions of the Canex Landfill with particular attention to the composition and treatment possibilities for leachate generation impacts on private land and Sheep Creek.

Erie Creek Provincial Park Rare and Endangered Wildlife and Plant Survey BC Parks, Nelson	Dulisse & Page 2001.	- Field sampling of this 14 ha park revealed 157 vascular plants, including one blue-listed plant species: marsh muhly (*Muhlenbergia glomerata*), a grass species.
FPC Riparian Management Area Guidebook BC Forest Service, Victoria	BC Environment and Forest Service 1995	- The guidebook outlines the requirements for forest management within riparian areas
Inventory of Mine Tailings and Ponds in the Salmo Watershed SWSS, Salmo	Heinbuch & Nellestijn 2000.	- The report provides maps and descriptions of the most significant mine and mill tailings and ponds in the Salmo Watershed.
Listed species records (provincial)	various	- For information on species with special provincial status go to: http://srmwww.gov.bc.ca/cdc
Listed species records (federal)	various	- For information on species with special provincial status go to: http://srmwww.gov.bc.ca/cdc
Pre-incubation Inventory of Harlequin Ducks in the Salmo River Valley CBFWCP, Nelson	Machmer 1999.	- The pre-incubation inventory resulted in 66 sightings of one or more Harlequin Ducks in the watershed - Recommendations were made for preservation of specific sites
Salmo River Harlequin Duck Inventory, Monitoring and Brood Habitat Assessment CBFWCP, Nelson	Machmer 2000.	- 51 adults found during pre-incubation surveys - Minimum productivity estimated at 0.6 ducklings per female - 42 plots were established to sample habitat characteristics.
Breeding inventory and habitat assessment of Great Blue Herons in the Columbia Basin. CBFWCP, Nelson	Machmer 2003.	- several heron sightings in Salmo watershed - suspected nest sites along main stem, approx. 2 km south of Salmo and at Apex near headwaters
The Place Where We Live: Looking Back To Look Forward SWSS, Salmo	SWSS not dated	- The report contains a satellite map of Salmo River watershed and includes chapters on first nations, the Dewdney Trail, history of mining, forestry, local railways, hydro-electric dam, and wildlife.
Wildlife-Habitat Relationships in BC's Columbia Basin CBT	various	- For reports, databases, and other pertinent information go to: http://habitat.cbt.ca
Yankee Girl Tailings EIA Summary Report MWLAP, Nelson	MWLAP 2002.	- Mill tailings located in riparian zone of river across from Ymir proper - The site has elevated levels of arsenic, cadmium, lead, cobalt, iron, silver, zinc, and manganese - Toxins are leaching into river - Site is considered "Special Waste Site"

5.2 Information Gaps

The following information gaps have been identified as being essential for completing the riparian profile and WFSP Stages III and IV:

- Delineation of riparian zone – The riparian zone along the main stem and major tributaries of the Salmo River needs to be mapped. Criteria for mapping include the area from the river's high water mark to the end of the flood plain. This task will involve air photo interpretation and ground verification. Information on the historical extent of the flood plain will be useful for restoration of riparian wetlands.

- Structural conditions within riparian zone – Current supply of forest, shrub/steppe, agricultural, and urban structural conditions (following the definitions of the Columbia Basin Database of Wildlife-Habitat Relationships) needs to be determined, to focus management and mitigation efforts. Field surveys are required.

- Habitat elements within riparian zone – Current supply of riparian habitat elements (following the definitions of the Columbia Basin Database of Wildlife-Habitat Relationships) needs to be determined, to focus management and mitigation efforts. Field surveys are required.

- Updated list of vertebrate species, their habitat associations, ecological functions, and relationships to fish and fish habitat – Riparian species information presented in this report was based on incidental observations. A systematic survey of riparian vertebrate wildlife species would increase the accuracy of future analyses, but is not critical for completion of the project.

- Mapping and GIS products (see Section 5.1.1). The following mapping resources are still needed:

  Air Photos - Historical air photos for entire watershed, earliest ones from ~1939.
  A digital index of the flight lines for the 1930s photos is available.

  Arrow Lake:
  Flight Line: B99011
  Photos: 12,13,96,97,127,128,211,212, 246, 247

  (from map B-018-FI-99_82f.)
  B99021: 127,128 (B-018-FI-99_82f.)
  B99032: 202,203,228,229
  (B-018-FI-99_82f.)
  B99033: 54,55,77,78,183,184,214,215 (B-018-FI-99_82f.)
  B99034: 40,41,74,75,76,77,78,79
  (B-018-FI-99_82f)

  BEC and TEM - Both BEC and TEM may be useful in terms of soil analysis and to identify vegetation species and densities, slope stabilities and areas with high erosion sensitivities. Can also indicate habitat diversity. BEC at 1:50,000 or smaller scales not useful for soils

  Surficial Geology - Helps to show stability of riparian habitat and groundwater flows and the effects high floods may have on river and groundwater flow.

Groundwater Flow Charts - Help to indicate riparian zone and effects terrestrial impacts can have on the water quality and flow.

Riparian Zone - Need clear delineation of riparian zone by using air photo interpretation and then ground truthing with GPS, or at least GPS on ground by identification of riparian vegetation.

River Attributes - Necessary to have delineation of pools, riffles, flow of Salmo main stem as well as known spawning grounds, large woody debris, etc.

Fish Locations - Places where certain species have been known to concentrate, based on angler surveys, radiotelemetry, etc.

Benchmark Points - Need GPS points of benchmark surveys and monitoring to continue with consistent data gathering.

Water Outake Sources and Licenced Quantity - Places on the Salmo main stem or tributaries where water is being taken out for private applications, highways, etc.

6.0 RECOMMENDATIONS

Stage II completion

1. Complete mapping and GIS analysis for the riparian zone as proposed in the analysis and management framework (Figure 1) and described in Sections 5.1.1 and 5.2.

2. Ground-verify the mapped information. Ground surveys can be designed and coordinated to collect a variety of information. For example, identification of the type, amount, and distribution of structural conditions and habitat elements within the riparian zone can be combined with species inventories. Furthermore, inventories of aquatic habitat characteristics, riparian habitat elements that interface with the aquatic environment and riparian species may be combined during surveys.

3. Extend and/or complete the structural and functional analyses of wildlife/fish-habitat relationships as outlined in this report. Emphasize species-habitat relationships that involve those terrestrial species that have (i) numerous and strong associations with riparian habitat elements and/or significant Key Ecological Functions (Section 4.2.2) and (ii) strong, consistent relationships with fish (Section 4.2.4).

Strategic direction for Stage III

4. The results of the preliminary analysis of wildlife-habitat relationships (Section 4.2.2) indicate a relatively high number of species being dependent on wetlands, marshes, wet meadows, bogs and swamps within the riparian zone. The amount and distribution and possible protection and restoration needs of these habitat elements should be established because extensive channelization and dyking of the river has reduced their availability throughout most of the watershed. Where restoration of riparian wetland components includes restoring some of the river's side arms and channels, fish populations will likely benefit.

5. Several riparian wildlife species feed on and/or compete with fish (Section 4.2.2); however, it is presently unknown whether and to what extent piscivorous species are responsible for the low levels of certain fish populations. Fish hide from predators, to some extent, under large woody debris. As the latter may be in reduced supply, there is a need to establish present levels of these structures and identify areas where restoration efforts should be applied, if needed.

6. Several wildlife species with listed conservation status or ecologically important functions inhabit the riparian zone along the river. Some of these species, for example, Great Blue Heron and Grizzly and Black Bear frequently use the riparian zone and require undisturbed habitat. The requirement for undisturbed *Environmentally Sensitive Areas* (ESAs) therefore has to be considered for all future developments within the riparian zone.

   Of particular significance is the proposal to establish a linear regional park on the Ministry of Transportation property of the railroad right-of-way. Unless ESAs are identified and adequately protected along the railroad, conflicts between the needs of wildlife species and trail users are likely to arise. We therefore recommend the establishment of objectives for the trail that ensure (a) protection of important riparian habitats and fish and wildlife species and (b) minimization of human-wildlife conflicts. In this context, important issues include:

   (i) identification and spatial context of ESAs;

   (ii) impacts on ESAs from different types and seasons of trail use (e.g., motorized, non-motorized; spring, summer, fall, winter);

   (iii) alterations to the rail bed to promote re-establishment of seasonal flooding and enhancement of fish habitat and riverine wetlands;

   (iv) RDCK requirements regarding development and maintenance activities in a linear Regional Park that potentially affect ecosystem values (e.g., snag and wildlife tree removal, access requirements, etc.);

   (v) MOTH requirements regarding ownership of the property that potentially affect ecosystem values;

   (vi) the requirement of "undisturbed" habitat by sensitive species and *species at risk* vs. encouragement toward human use of the trail – the option of different "use zones" along the trail;

   (vii) human-wildlife interactions such as confrontations with bears or moose, or disturbance of sensitive species such as Bull Trout, Great Blue Heron, Harlequin Duck, Grizzly Bear, among others."

7. Historical mine and mill residue tailings and ponds are impacting the riparian zone (e.g., at the Ymir town site; Section 4.5 and 4.6)). Some of contaminated sites in the watershed are in urgent need of restoration. We recommend development of an impact database for

these and other impact sites, to guide and prioritize management efforts. This database may include the following fields:

- File number
- Impact Type (e.g., recreation, mining, forestry, etc.)
- Status/Phase (i.e., restoration planning, restoration implementation, restoration monitoring, prevention)
- Parties (agencies, organizations, individuals) involved, their role and primary contacts
- Location/Polygon #
- Available reports, maps, data, and other information
- Comments

With respect to the impact of past and potential future mining operations, we recommend continued encouragement for representation of the mining sector in the Salmo WFSP initiative.

8. Due to the high amount of private properties within the riparian zone of the watershed, consider development of an incentive-based habitat stewardship program for private landowners. Such a program could include eco-asset investments such as compensation payments for conservation of forest cover or important habitats or the selling and buying of "shares" in vital services of nature (Ellison & Daily 2003). Such new approaches to ecosystem conservation appear to be gaining momentum in numerous jurisdictions and may be feasible for the Salmo Watershed.

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8.0 APPENDICES

APPENDIX 1: Wildlife Habitat Type of the Salmo River Riparian Zone

APPENDIX 2: Terrestrial Vertebrate Wildlife Species confirmed to occur in the Salmo Riparian Zone, their degree of habitat association and total number of Key Ecological Functions (KEFs).

APPENDIX 3: Riparian Habitat Elements Definitions (based on Johnson & O'Neil 2001).

APPENDIX 4: Key Ecological Function Definitions (based on Johnson & O'Neil 2001).

APPENDIX 1: Wildlife Habitat Type of the Salmo River Riparian Zone

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The following habitat type is one of 15 vegetated habitat types recognized in the BC portion of the Columbia River Basin. It is the only one that applies to interior riparian zones (see http://habitat.cbt.org).

Eastside (Interior) Riparian-Wetlands

Vegetation:
This habitat type contains shrublands, woodlands and forested communities within close proximity to lakes, rivers, streams or wetlands. Stands are closed to open canopies and often multi-layered. Trees include broadleaf, conifer or mixtures of both. Closed thickets of tall deciduous shrubs are common with an undergrowth of low shrubs or dense patches of grasses, sedges or forbs. Rocks and boulders may be prominent. Common species include black cottonwood, trembling aspen, paper birch, willows, mountain alder, red-osier dogwood, gooseberry, rose and snowberry. If Eastside Interior Riparian-Wetlands are surrounded by Shrub-Steppe habitat, then Ponderosa pine and Douglas fir may be present.

Climate:
Eastside Interior Riparian Wetlands are found in warm montane and adjacent valleys and riparian areas.

Location:
Riparian areas are found along perennial and intermittent rivers and stream, lakes, ponds and seeps surrounded by Eastside Mixed Conifer Forests, Ponderosa Pine Forests, and the Shrub-Steppe habitat types.

BEC Comments: Found within very moist to very wet sites of all non-subalpine or alpine BEC units.

APPENDIX 2: Terrestrial Vertebrate Wildlife Species confirmed to occur in the Salmo Riparian Zone, their degree of habitat association and total number of Key Ecological Functions (KEFs).

English Name	Scientific Name	Degree of Association with Riparian[1]	Total KEFs
American Beaver	*Castor canadensis*	*C*	24
American Crow	*Corvus brachyrhynchos*	*A*	21
American Dipper	*Cinclus mexicanus*	*C*	9
American Goldfinch	*Carduelis tristis*	*C*	16
American Kestrel	*Falco sparverius*	*A*	11
American Marten	*Martes americana*	*P*	14
American Redstart	*Setophaga ruticilla*	*C*	10
American Robin	*Turdus migratorius*	*A*	12
American Wigeon	*Anas americana*	*P*	19
Bald Eagle	*Haliaeetus leucocephalus*	*C*	14
Bank Swallow	*Riparia riparia*	*C*	11
Barn Swallow	*Hirundo rustica*	*C*	11
Barred Owl	*Strix varia*	*A*	14
Belted Kingfisher	*Ceryle alcyon*	*C*	15
Black Bear	*Ursus americanus*	*A*	33
Black-backed Woodpecker	*Picoides arcticus*	*P*	8
Black-capped Chickadee	*Poecile atricapilla*	*C*	16
Black-headed Grosbeak	*Pheucticus melanocephalus*	*C*	16
Bobcat	*Lynx rufus*	*A*	8
Bohemian Waxwing	*Bombycilla garrulus*	*A*	15
Brown Creeper	*Certhia americana*	*A*	7
Brown-headed Cowbird	*Molothrus ater*	*A*	12
Bufflehead	*Bucephala albeola*	*C*	14
Bullock's Oriole	*Icterus bullockii*	*C*	15
Bushy-tailed Woodrat	*Neotoma cinerea*	*C*	16
Calliope Hummingbird	*Stellula calliope*	*A*	9
Canada Goose	*Branta canadensis*	*A*	16
Cedar Waxwing	*Bombycilla cedrorum*	*C*	14
Chipping Sparrow	*Spizella passerina*	*A*	15
Cliff Swallow	*Petrochelidon pyrrhonota*	*C*	11
Columbia Spotted Frog	*Rana luteiventris*	*C*	12
Columbian Ground Squirrel	*Spermophilus columbianus*	*A*	16
Common Garter Snake	*Thamnophis sirtalis*	*C*	12
Common Goldeneye	*Bucephala clangula*	*P*	16
Common Loon	*Gavia immer*	*C*	11
Common Merganser	*Mergus merganser*	*C*	18
Common Raven	*Corvus corax*	*A*	20
Common Snipe	*Gallinago gallinago*	*A*	12

Cooper's Hawk	*Accipiter cooperii*	*A*	9
Coyote	*Canis latrans*	*A*	18
Dark-eyed Junco	*Junco hyemalis*	*A*	13
Deer Mouse	*Peromyscus maniculatus*	*C*	26
Downy Woodpecker	*Picoides pubescens*	*A*	11
Eastern Kingbird	*Tyrannus tyrannus*	*C*	14
Elk	*Cervus elaphus*	*A*	20
Ermine	*Mustela erminea*	*A*	7
European Starling	*Sturnus vulgaris*	*C*	18
Evening Grosbeak	*Coccothraustes vespertinus*	*A*	15
Golden-crowned Kinglet	*Regulus satrapa*	*A*	12
Gray Catbird	*Dumetella carolinensis*	*C*	14
Gray Jay	*Perisoreus canadensis*	*A*	16
Great Blue heron, *herodias* subspecies	*Ardea herodias herodias*	*C*	17
Great Horned Owl	*Bubo virginianus*	*A*	9
Green-winged Teal	*Anas crecca*	*A*	18
Grizzly Bear	*Ursus arctos*	*A*	22
Hairy Woodpecker	*Picoides villosus*	*A*	9
Harlequin Duck	*Histrionicus histrionicus*	*C*	7
Hoary Bat	*Lasiurus cinereus*	*A*	8
Hooded Merganser	*Lophodytes cucullatus*	*C*	18
Killdeer	*Charadrius vociferus*	*A*	13
Lazuli Bunting	*Passerina amoena*	*A*	14
Little Brown Myotis	*Myotis lucifugus*	*A*	9
Mallard	*Anas platyrhynchos*	*C*	21
Merlin	*Falco columbarius*	*P*	6
Mink	*Mustela vison*	*C*	17
Moose	*Alces alces*	*C*	11
Mountain Bluebird	*Sialia currucoides*	*A*	11
Mountain Chickadee	*Poecile gambeli*	*A*	14
Mountian Lion	*Puma concolor*	*A*	9
Mule Deer	*Odocoileus hemionus*	*A*	18
Muskrat	*Ondatra zibethicus*	*C*	17
Nashville Warbler	*Vermivora ruficapilla*	*A*	13
Northern Alligator Lizard	*Elgaria coerulea*	*A*	8
Northern Flicker	*Colaptes auratus*	*A*	9
Northern Flying Squirrel	*Glaucomys sabrinus*	*A*	16
Northern Goshawk	*Accipiter gentilis*	*A*	9
Northern Harrier	*Circus cyaneus*	*P*	8
Northern Pocket Gopher	*Thomomys talpoides*	*P*	13
Northern Pygmy-Owl	*Glaucidium gnoma*	*A*	6
Northern River Otter	*Lontra canadensis*	*C*	12
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	*C*	9
Northern Saw-whet Owl	*Aegolius acadicus*	*A*	10
Northern Waterthrush	*Seiurus noveboracensis*	*C*	7

Olive-sided Flycatcher	*Contopus cooperi*	*A*	8
Osprey	*Pandion haliaetus*	*A*	10
Pileated Woodpecker	*Dryocopus pileatus*	*A*	10
Pine Grosbeak	*Pinicola enucleator*	*P*	14
Pine Siskin	*Carduelis pinus*	*A*	17
Purple Finch	*Carpodacus purpureus*	*P*	16
Raccoon	*Procyon lotor*	*C*	27
Red Crossbill	*Loxia curvirostra*	*P*	13
Red-breasted Nuthatch	*Sitta canadensis*	*A*	15
Red-eyed Vireo	*Vireo olivaceus*	*C*	12
Red-naped Sapsucker	*Sphyrapicus nuchalis*	*C*	13
Red-tailed Hawk	*Buteo jamaicensis*	*A*	12
Red-winged Blackbird	*Agelaius phoeniceus*	*A*	12
Ruby-crowned Kinglet	*Regulus calendula*	*P*	13
Ruffed Grouse	*Bonasa umbellus*	*C*	16
Rufous Hummingbird	*Selasphorus rufus*	*A*	9
Sharp-shinned Hawk	*Accipiter striatus*	*A*	11
Silver-haired Bat	*Lasionycteris noctivagans*	*A*	11
Snowshoe Hare	*Lepus americanus*	*C*	20
Solitary Sandpiper	*Tringa solitaria*	*C*	9
Song Sparrow	*Melospiza melodia*	*A*	15
Spotted Sandpiper	*Actitis macularia*	*C*	14
Spotted Towhee	*Pipilo maculatus*	*C*	13
Steller's Jay	*Cyanocitta stelleri*	*A*	16
Striped Skunk	*Mephitis mephitis*	*A*	22
Swainson's Thrush	*Catharus ustulatus*	*A*	13
Three-toed Woodpecker	*Picoides tridactylus*	*P*	10
Townsend's Big-eared Bat	*Corynorhinus townsendii*	*A*	10
Townsend's Solitaire	*Myadestes townsendi*	*P*	12
Townsend's Warbler	*Dendroica townsendi*	*P*	9
Tree Swallow	*Tachycineta bicolor*	*C*	11
Turkey Vulture	*Cathartes aura*	*A*	6
Varied Thrush	*Ixoreus naevius*	*A*	15
Violet-green Swallow	*Tachycineta thalassina*	*A*	10
Warbling Vireo	*Vireo gilvus*	*C*	12
Western Screech-Owl	*Otus kennicottii*	*C*	8
Western Tanager	*Piranga ludoviciana*	*P*	11
Western Terrestrial Garter Snake	*Thamnophis elegans*	*A*	14
Western Toad	*Bufo boreas*	*C*	15
White-tailed Deer	*Odocoileus virginianus*	*C*	14
White-winged Crossbill	*Loxia leucoptera*	*P*	12
Wild Turkey	*Meleagris gallopavo*	*A*	17
Willow Flycatcher	*Empidonax traillii*	*C*	12
Wilson's Warbler	*Wilsonia pusilla*	*P*	10
Winter Wren	*Troglodytes troglodytes*	*A*	7
Wood Duck	*Aix sponsa*	*C*	16

Wood Frog	*Rana sylvatica*	*C*	15
Yellow Warbler	*Dendroica petechia*	*C*	10
Yellow-bellied Marmot	*Marmota flaviventris*	*A*	14
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	*C*	9
Yellow-Pine Chipmunk	*Tamias amoenus*	*A*	18
Yellow-rumped Warbler	*Dendroica coronata*	*A*	11

[1] C = closely associated, A = generally associated, P = present.

APPENDIX 3: Riparian Habitat Elements Definitions (based on Johnson & O'Neil 2001).

The following riparian habitat elements were selected for the purpose of this report. For a complete list of habitat elements see http://habitat.cbt.org

4 FRESHWATER RIPARIAN AND AQUATIC BODIES HABITAT ELEMENTS

Includes selected forms and characteristics of any body of freshwater.

4.1 – not included

4.2 rivers & streams - Various characteristics of streams and rivers.

4.2.1 oxbows - A pond or wetland created when a river bend is cut off from the main channel of the river.

4.2.2 order and class - Systems of stream classification.

4.2.2.1 intermittent - Streams/rivers which contain non-tidal flowing water for only part of the year, water may remain in isolated pools.

4.2.2.2 upper perennial - Streams/rivers with a high gradient, fast water velocity, no tidal influence, some water flowing throughout the year, substrate consists of rock, cobbles, or gravel with occasional patches of sand, little floodplain development.

4.2.2.3 lower perennial - Streams/rivers with a low gradient, slow water velocity, no tidal influence, some water flowing throughout the year, substrate consists mainly of sand and mud, floodplain is well developed.

4.2.3 zone - System of water body classification based on the horizontal strata of the water column.

4.2.3.1 open water - Open water areas not closely associated with the shoreline or bottom.

4.2.3.2 submerged/benthic - Relating to the bottom of a body of water, includes the substrate and the overlaying body of water within one meter of the substrate.

4.2.3.3 shoreline - Continually exposed substrate that is subject to splash, waves, and/or periodic flooding. Includes gravel bars, islands, and immediate nearshore areas.

4.2.4 in-stream substrate - The bottom materials in a body of water.

4.2.4.1 rocks - Rocks > 256 mm (10") in diameter.

4.2.4.2 cobble/gravel - Rocks or pebbles, 4-256 mm in diameter (10), substrata may consist of cobbles, gravel, shell, and sand with no one substratum type exceeding 70 percent cover.

4.2.4.3 sand/mud - Fine substrata < 4 mm in diameter, little gravel present, may be mixed with organics.

4.2.5 vegetation - Herbaceous plants.

4.2.5.1 submergent vegetation - Rooted aquatic plants that do not emerge above the water surface.

4.2.5.2 emergent vegetation - Rooted aquatic plants that emerge above the water surface.

4.2.5.3 floating mats - Un-rooted plants that form vegetative masses on the surface of the water.

4.2.6 coarse woody debris in streams and rivers - Any piece of woody material (debris piles, stumps, root wads, fallen trees) that intrudes into or lies within a river or stream.

4.2.7 pools - Portions of the stream with reduced current velocity, often with water deeper than surrounding areas.

4.2.8 riffles - Shallow rapids where the water flows swiftly over completely or partially submerged obstructions to produce surface agitation, but where standing waves are absent.

4.2.9 runs/glides - Areas of swiftly flowing water, without surface agitation or waves, which approximates uniform flow and in which the slope of the water surface is roughly parallel to the overall gradient of the stream reach.

4.2.10 overhanging vegetation - Herbaceous plants that cascade over stream and river banks and are < 1 meter above the water surface.

4.2.11 waterfalls - Steep decent of water within a stream or river.
4.2.12 banks - Rising ground that borders a body of water.
4.2.13 seeps or springs - A concentrated flow of ground water issuing from openings in the ground.
4.3-4.6 – not included
4.7 wetlands/marshes/wet meadows/bogs and swamps - Various components and characteristics related to any of these systems.
4.7.1 riverine wetlands - Wetlands found in association with rivers.
4.7.2 context - When checked, indicates that the setting of the wetland, marsh, wet meadow, bog or swamp is key to the queried species.
4.7.2.1 forest - Wetlands within a forest.
4.7.2.2 non-forest - Wetlands that are not surrounded by forest.
4.7.3 size - When checked, indicates that the queried species is differentially associated with a wetland, marsh, wet meadow, bog or swamp based on the size of the water body.
4.7.4 marshes - Frequently or continually inundated wetlands characterized by emergent herbaceous vegetation (grasses,sedges, reeds) adapted to saturated soil conditions.
4.7.5 wet meadows - Grasslands with waterlogged soil near the surface but without standing water for most of the year.
4.8 islands - A piece of land made up of either rock and/or unconsolidated material that projects above and is completely surrounded by water.
4.9 seasonal flooding - Flooding that occurs periodically due to precipitation patterns.

APPENDIX 4: Key Ecological Function Definitions (based on Johnson & O'Neil 2001).

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1 TROPHIC RELATIONSHIPS

1.1 heterotrophic consumer - an organism that is unable to manufacture its own food and must feed on other organisms
1.1.1 primary consumer - herbivore; an organism that feeds primarily on plant material (also see below under Herbivory)
1.1.1.1 foliovore - leaf eater
1.1.1.2 spermivore - seed eater
1.1.1.3 browser - leaf, stem eater
1.1.1.4 grazer - grass, forb eater
1.1.1.5 frugivore - fruit eater
1.1.1.6 sap feeder
1.1.1.7 root feeders
1.1.1.8 nectivore - nectar feeder
1.1.1.9 fungivore - fungus feeder
1.1.1.10 flower/bud/catkin feeder
1.1.1.11 aquatic herbivore
1.1.1.12 feeds in water on decomposing benthic substrate - benthic is the lowermost zone of a water body
1.1.1.13 bark/cambium/bole feeder
1.1.2 secondary consumer - primary predator or primary carnivore; a carnivore that preys on other vertebrate or invertebrate animals, primarily herbivores
1.1.2.1 invertebrate eater
1.1.2.1.1 terrestrial invertebrates
1.1.2.1.2 aquatic macroinvertebrates (e.g., not plankton)
1.1.2.1.3 freshwater or marine zooplankton
1.1.2.2 vertebrate eater - consumer or predator of herbivorous vertebrates
1.1.2.2.1 piscivorous - fish eater
1.1.2.3 ovivorous - egg eater
1.1.3 tertiary consumer - secondary predator or secondary carnivore; a carnivore that preys on other carnivores
1.1.4 carrion feeder - feeds on dead animals
1.1.5 cannibalistic - eats members of its own species
1.1.6 coprophagous - feeds on fecal material
1.1.7 feeds on human garbage/refuse
1.1.7.1 aquatic (e.g., offal and bycatch of fishing boats)
1.1.7.2 terrestrial (e.g., garbage cans, landfills)
1.2 prey relationships
1.2.1 prey for secondary or tertiary consumer - primary or secondary predator

2 AIDS IN PHYSICAL TRANSFER OF SUBSTANCES FOR NUTRIENT CYCLING (C,N,P, etc.)

3 ORGANISMAL RELATIONSHIPS

3.1 potentially controls or depresses insect population peaks
3.2 controls terrestrial vertebrate populations (through predation or displacement)
3.3 pollination vector

3.4 transportation of viable seeds, spores, plants, or animals (through ingestion, caching, caught in hair or mud on feet etc.)
3.4.1 disperses fungi
3.4.2 disperses lichens
3.4.3 disperses bryophytes, including mosses
3.4.4 disperses insects and other invertebrates (phoresis)
3.4.5 disperses seeds/fruits (through ingestion or caching)
3.4.6 disperses vascular plants
3.5 creates feeding, roosting, denning, or nesting opportunities for other organisms
3.5.1 creates feeding opportunities (other than direct prey relations)
3.5.1.1 creates sapwells in trees
3.5.2 creates roosting, denning, or nesting opportunities
3.6 primary creation of structures (possibly used by other organisms)
3.6.1 aerial structures - typically large raptor or squirrel stick or leaf nests in trees or on platforms, or barn swallow/cliff swallow nests
3.6.2 ground structures - above-ground, non-aquatic nests and dens and other substrates, such as woodrat middens, nesting mounds of swans
3.6.3 aquatic structures - muskrat lodges, beaver dams
3.7 user of structures created by other species
3.7.1 aerial structures - typically large raptor or squirrel stick or leaf nests in trees or on platforms, or barn swallow/cliff swallow nests
3.7.2 ground structures - above-ground, non-aquatic nests and dens and other substrates, such as woodrat middens, nesting mounds of swans, for example
3.7.3 aquatic structures - muskrat lodges, beaver dams
3.8 nest parasite
3.8.1 interspecies parasite - commonly lays eggs in nests of other species
3.8.2 common interspecific host - parasitized by other species
3.9 primary cavity excavator in snags or live trees - organisms able to excavate their own cavities
3.10 secondary cavity user - organisms that do not excavate their own cavities and depend on primary cavity excavators or natural cavities
3.11 primary burrow excavator - fossorial or underground burrows
3.11.1 creates large burrows (rabbit-sized or larger)
3.11.2 creates small burrows (less than rabbit-sized)
3.12 uses burrows dug by other species - secondary burrow user
3.13 creates runways (possibly used by other species; runways typically are worn paths in dense vegetation)
3.14 uses runways created by other species
3.15 pirates food from other species
3.16 interspecific hybridization - species known to regularly interbreed

4 CARRIER, TRANSMITTER, OR RESERVOIR OF VERTEBRATE DISEASES

4.1 diseases that affect humans
4.2 diseases that affect domestic animals
4.3 diseases that affect other wildlife species

5 SOIL RELATIONSHIPS

5.1 physically affects (improves) soil structure, aeration (typically by digging)
5.2 physically affects (degrades) soil structure, aeration (typically by trampling)

6 WOOD STRUCTURE RELATIONSHIPS(either living or dead wood)

6.1 physically fragments down wood
6.2 physically fragments standing wood

7 WATER RELATIONSHIPS

7.1 impounds water by creating diversions or dams
7.2 creates ponds or wetlands through wallowing

8 VEGETATION STRUCTURE AND COMPOSITION RELATIONSHIPS

8.1 creates standing dead trees - snags
8.2 herbivory on trees or shrubs that may alter vegetation structure and composition - browsers
8.3 herbivory on grasses or forbs that may alter vegetation structure and composition - grazers

Salmo & Lower Pend d'Oreille Rivers

Summary of Community Involvement Process Renewal Recommendations for 2000

Prepared for the
Columbia Kootenay Fisheries
Renewal Partnership

Prepared by
Lynn Betts

With contributions from
Joanna Maratta

July 2000

Background & Context

The Columbia-Kootenay Fisheries Renewal Partnership (the Partnership) was formed in 1999 and is a coalition of anglers, First Nations, environmentalists, watershed stewards, naturalists, government representatives, regional district representatives and youth. Together this group developed a partnership, funded by Fisheries Renewal British Columbia, the Columbia Basin Trust and the Department of Fisheries and Oceans.

The Partnership's mission is to *"engage a broad range of fisheries perspectives in a cooperative, community-based partnership to prioritize regional fish and fish habitat conservation and restoration needs and opportunities, and to guide delivery of available funding to maximize environmental, social and cultural benefits in the Columbia-Kootenay region."*

The Partnership has developed a strategy for fish, and fish habitat conservation based on the following regional priorities:

- Conservation of wild fish populations;
- Improvements to fish passage at artificial barriers;
- Improved management of water flows; and
- Improvement of water quality.

In order to address these key fisheries renewal issues, the Partnership identified five program areas

1. Stewardship, public awareness and education;
2. Habitat conservation and restoration;
3. Research, monitoring and assessment;
4. Community support and project monitoring and evaluation; and
5. Strategic planning at the watershed level.

The Partnership recognizes that the best approach to fisheries renewal planning is to make strategic planning decisions at the sub-regional (local, community, regional, watershed) level.

The Salmo and Lower Pend d'Oreille Rivers together are a logical watershed area for planning activities and were identified as priority sub-region within the Columbia-Kootenay watershed. The Salmo River was once an important spawning area for sea going (anadromous) Pacific Salmon. Today it is home to a declining bull trout population. The bull trout is on British Columbia's Blue List, meaning it is a vulnerable

species that could become endangered unless conservation efforts are taken. The Pend d'Oreille River has been impacted by dam construction and like the Salmo River, was once home to a thriving pacific salmon population. Today the Pend d'Oreille is home to a fishery made up largely of non-native fish species (species of fish that did not naturally occur in the area).

Recognizing that this area would benefit from renewal activities, the Partnership began a community-based process in March 2000 to determine attitudes and preferences towards the development of a strategic plan to help renew the Salmo and Lower Pend d'Oreille Rivers. Feedback from a community meeting in March 2000 demonstrated that there was a significant level of community interest in protecting and enhancing the long-term health of the rivers and the fisheries for future generations. It also became clear at this meeting that the process for beginning such a planning process would have to reflect community values and address concerns related to a transparent decision making process. Other issues related to relationships between community members were also identified in March.

In order to advance discussions, a working group, comprised of community members, stakeholders, fisheries biologists, and others was formed to work with the Partnership to identify next steps and work towards fisheries renewal in the watershed. When a meeting of the working group was convened in May 2000 it became clear that implementing "hands-on" renewal projects that could involve community members would likely receive more community support in the short-term than would a strategic planning process that would not necessarily result in any immediate improvements to the rivers and the fisheries in 2000.

Since the Partnership is a responsive, community-oriented organization, it accepted the advice from the Working Group to postpone strategic planning in the short-term and instead the Partnership agreed to provide $10,000 in funding for "hands on" renewal projects to be implemented in 2000. By selecting projects that reflect community preferences and have the potential to involve community members, the Partnership and the Working Group members hope to begin building long-term relationships within the watershed with the goal of achieving renewal through the delivery of projects that have community support.

In order to select "hands on" renewal projects, the Partnership embarked on a community-based information and involvement process designed to achieve the following goals and objectives:

1. Introduce the Partnership and explain its mandate;
2. Educate and inform people about the state of the rivers and the fisheries; and
3. To present potential projects and seek community input on potential renewal activities in the short- and long-term.

In order to achieve these goals and objectives the Partnership contracted the services of experienced community involvement practitioners Lynne Betts and Joanna Maratta. Together the contractors delivered the community involvement program that included:

- Distribution of approximately 3,200 newsletters to homes and businesses in the Watershed (through the Ymir, Salmo, Fruitvale, Waneta, and Montrose post offices);
- Distribution of the newsletter to another 150 (approximate) stakeholders including local elected officials, forestry companies, provincial ministries, First Nations, schools and others.
- Paid advertisements in the Salmo Valley Monthly, Trail Times, West Kootenay Weekender, Nelson Daily News, Pennywise, The Express, and the Castelegar Sun. News releases were also distributed to local print and electronic media.
- Three widely advertised free public open houses were held in Fruitvale (June 20), Ymir (June 21) and Salmo (June 22).
- In addition to attending the open houses, people were encouraged to provide their comments in writing and drop-off locations were found in Fruitvale, Ymir and Salmo.

Potential Renewal Projects for 2000

The Working Group, with input from the Partnership, developed an initial list of potential renewal projects that could be completed in 2000. While there are other projects that could be done this year, (e.g., radio telemetry studies, and coarse fish tagging), the focus is on selecting and implementing renewal projects that could potentially involve community members as opposed to projects that are more study oriented and likely involving only a few biologists and others with related expertise.

The potential renewal projects for 2000 that were the basis for community input are:

1 **Riparian Planting & Bank Stabilization** – planting native vegetation along the shoreline. Areas to consider include Hall Siding, Lost Creek, South Salmo and others.

2 **Enhance Spawning Grounds –** improve spawning habitat in key areas (Sheep Creek, Clearwater Creek).

3 **Stewardship –** focus on prevention, clean up, and increase awareness related to litter and other materials that end up in the rivers.

4 **Habitat Diversification Projects** – create a variety of fish habitats in key locations on the river (Erie Creek where it enters the Village of Salmo, areas along Highway 3 between Salmo and Nelson, and others).

5 **Slope Stabilization** – stabilize slopes that have been degraded because of road construction and other activities. Areas of interest include the sloughs on Sheep Creek, Dolomite Mine Road and Lost Creek.

6 **Wetland Restoration** – restore natural wetlands in key areas (South Salmo, near the sewage treatment plant, between the Village of Salmo and the golf course and others).

These projects were the focus of discussion and comment during the community involvement process.

Summary of Community Involvement Process

The following sections summarize key themes and provide a comprehensive summary of the concerns, suggestions, and advice received in writing (completed comment forms), and/or through informal discussions at the open houses during the community involvement process. By the conclusion of the community involvement process, approximately 50 people had attended the open houses and taken part in informal discussions with resource people.

Themes & Highlights

- Support for renewal projects is unanimous among respondents.
- Enhancing spawning grounds and riparian planting/bank stabilization were identified frequently by participants as viable renewal projects that they would like to see undertaken in 2000.
- People expressed support for the potential renewal projects that were presented but also identified other renewal opportunities including a "catch and release" fishery, stocking the rivers and cleaning up the tailings.
- Some suggested that a viable (non-native) fishery could be established in the Seven Mile Dam reservoir.
- Local economic benefits and an improved quality of life were cited as the two key benefits that would result from healthy fisheries and rivers.
- Clean water, community pride, establishing the area as a desirable destination, and increased recreational opportunities were other frequently cited benefits of a healthy watershed.

- Participants' long-term vision includes a healthy river and a fishery that can be enjoyed by future generations and a watershed that remains wild and in a natural state.

- Support for strategic planning was nearly unanimous with the dissenters requesting short-term actions over long-term planning.

- Other issues identified during the community involvement include:
  - concern that commitments made by BC Hydro during the construction of dams have not been fulfilled;
  - limiting the catch for anglers; and
  - the need for local people to be involved in the planning and delivery of projects.

- Several people expressed appreciation for the community involvement process initiated by the Partnership.

Detailed Summary of Responses

This section provides a comprehensive summary of the comments, advice and suggestions provided to the Partnership during the community involvement process. This input, along with advice from the working group, is the basis for recommendations contained in the final section of this report.

1. Do you agree it's a good idea to try and improve the health of the rivers and the fisheries? If so, why?

Participants unanimously support efforts to improve the health of the rivers and the fisheries for a variety of reasons including:

Environmental benefits

- Healthy rivers mean a healthy environment.
- Healthy watersheds lead to healthy communities both ecologically and economically.
- The rivers and fisheries are indicators of the valley's health.
- Improving the health of the rivers and the fisheries is the right thing to do socially and environmentally.
- The rivers should be kept clean.
- Fisheries have been on the decline and help is needed.
- Fish are part of our ecosystem and are vital to ensuring a balance in nature. The food chain depends on healthy rivers.
- Society and the natural environment can't afford to lose any more species.
- The Salmo River could provide a good spawning area for many species.

Economic benefits

- Eco-tourism and other related tourism activities would result from healthy rivers.
- Local economic activity would increase as a result.
- The rivers and the fisheries are a valuable natural resource for the area that could be an important part of economic activities.
- Healthy rivers could support swimming, rafting, fishing and gold panning opportunities.

Community and Social benefits

- Future generations deserve healthy rivers and fisheries.
- The community can take pride in healthy rivers and fisheries.
- Increased recreation opportunities will result.
- Healthy rivers will provide healthy, outdoor opportunities for youth and families.

Kids are always asking, "Are there any fish in the river?"

2. If you do think it's important to protect the rivers and the fisheries, what do you think could be done?

In addition to the potential renewal projects, participants identified a number of actions that could be taken in order to improve the health of the fishery(s) and the rivers.

Angling Practices

- Limit the number of bull trout that an angler can catch each year (suggested annual limit = 10).
- Angling (i.e., over fishing) is considered to be the largest factor in the declining fish (bull trout and other species) populations.
- Establish a "catch and release" fishery.
- Close rivers to fishing for two to three years in order to assist declining fish populations.
- Establish a native fish hatchery in order to bring back the fish populations.

Community Involvement

- Get local people involved in projects and decision making. Government should provide technical assistance and support based on a plan developed by community members.
- Support for implementing the plan should be provided as well as training to community members.
- Community members should be rewarded through local hire for any jobs that result.
- Community involvement should include youth, seniors, First Nations and others.

Community Awareness

- Develop and implement awareness programs about the rivers/fisheries/watershed and target local youth.

Land Use Practices & Planning

- Eliminate clear cut logging practices, which result in changes in water temperatures. Increased water temperatures contribute to a declining fishery.
- Stop the Regional District of Central Kootenay from removing land along the river from the Agricultural Land Reserve and turning it into industrial land.
- Clean up the existing RDCK dumpsite and the old dumpsite at the ski hill.

Managing the Fishery(s)

- Protect wild fish.
- Establish a hatchery for sport fish.
- Determine bull trout population level through appropriate studies.
- Implement a fertilization program.
- Add nutrients to the rivers.
- Decrease the number of undesirable fish (squawfish etc.).
- Eliminate water level fluctuations (from dam operations) during spawning
- Stock the rivers.
- Build a river around Hugh Keenleyside dam (at Robson) in order to increase the downstream feedstock.

Water & Land Use Planning

- Remove dams on the Columbia River and return the forest corridor to its natural state.

Pollution Prevention/Clean Up

- Prevent industrial pollution.
- Clean up tailings/tailing management.
- Request that the Ministry of Transportation and Highways use less (or no) salt on the roads.
- Stop putting sewage from the Village of Salmo into the river.
- Open up back washes (re: Village of Salmo sewage).
- Develop bulrushes/wetland near the sewer backwash (a wetland will act as a natural filter system and will help clean the water).
- Stop using the dump (which is leaching into the river) and start incinerating garbage instead.
- Remove debris and relic vehicles.

Reservoir Fishery

- Focus on species that can survive in a reservoir environment.
- Develop Seven Mile reservoir fishery based on species that can survive in a reservoir environment.
- Research/explore reservoir habitats in other locations and develop options for enhancing/maintaining a fishery.

3. What restoration projects do you think should be done first?

Participants were generally supportive of the potential renewal projects suggested and felt they would be beneficial.

The preferred potential renewal projects identified most frequently by people taking part in the community-based planning process are enhancing spawning grounds, and riparian planting combined with activities to stabilize the river bank. Wetland restoration was also identified by participants as a viable project.

4. How do you think people in the watershed would benefit from healthy rivers and sport fisheries?

An enhanced quality of life and an improvement in local economic activities were cited most frequently as the key benefits that would accrue to people in the watershed as a result of healthy rivers and fisheries.

Economic Benefits

- Healthy rivers and fisheries would attract tourists to the area, which would benefit local fishing suppliers, hotels, restaurants etc.
- Increased property values would result from having healthy rivers and fisheries.
- Sustainable forests and rivers will result in sustainable communities.
- Healthy fisheries and rivers would make the area a desirable destination.

Environmental Benefits

- A clean watershed.
- A clean water.
- A beautiful river.
- Less sloughing (erosion) of shoreline/river banks.

Quality of Life

- Healthy rivers and fisheries will improve the overall quality of life for people living and working in the watershed.
- There would be more opportunities to enjoy the natural environment.
- Healthy rivers and fisheries would be a source of community pride.
- There would be fishing opportunities for residents and visitors.
- There would be recreation opportunities for children/young people.
- A plentiful fishery would increase fish available for consumption.

5. What is your vision of the rivers and the sport fisheries in the future?

If the vision of the rivers and the fisheries in the future is achieved it would include the following attributes:

- The river would be wild and protected and home to a healthy fishery.
- The water would be clean and used for a variety of recreational uses.
- For some the future would include a return of Salmon to the river and for others the vision would include establishment of a "world class" sport fishery that includes species able to thrive in a reservoir environment.
- Regardless of the fish species, a thriving fishery and the clean river, would attract tourism and result in local economic benefits

Protecting the Rivers

- The rivers would remain wild, natural.
- Renewal activities would focus on natural techniques.
- There would be more protected areas along the rivers.
- This important natural resource would be maintained or improved.
- The rivers would return to the way they were.
- Leave healthy rivers for future generations.
- Clean water would flow in the rivers.
- A plentiful supply of fish in the river would support other species in the ecosystem.
- Enhancement/renewal fees could be collected as part of the fishing license cost and used to fund ongoing renewal activities.

Economic Activities

- Increased tourism activities as a result of healthy rivers and fisheries.

Improved Fishery(s)

- The bull trout and rainbow trout fisheries would be healthy
- Spawning channels would be clean and healthy.
- The rivers would be stocked with fish.

Return the Salmon

- Fish ladders would be installed at the dam so salmon can be brought back.
- The Salmo River would revert to being called, as it once was, the "Salmon" river as a reminder of what it once was.

Angling/Sport Fishery

- A sport fishery would be developed and trout populations would be increased in order to develop a sport fishery.
- The sport fisheries would not be closed due to declining numbers of fish.
- The rivers would be stocked with bull trout in order to encourage a world class fishery.
- The single hook ban would be eliminated. Single and treble barbless hooks would be used instead.

Reservoir Fishery

- Develop and maintain fisheries in the reservoirs at the Seven Mile and Waneta dams (the Seven Mile Reservoir is a viable fishery).
- Alternate species, which could thrive in the reservoir environment created by dam construction, would be introduced. This would make the reservoirs a useful fishery.

Other Recreational Uses

- Water would be clean for recreational activities (swimming/boating).
- While the rivers would be used for a variety of recreational uses, they would remain uncrowded.

6. Do you think it's important to develop a strategic plan to improve the rivers and the fisheries?

Support for a strategic plan that would set priorities for renewal efforts was nearly unanimous. Those who did not indicate support for strategic planning instead called for more projects and expressed concern that planning would not result in improvements. Some expressed concern about a long-term planning process that would reduce the likelihood of doing more projects while the planning was underway.

Other Comments:

- There is a need to fully understand the cause of the problem in order to try and fix it.
- Planning should be done but it should be done quickly and efficiently to avoid a scenario where time passes and few renewal projects are completed.
- A strategic plan will help ensure that the time and funds spent will go towards projects that will really improve the fisheries.
- Planning efforts should be kept small to minimize government intervention.
- The plan should address development and maintenance.
- Get the community involved in developing and implementing the strategic plan so they accept the plan and participate in its delivery.
- Involve individuals with expertise to avoid repeating mistakes.
- Stop planning and take action.
- Don't spend all the money planning. Put the money in the fisheries.

7. Any other comments? Questions?

Angling/Sport Fishery

- Close the rivers to fishing if necessary. If that happens an adjacent river should be opened.
- Stock the rivers with spawning size fish.

- Introduced species (walleye, bass) are a large part of the problem.
- Develop/provide fishing opportunities besides salmonids.
- Overfishing and poaching are a key factor in the declining bull trout population.
- Use of barbless hooks is not sufficient.

Reservoir Fishery

- Habitat was destroyed by construction of the Seven Mile and Waneta dams. The water reservoirs can have thriving populations of warm water fish (muskie, crappie etc.).
- Reservoirs may not provide the optimum habitat for trout/dollies so other species that can do well in that environment should be considered.

BC Hydro / Dam Construction

- Commitments made by BC Hydro during the construction of dams have not been fulfilled.
- BC Hydro should be eliminated from decisions that control the river (i.e., water levels). Instead a new independent agency should make decisions about the river.
- Restricted spawning as a result of dam construction has contributed to the decline of salmon in the Salmo and Columbia Rivers.

Community Involvement

- The open houses hosted by the Partnership were informative and helpful.
- Local people should head-up solutions to local problems.
- Concerns related to the Salmo Watershed Streamkeepers Society are a potential barrier to gaining community support for renewal projects.

Public Awareness

- Many people lack information and an understanding of how human activity affects the watershed.

The Partnership

- Discussion with some participants indicates that the role/mandate of the Partnership is not clearly understood.

Other Comments

- Open the Pend d'Oreille River road to traffic.
- Create a greenbelt in Fruitvale by planting Aspens along the Burlington-Northern railway track.
- Special interest groups should not block recreation opportunities.
- Grants and monies already provided for restoration work have not achieved much and would be better redirected towards a native fish hatchery to support fish populations. If a native fish hatchery is not established then small mouth bass should be introduced into the system.

Recommendations

Planning for Renewal Projects in 2000

Working Group members received the advice collected during the community involvement process related to renewal projects for 2000. Members agree that the riparian planting and spawning ground projects identified by community members are important, however, the group agreed that in the "bigger picture" it is more important to ensure that the tailing pond(s) do not leach into the river, resulting in significant degradation of the rivers and fisheries. Therefore, the Working Group agreed to focus renewal funds in 2000 on efforts to protect the rivers from further leaching from the tailing pond(s).

The following consensus recommendation is based on the assumption that an allocation of $10,000 is available from the Columbia-Kootenay Fisheries Renewal Partnership to fund renewal projects in the watershed in 2000.

2000 Funding Recommendations

- A portion of the funds (up to a maximum of $1000) should be set aside to do the necessary assessment work related to the construction of spawning platforms in Sheep Creek in 2000.
- Construction of the spawning platforms could be funded and completed in 2001 based on the results of the assessment work.
- The Working Group recommends that the remaining funds be allocated towards restoration activities along the shoreline near the (Cannex) tailing pond(s) at Vector Road.
- Available funds should be allocated towards physical, in-stream activities and structures related to the restoration work planned for the tailings pond area (commonly referred to as the Marty Ross project). The funds should not be used for design or engineering aspects of the restoration work.

CKFRP Extension Officer Kenton Andreashuk was asked to meet with the Working Group members in the of summer of 2000 to review the so-called "Marty Ross" project and discuss with members what aspects of that proposal could be funded with the dollars allocated for renewal projects in 2000.

Future Renewal Planning & Funding

The primary task of the Working Group was to work with the Partnership to identify renewal projects for 2000. That task has now been achieved and the initial responsibility of the Working Group has been completed. However, the Partnership wishes to continue

a dialogue with the community in order to achieve habitat conservation and restoration through the delivery of renewal projects that have community support. In order to inform the Partnership's continued work in the sub-region, Working Group members were asked to comment on strategic planning and future community committee structures.

Strategic Planning

A roundtable discussion amongst Working Group members confirmed the group's support for a strategic planning process to identify priorities for further renewal activities, reveal information gaps, and to articulate a vision for renewal efforts. While all agreed that a planning process was necessary in order to make wise and pragmatic use of available resources, some Working Group members echoed similar concerns and caveats as those heard during the community involvement process about the length and cost of such an exercise. Members offered the following consensus recommendations for further planning processes:

- It should be simple and cost effective;
- It should be based on proven, existing models for fisheries renewal (i.e., don't reinvent the wheel);
- It should include a comprehensive literature review to confirm available information and information gaps;
- Make use of knowledgeable experts (including Kenton Andreashuck and James Baxter); and
- Consider other potential partners (e.g., other government ministries).

Some suggested that such a planning process could be achieved in a retreat setting involving members of the Working Group. Others noted that in order for members of the group to be properly informed, and participate fully in such a planning process, members of the Working Group would require further background documents and information. Some questioned what funds/resources might be available to assist the Working Group.

Working Group

Members of the Working Group in attendance confirmed their desire for such a committee to continue working with the Partnership to achieve renewal objectives and they offered the following recommendations related to future Working Group structure and responsibilities:

- Representation should be broad based and include schools, the Chamber of Commerce, BC Hydro, Columbia Basin Fish and Wildlife Compensation Program, the Ministry of Environment Lands and Parks and others.
- Attendance at meetings would be bolstered by setting regular meeting dates/times.
- Membership could remain open so people can get involved with specific projects but it may be necessary to cap membership at 12 people in order to ensure productive discussions.
- The Terms of Reference for the group should clearly articulate roles and responsibilities.

- Since members would participate on a volunteer basis it was felt that it would not be appropriate to dismiss members based on a lack of performance/attendance.
- It may be necessary to delegate administrative and other infrastructure responsibilities within the group.

It was noted during the discussion that if Strategic Planning and future Working Group efforts are to succeed, it is critical to resolve issues between the Salmo Watershed Streamkeepers Society, some members of the Working Group, and some members of the broader community.

Closing Remarks

The community involvement process undertaken by the Partnership achieved its initial objectives related to increasing awareness and setting renewal priorities for 2000. In addition, this process has confirmed the community's desire for an effective (strategic) planning process that will help determine future priorities and projects. Support for such a planning initiative has also been confirmed by the Working Group members that provided advice and direction to the Partnership during this process.

The projects recommended by the Working Group will give people a chance to work together to renew the river. When the tailing(s) pond is secured and the spawning platform is in place, both will be tangible results of this process that all will be able to see and take pride in.

While there continue to be concerns from some related to local watershed protection initiatives those issues remained in the background during this process. As a result the Partnership was able to effectively introduce itself to the people and communities in the watershed and focus discussion on fisheries renewal planning.

The Partnership's flexible and transparent approach has helped to establish relationships within the watershed and the stage is now set for continued positive dialogue related to renewal efforts in the Salmo and Lower Pend d'Oreille Rivers.

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Objectives, Strategies, Targets and Monitoring Matrix - February, 2006

Objective	Strategy/ Indicator	Measure	Measurement Unit	Spatial/Geographic Scale	Frequency/ Monitoring	Data Source	Initial Targets	Knowledge Gaps	Monitoring Technique	Tools Required	Skill Sets Required	Information System Used To Document	Who Is Responsible To Perform	Cost	Funding Opportunities	Comments
Objective 1: Promote conservation and stewardship action by local residents, businesses and governments																
	Strategy 1: Fund core project support for stewardship awareness to promote education about water stewardship within local schools/community.															
		Type and # of Awareness opportunities	# of dollars in place to conduct awareness activities	Salmo Watershed & by extension the Upper Columbia Basin	Annual	SWSS Annual Report	Seven thousand Dollars		SWSS Annual Report & Specific project budgets	Computer nd appropriate software/other	Design skills, presentation skills, writing/ organizational skills		SWSS	$7,000	CBT/other	Need to develop concrete commitment from CKFRP / CBT / Others that stewardship has value. Develop appropriate criteria.
	Indicator 1: Approval of Salmo Secondary School Stream Team by Principal and Science Teacher															
		# of Stream Team Projects/mtg's	# of people involved	Salmo Watershed & by extension the Upper Columbia Basin	Annual	Stream team log book	6 Stream Team members - 4 projects		Stream Team log book	Computer, waders. Streamkeepers manual, Streamkeepers kit			Salmo Secondary school and SWSS	Initially $6000.00+	CBT/other	
	Indicator 2: Implement 'Rivers of Snow' snow and Water Hydrology presentations in local schools															
		# of presentations and ski nights	# of people attending presentation and ski night	Salmo	Annual	SWSS Annual Report	200 people attend		class room attendance - ski tickets sold	Presentation tool kit	presentation skills, organizational skills		SWSS	$600	Community businesses and SWSS members	
	Indicator 3: Provide bi-monthly articles on stream stewardship to local newsletter															
		# of articles	Specific Newspaper distribution numbers	Salmo Watershed & by extension the Upper Columbia Basin	Bi-monthly		6 articles / year		Word of mouth/ actual articles produced/for what paper	Computer, Design software	Design/writing skills		SWSS members/whoever wants to contribute	$100/ article	SWSS Members/donations	
	Indicator 4: Implement 'Watershed Radio' public service announcements on local radio stations															
		# of 30 second 'infomercials'	# of people thought to be listening	West Kootenay Area	Every 2 weeks.		12 infomercials		# of hits to website	Computer and word processing software	Creative writing		SWSS	$9,000	DFO/BCH	
	Indicator 5: Begin Salmo Secondary School Student Scholarship Program															
		Provide 1 scholarship	# of students applying	Salmo Secondary School (SSS)	Annual	SSS Scholarship Program	One Student finalist list.		SSS Scholarship selection committee				SSS	$300	SWSS Members/donations	
	Indicator 6: Angler Awareness Fish ID / Regulations Card															
		Fish ID / Reg's Card Production	# of anglers receiving cards	Salmo watershed	Annual		50 anglers		SWSS distributors	Computer, colour printer, publisher/design software	Design skills, presentation skills, writing/ organizational skills		SWSS	$1,000	SWSS Members/donations	
	Strategy 2: Contribution of local and traditional knowledge and participation in planning															
	Substrategy: *Get local knowledge used in planning*															
		Type and number of participation opportunites and actual attendance in opportunity	Number of local citizens attending planning meetings, names and interest documented	Salmo Residents, Ymir residents, local First Nations	Annual	Meeting Minutes of WPT and WTT as well as Public Meetings	8 citizens willing to participate in evolution of the plan	Unknown who will make the commitment, some citizens now participating	WPT reveiws and approves minutes	Stakeholder list of individuals with names addresses and interest	Willingness to provide local knowledge and participate in representing the community	Meeting minutes documented electronically and stored by hard copy in the Salmo library	Lead responsible for documentation designated by the WPT, reporting back to the WPT	Physical time to document, print and cataloque in the library		
	Indicator 2: Collaborative Decision Making															
	Substrategy: *Get local participants and general public directly involved in deciding planning direction, and implementation of projects*															
		Planning and projects done collaboratively	Number of projects that community members are directly involved in doing the project . Partnership contributions of dollars and time	Salmo Watershed or specific sub-units of watersheds or portions of the mainstem related to local population areas.	Annual Reportir	Project ranking, implementation, and documentation	All projects that have a field component that requires equiment, local knowledge and expertise	Project plans for the carbody run, bank stability and habitat complexes will have to be developed	WPT reveiws and approves minutes	Dependent of each project. These should be identifed in the project plans	Dependent on specific project approval and permit requirements	Project reporting back to the WPT should be a requirement of any and all projects	Project contractor or community leader assigned responsibility to report back to the WPT on participation, and measures of partnership dollars expended and volunteer time accumulated	Time allocated for documentation		

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	Indicator 3: Productive populations of selected species or species guilds are well distributed throughout the range of their habitat															
		Species density per unit area, population trend														
Objective 2: Conserve available habitats and restore riparian floodplain functions as opportunities arise																
	Strategy 1: Map distribution of riparian habitat types - Salmo mainstem and accessible tributary reaches															
		GIS map layers completed	Number of map layers	Salmo watershed	Every twenty years	Air photo interpretation	1. Riparian habitat types layer; 2 Current land uses. Two maps produced: current land uses and channelized habitats	Distribution of species by habitat types		Up-to-date orthophotos; GIS workstation	GIS and air photo interpretation	Arcinfo	SWSS to contract technician	$20,000		
	Strategy 2: Educate watershed residents and leaders															
		Community/ watershed newsletters	Number of newsletters produced	Salmo watershed	Annual	Newsletter	One - spring, 2006			Computer, colour printer, publisher/design software	Editing and newsletter design		SWSS	$2,000		
		Newspaper articles	Number of newspaper articles	Salmo watershed and Nelson / W. Kootenay region	Annual	Newspaper archives or SWSS files	one- fall, 2005; one – spring, 2006			Computer and word processing software	Written communication		SWSS	$200		
		Public meetings	# of public meetings	Salmo watershed	Annual	SWSS files	One - spring, 2006			Laptop computer and digital projector; meeting space			SWSS	$500		
		Meetings with local organizations (on request)	# of meetings	Salmo watershed and Nelson / W. Kootenay region	Annual	SWSS files	Two - winter 2006-2007			Laptop computer and digital projector; meeting space			SWSS	$200		
		Provide community update on Yankee Girl rehab	# of meetings. Poster. Newsarticle	Salmo watershed and Nelson / W. Kootenay region	As needed	SWSS files	Spring 2006			Computer, colour printer, publisher/design software Mtg. Facilitator	Editing and newsletter design, writing, facilitation		SWSS	$500		Community of Ymir should be involved in final use decision.
	Strategy 3: Develop and promote financial incentives for riparian habitat conservation															
		Discussion paper on financial incentivies	Discussion paper produced	Salmo watershed, but possibly province-wide	Once only	SWSS files	Summer, 2006	Financial incentives currently available in BC and other jurisdictions	Review discussion paper	Access to major university library and on-line info sources	Degree in Economics		SWSS and CKFRP	$20,000	BC Real Estate Foundation; CBT	
		Review tools available through 'Riparian Area Regulation'														
		Evaluate potential riparian education program for real estate agents	# of contacts with Real Estate Board. # of mtg's with R.E.Agents.	Salmo watershed, but possibly province-wide	Annual	SWSS files	Summer, 2006			Computer and word processing software. Presentation Equipment.	W	Written communication, proposal writing, presentation skills	SWSS			

Objectives, Strategies, Targets and Monitoring Matrix - February, 2006

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Objective 3: Restore and enhance instream habitats																
	Strategy 1: Complete habitat assessments - overview															
	Indicator 1: Completed report with maps and prioirity list															
		Completed report	1 report with priority list	Mainstem Salmo and Car Body Run, Salmo-Erie confluence. Airport Rd. to Rest stop. U/S of Ymir. Hidden Cr. to Airport Rd.	Once	SWSS, federal and prov. Agencies; local knowledge and industry; RDCK	CBR & Salmo/Erie Completed by Feb. 2006; Airport Rd.-Rest Stop &Hidden - Airport Rd. and U/S of Ymir by Dec. 2007	baseline information;	Review draft and final reports; confer with local expertise;	Airphotos; cadastral maps; 1:20,000 TRIM maps;	Professional biologist and/or engineer with local technician data collection and analysis	GIS map layer, sites identified by GPS; site mapping and photodocumentation	DFO - HEB; SWSS; CKFRP; RFP process to select consultant	$20,000	CBT, HCTF, CPC, Trout Unlimited, Evergreen Fund	Must understand upstream impacts/influences (esp. for Salmo/Erie confluence) Erie confluence and car body run FHAPs completed with prescriptions. Seek funding for FHAP for other areas and upstream YMIR. Comment: CBT funding proposal not approved. DFO Funds.
	Strategy 2: Publish and distribute information to educate the public															
	Indicator 2: General community support and municipal government, corporate and stakeholder approval															
		Newsletter	1 newsletter to all households	Ymir - Nelway	1	assessment report	Spring 2006	public concerns	WPT approval	desktop publishing	local writer and designer	Table summary of communications	SWSS	$300	as above	local community and government support critical; every WPT member responsible for communications
		Newspaper article	No. of articles	Pennywise and Salmo Valley newsletter	Monthly	assessment report	Summer 2006 - Spring 2006	public concerns	Designate writer and reviewer	access to editor	local writer	Table summary of communications	SWSS	$200	as above	"
		Public meeting	1 public mtg.	Watershed - Salmo	One	assessment report	Spring 2006	public concerns	Meeting minutes; number of partiicipants	copies, displays, meeting hall, projector, presenters	presentation skills	Table summary of communications	WPT	$500	as above	"
		Meetings with organizations on request Internet??	# of meetings	Village of Salmo council meeting; RDCK/Area G director approval	Once per organization	assessment report	Winter 2006	public concerns	Meeting notes; resolutions or letters of support	as above	presentation skills	Table summary of communications	WPT	$150.00	as above	"
	Strategy 3: Seek funding partners															
	Indicator 3: Amount of funding obtained for instream works															
		Amount of funding obtained for instream works	Dollars	Federal, provincial and regional funds;	Annual	n/a	$70,000 for 2005 and 2006 (assessment and car body run)	non-government funding sources	n/a	n/a	proposal writing and lobbying skills; financial manager	MS Word proposals	WPT, SWSS; CKFRP	2000	HCTF seed funding	local in-kind support can be used to lever and maximize funds
	Strategy 4: Implement															
	Indicator 4: Number of instream habitat projects completed															
		Number of sites completed	Linear metres completed; Square metres by habitat type	1. Car body run; 2. Salmo/Erie confluence; 3. Priority sites from assessment	Annual for physical integrity; After 1:10 yr. floods for biological effectiveness	Physical inspections; Fish inventories; Known restoration techniques	1. Car body run: Design 2004; Implement 2006; 2. Erie/Salmo: Planning/design/concept 2006; implement 2006;; Priority FHAP sites - Design 2005/6; implement 2007 or as funded	Engineering stability; hydrologic performance; preferred habitat types; upstream sediment inputs; environmental changes between assessment and implementation;	Fish inventories: electrofishing and snorkel surveys; Physical stability of structures; Photomonitoring; public comment	construction equipment; sediment control equipment;	instream project supervision; fish-friendly excavator operator; engineer; biologist	photography; as-built reports; monitoring reports; MSRM database; permits; HRTS	WPT to develop ToRs; SWSS, CKFRP, Village of Salmo	Car body run: $75,000; Salmo-Erie confluence - $250 - 500K	PEP; RDCK; Municipal environmental (FCM) funding; CBT; CPC; Env. Farm Management Planning;Shell	
	Strategy 5: Report, monitor and evaluate															
	Indicator 5: Teck Cominco Waneta Upgrade Compensation - South Salmo River Structures															
		Eight structures completed in the South Salmo River 1999.	Approx. 200 meters of River affected	River Right of South Salmo R. across from 'Italian Campground'.	Annual structural integrity and fish inventory @ 3&6 yrs. And after any 1:20 flood event.	Physical inspections / reports thereof.	Compensatory project for Waneta dam upgrade. Create spawnig habitat for 50 pr RBT or rearing habitat for 500 juvenile RBT. Habitat redundancy built in.	Engineering stability; hydrologic performance; preferred habitat types; upstream sediment inputs; environmental changes between assessment and implementation;	Fish inventories: electrofishing, Physical stability of structures; Photomonitoring; public comment	Construction equipment, sediment control and monitoring - electroshockers, data books waders etc.	instream project supervision, fish friendly excavator operator,engineer, environmental monitor.	photography; as-built reports; monitoring reports; MSRM database; permits	Teck Cominco	Enginering / build + or - $50,000.00	NA	Structures complete and well monitored and maintained.

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	Indicator 6: Salmo River Protection Committee (SRPC) - Upper Canex Structures															
		9 Structures as above no monitoring program														
	Indicator 7: Salmo River Protection Committee (SRPC) - Side Channel Structures															
		Three structures no monitoring program														
	Indicator 8: Terrasen Structures															
		TBA														
	Indicator 9: Car Body Run Structures															
		TBA														
Objective 4: Restore the physical functioning of riparian, floodplain and aquatic ecosystems																
	Strategy 1: Reconnect the floodplain															
	Indicator 1: Indicator number of hectares rewetted to natural conditions															
		No. of hectares No. of species and abundance (ingress)	(Areas to be identified)	Mainstem first priority	Annual	Interviews with landowners Air photos	Two sites (5 ha), one in 20 year flood benchmark:	Do not know which sites are appropriate				IGS usins GPS and report	By September 2004, WPT drafts project parameters and secures funding WPT Ranks Sites Unknown specific names	$30,000 for assess-ment only	Partner with CBT, HCTF, CPCD, Ducks Unlimited, Trout Unlimited	A. Assessment will identify priority areas for opportunity B. Assessment by qualified expert, professional community for monitoring, engineering and surveying
	Strategy 2: Develop wetlands															
	Indicator 1: Percentage of potential sites developed relative to historical profile															
		No. of hectares	No. of hectares No. of sites	Mainstem and lower gradients of tributaries	Low water to be estimated after assessment process	· Local knowledge · Boat surveys · Ripairan profile · Hydrological profile · Where is the easiest connectivity · Inventory	· One site by 2006 (size to be determined) · 50% of historical profile by 2025 Two watershed residents are developing a plan for the restoration of one wetland	· Site location · Amount of restoration to bring back to historical profile · Where is the easiest connectivity · Inventory		Approved project plan	· Project management including Engineering, Hydrologist, Education and Facilitation · Biologists and Technicians · Flood control expertise	GIS, GPS and report within three months of completion of project	The proponent that the WPT assigns roles and responsibilities to by March 31 2006.	Subject to site	CBT, HCTF, CPC, Ducks Unlimited, Trout Unlimited, etc.	A. This strategy may meet other wildlife objectives should be proceeded by communication strategy that identifies what wetlands are and what values they have - project description may be suitable for nesting Strategy 1. I1 and Strategy 2.I1. B. Assessment will identify priority sites based on ranking and prioritize by WPT and WTT. Effectiveness evaluation to take place every 5 years. C. We need a demonstration project to start, but the assessment in S1 still needs to be done.

Objective	Strategy/ Indicator	Measure	Measurement Unit	Spatial/Geographic Scale	Frequency/ Monitoring	Data Source	Initial Targets	Knowledge Gaps	Monitoring Technique	Tools Required	Skill Sets Required	Information System Used To Document	Who Is Responsible To Perform	Cost	Funding Opportunities	Comments
Objective 5: Manage fish harvesting to assist in population restoration																
	Strategy 1: Continue existing sportfishery regulations															
	Indicator 1: Existing regulations continued in Freshwater Fishery Regulations															
		Bull trout release and bait ban		Salmo mainstem and tributaries	Annual	BC Freshwater Fishing Regulations Synopsis	Include in 2004-05 regulations	None	Read Synopsis			Document	MoE/Fisheries	nil	n/a	Done
		Rainbow trout release zone		Sheep Creek to South Salmo	Annual	BC Freshwater Fishing Regulations Synopsis	Include in 2004-05 regulations	None	Read Synopsis			Document	MoE/Fisheries	nil	n/a	Done
		Trout/char daily quota = 1; min. 30 cm., June 15 - Oct. 31		Mainstem except Sheep Creek to S. Salmo;	Annual	BC Freshwater Fishing Regulations Synopsis	Include in 2004-05 regulations	None	Read Synopsis			Document	MoE/Fisheries	nil	n/a	Done
	Strategy 2: Continue population monitoring projects															
	Indicator 2: Conduct annual snorkel surveys															
		Number of rainbow and bull trout in index area	Number of fish > 30 cm.; Number of fish < 30 cm.	Mainstem Hidden Creek to South Salmo	Annual		Implement in July 2004	None	Snorkel floats	wetsuits, swimming gear, support inflatables	Fish identification, snorkel float experience	Document	SWSS, BC Hydro, CBFWCP, MoE/Fisheries	$5,000	BC Hydro, MoE/Fisheries, in-kind	Done/Continuing
		Proportion of populations in index area	Percent of total fish population	Entire Salmo mainstem and accessible reaches of tributaries	Every five years	Rainbow and bull trout telemetry	Implement in 2007		Tracking of radio-tagged bullt and rainbow trout	radio transmitters, surgical gear, fishing gear, inflatable or drift boats, receiver, etc.	fishing, tracking, fish handling, surgery, mapping	Document with maps	MoE/Fisheries, BC Hydro, SWSS	$40,000		Project Complete snorkel surveys continuing
	Strategy 3: Assess population trends and revise regulations as needed															
	Indicator 3: Report on population trends with recommendations															
		Report with recommendations		Salmo watershed	Every five years	Reports on index and telemetry surveys	Review in 2007-08	Many: harvesting impact, tributary recruitment, etc., etc		Reports	Fisheries biologist; population assessment; statistical analysis	Report with recommendations	MoE/Fisheries, consultation with WPT?	staff time	n/a	
		Review relevant sportfish regulations annually		Salmo watershed	Annual	Regulation Synopsis		Many: harvesting impact, tributary recruitment, etc., etc	Creel, Word of mouth, Snorkel surveys	Reports			MoE/Fisheries	nil		
	Indicator 4: Sub-adult Bull Trout Monitoring and Entrainment Study															
		#Sub-adult bull trout in Lower Salmo R. and 7 Mile Reservoir.	Tagged Bull Trout < 25cm.	Lower Salmo River and 7Mile Reservoir	As needed		Tag (and track) 20 sub-adult bull trout		Tracking of radio-tagged bull trout	Snorkel gear, fishing gear, radio tags, tracking gear	angling, safe snorkel surveys, fish surgery, tracking.		CCRIFC	??	BC Hydro,	
	Indicator 5: Non-Sport Fish Monitoring Program															
		Verify Non-Sport fish migration patterns in the Salmo R.	# of species # of fish	Hidden Cr. to Swift Cr.	Every 3 yrs.	BC Hydro, SWSS	Conduct 1st monitoring swims in 2006	Population Trends	Conduct Snorkel Swims, possible Tag & Track program	Snorkel gear, and possibly fishing gear, radio tags, tracking gear	Safe snorkel skills Swift Water Rescue Possibly fish surgery/ tracking	Report with recommendations	BC Hydro & SWSS	Conduct while doing RBT Monitoring?	BC Hydro, MoE/In-kind	Repeated concern of people living on the lower river and anglers
	Indicator 6: Introduced Species Identification,Assesment and Evaluation Project															
		Presence of introduced species above fish barrier	# of species # of fish	Canyon Area - Reads place & downstream	Every 3 yrs.	BC Hydro, SWSS	Conduct 1st monitoring swims in 2006	Population Source, Type & Trends	Conduct Snorkel Swims, possible Tag & Track program	Snorkel gear, and possibly fishing gear, radio tags, tracking gear	Safe snorkel skills Swift Water Rescue Possibly fish surgery/ tracking	Report with recommendations	BC Hydro & SWSS	Conduct while doing RBT Monitoring?	BC Hydro, MoE/In-kind	First noticed during 2004 snorkel swims.

SALMO WATERSHED Streamkeepers SOCIETY

TELEPHONE 250 357-2630 FAX 250 357-2630
EMAIL gerry@streamkeepers.bc.ca
PO BOX 718, SALMO, BRITISH COLUMBIA V0G 1Z0

Feb. 24th/00

Dear Mainstem Property Owners,

I want to write you a brief letter to up date you all on ongoing and up and coming Streamkeeper projects. This year we will continue our bull trout radio telemetry project. We have 'implanted' 10 bull trout with radio transmitors that send out a signal that can be picked up by a special receiver. We are trying to determine overwintering and spawning ares for these important blue listed (threatened) sport fish.

We are also trying to get a count on the intrusion of 'coarse fish' into our watershed. These species are understudied and we have little idea of how they affect aquatic health. We are primarily looking for squawfish, longnose suckers and walleye. We have done 2 snorkel swims covering some 15km's +or-, 1 in Nov. and 1 in Dec. We found no walleye or squawfish, leading us to believe that they may be migratory, moving down into the 7mile reservoir. Any insights into observations/thoughts from any of you would be greatly appreciated. Counts on bull trout and rainbow trout were low with rainbows showing the highest, eastern brook (brown) trout showed moderate numbers. The highest number of fish counted were suckers. This may be disappointing initially but we have a few more swims to indulge in before interpretations are made. We'll be swimming in warmer times of the year from here on in!

We have completed the 1st year of our Harlequin Duck inventory, a copy of the resulting report is in the Salmo Library and another in the Ymir store. We hope to add to this data on these beautiful sea ducks that arrive here yearly to breed and rear young.

Perhaps of greatest importance to 'the big picture' for fisheries in our watershed is the request to SWSS from the Columbia/Kootenay Fisheries Renewal Partnership. We have been asked by this group to host a fisheries Strategic Plan for the Salmo and Pend D'Oreille Rivers. It is our intention to have a public information sharing meeting at the KP Hall March 15th (please watch for posters around town to confirm) at 7PM. We hope that this meeting will be informative for all and that we will be able to attract all interested stakeholders. As you can see this could set a very important direction for the health of our fisheries, it is important to participate if you can. We will be looking for folks from the public to be representatives on a Stakeholder Steering Committee to develop this Strategic Plan. A commitment of 2 - 4 meetings are expected to finish the work. We hope it won't go over this. The process will be facilitated by James Baxter, a fisheries biologist who has worked in this watershed for years and another recording and organizational facilatator.
Please watch local poster boards etc. for confirmation of time and place for this very important meeting. Come and join in!

Thank You and if you have any questions, don't hesitate to call Gerry Nellestijn, 357-2630.

SALMO WATERSHED Streamkeepers SOCIETY

Box 718, Salmo, BC, Canada V0G 1Z0 ■ Telephone / Fax 250.357.2630
www.streamkeepers. bc.ca ■ gerry@streamkeepers.bc.ca

April 14th, 2002

Dear Mainstem Property Owners,

We wanted to write a letter of request and to give you an update for what we've done in 2001, and to what we are looking forward to in 2002.

Of greatest importance is the request, participate in the Watershed-Based Fish Sustainability Plan. As a bit of background you may recall on Feb. 24/00 we wrote you about the possibility of the Columbia Kootenay Fisheries Renewal Partnership (CKFRP) supporting a 'Fisheries Strategic Plan' for our watershed. After an energetic public meeting it was decided to facilitate a working group to formulate some immediate project plans for assessment and restoration possibilities on our river, as well as to hold a series of open houses and kitchen table meetings to discover if strategic planning was even wanted here. From this effort the consultants found that there was "almost unanimous support" for this type of planning. As a result CKFRP has asked SWSS to co-host a *Watershed-Based Fish Sustainability Plan.* Please have a look at the accompanying Press Release and the 'wanted' advertisement that will be submitted to the April *Salmo Valley Newsletter*. We hope that there will be interest in participating, especially from those of you that live on our river. A successful, insightful development of this plan will provide guidance to helping our beautiful river become healthier.

Now, an update! Last year we were involved in a number of fun and interesting projects. In terms of research we have helped to collect 'periphyton samples' from the South Salmo and Sheep Ck. This is a process where you drop a sample board into the stream that allows mosses to grow on it. These samples are collected weekly and forwarded to a lab to assess the type and rate of growth of aquatic plants (mosses) that we have in those specific streams. This information will be used to determine if the South Salmo would be a candidate for fertilization. This fertilization process has been working successfully in lakes and more recently in other rivers; it seems to lead to an increase in fish numbers. Periphyton work will be going on in the South Salmo and in Sheep Ck. For at least 1 and perhaps 2 more years before fertilization options will be explored. Ongoing with periphyton sampling is an invertebrate sampling element, a habitat characterization element and a fish inventory element to give us a good idea as to what we have in these 2 creeks.

In 2001, SWSS teamed up with Beaumont Timber, CKFRP, Columbia Basin Trust, the Columbia Basin Fish & Wildlife Compensation Program, the BC Ministry of Water, Land and Air Protection as well as BC Hydro to fund and participate in the Salmo River Rainbow Trout Population Size and Habitat Use study. This is a Radio Telemetry project to discover where rainbow overwinter and spawn as well as to make determinations as to how many fish of certain size ranges there are in our system. Baxter Environmental and team implanted radio tags in rainbow trout over 40cm. As well, radio tagged fish were floy tagged with a coloured tag placed in the dorsal fin area. Other rainbows of appropriate size were floy tagged with other colours. In this way swimmers accompanied by a tracking boat could ID tagged fish. A 'sightability' determination could be made against radio tagged fish, floy tagged fish as well as untagged fish to make calculated estimates of how many fish of various size categories there are in the system. Sounds complicated, but it is giving us an idea of rainbow life history and numbers here. This research will be ongoing for one more year.

You may recall in 2000 SWSS produced an Inventory of Mine Tailings Piles and Ponds in the Salmo Watershed. As a result we identified the Old Yankee Girl site across from Ymir as a priority site and have been focusing on trying to work toward a community based 'restoration' activity for these orphaned (abandoned by the company) tailings. Approximately 4 acres, this site still has no revegitation after 50+ years of disuse. SWSS hopes to get together a team of industry, government and concerned citizens to at least

contain and cover the site. As I write, the water levels are extremely high and tailings are washing directly into the Salmo River! We will work hard in 2002 to see a resolution to this problem.

Perhaps of more fun to all has been the awareness work we have been doing. From the simple info posters we have been generating, to the conferences we have presented at, we've had some real fun and valuable times. Of special note was the 6 days we participated at the International Girl Guide Jamboree, Spirit of Adventure Rendevous (SOAR). What a great time that was, we had over 400 Guides and their leaders come through our awareness sessions and I can assure you that not 1 of them left without getting wet! As a consequence to that fun and learning experience, BC Guide executives are considering the possibility of creating a streamkeeping badge!

Again our September BC Rivers Day activities built around our 'The River Speaks' Festival awareness campaign was well attended, we repeated our 'Creepy Crawly Creature Show' around invertebrate education as 'indicators of a healthy watershed'. We also had a riverside interpretive trail hike focusing on birds and riparian plants.

Lastly, our RiverArt 2000 initiative and resulting tour was well received in 11 communities in the Upper Columbia. We think it has brought a lot of positive attention to Salmo and to our watershed.

In 2002, RiverArt seems to have 'spawned' a new life in an exhibition called 'Chronicle of the Upper Columbia'. The exhibition has already attended the Conservation Symposium in Cranbrook and will move across the US/Canada border to the large (700+) international conference 'Toward Ecosystem-Based Management: Breaking Down the Barriers in the Columbia River Basin and Beyond'. SWSS will be giving 2 presentations as well as working with the Columbia Basin Trust on their youth initiatives there. Finally, we are organizing and participating in an evening of learning and fun called the 'No Boundary Concert'.

This year it will be back to the periphyton study and the rainbow trout study for us. We will continue to lobby and create partnerships to remediate the 'Old Yankee Girl' tailings and create partnerships for a wider more eventful River Speaks Festival. We will continue with our poster campaigns and awareness programs. We hope to engage the elementary school in a 'Storm Drain Marking' exercise that will be accompanied with a flyer campaign to remind folks that what we put down our sinks eventually runs into our river. We will also be repeating our 'Win a Helicopter Flight Essay Contest' for grade 11 and 12 students at the secondary school. We will be involved in Earth Day events, in giving presentations to community groups and schools as well as a variety of agencies. Streamkeepers will continue our commitment to sit on the Action Planning Group and the Communications Sub-committee for the multi agency Sturgeon Recovery Initiative. We will help in any way that we can to increase the health of our watershed, and by extension the health of our community.

We hope that you will support us in our activities, as you know we are a non-profit charitable organization and could very much use your help. We hope that you give your consent to the Watershed Based Fish Sustainability Plan. It could set our priorities for years to come, and we need to know that it will be inclusive and positive. The plan could make a huge difference in the Salmo Watershed, both in creating partnerships and in setting directions. SWSS feels honoured that the agencies involved would see the Salmo watershed as the 1st area in the interior to put a plan like this in place.

Thanks to all of you that have contributed your time and energy. We hope that you will continue to see that our river is a vital and valuable 'character' in our watershed. Most of all we hope that you will take some time from your busy schedules to go down and enjoy a few moments by the Salmo River.

Thank you for your time! Cheers! Gerry Nellestijn

President/Coordinator: Salmo Watershed Streamkeepers Society

SALMO WATERSHED Streamkeepers SOCIETY

Box 718, Salmo, BC, Canada V0G 1Z0 ■ Telephone / Fax 250.357.2630
www.streamkeepers. bc.ca ■ gerry@streamkeepers.bc.ca

Nov. 3rd, 2003

Dear Mainstem Property Owners and Members,

We wanted to write to give an update on what we've accomplished in 2002/03, and to what we are looking forward to.

Included herein is 'FLOW', the Salmo River Watershed-Based Fish Sustainability Plan Newsletter. It will give you an overview of this very detailed activity. Lots of hard work has gone into the WFSP, as it's known. We are completing stage 2 and will be holding a Public Open House on Mon. Nov. 17th/03. Come that evening to see what we've put together. There will be maps, a chronology or storypole of events in the Salmo Watershed starting back when First Nations harvested 70,000 lbs. of salmon a year out of our river, until present. There will be a couple of presentations - coffee and donuts will be served. The successful, development of this plan will provide guidance to helping our beautiful river become healthier.

Now, an update! Last year we were involved in a number of fun and interesting projects. In terms of research we have helped B C Hydro to collect 'periphyton samples' from the South Salmo and Sheep Cr. This is a process where you place a sample board into the stream and allow mosses to grow on it. These samples are collected weekly and forwarded to a lab to assess the type and rate of growth of aquatic plants (mosses) that we have in those specific streams. This information will be used to determine if the South Salmo or Sheep Cr. would be a candidate for fertilization. This fertilization process has been working successfully in lakes and more recently in other rivers; it seems to lead to an increase in fish numbers. Ongoing with periphyton sampling is an invertebrate sampling element, a habitat characterization element and a fish inventory element to give us a good idea as to what we have in these two creeks.

For three years SWSS has teamed up with Beaumont Timber, Columbia Kootenay Fisheries Renewal Partnership, Columbia Basin Trust, Columbia Basin Fish & Wildlife Compensation Program, the BC Ministry of Water, Land and Air Protection as well as BC Hydro to fund and participate in the 'Salmo River Rainbow Trout Population Size and Habitat Use Study'. This is a Radio Telemetry project to discover where rainbow overwinter and spawn as well as to make determinations as to how many fish of specific size ranges there are in our system. Radio tags were implanted in 30 rainbow trout over 40cm. These radio tagged fish were floy tagged with a coloured tag placed in the dorsal fin area, while other rainbows of appropriate size were 'floy tagged' with other colours. Swimmers accompanied by a tracking boat could ID tagged fish. A 'sightability' determination could be made against radio tagged fish, floy tagged fish as well as untagged fish to calculate estimates of how many fish of various size categories there are in the system. Sounds complicated, but it is giving us an idea of rainbow life history and numbers here. This research indicates that there are 200 + or – spawning aged rainbow trout in our system.

You may recall that in 2000, SWSS produced an Inventory of Mine Tailings Piles and Ponds in the Salmo Watershed. As a result, we identified the Old Yankee Girl site across from Ymir as our priority concern and have been focusing on working toward a community based 'restoration' activity for this orphaned (abandoned by the company) tailings. Approximately 4 acres, the Yankee Girl site still has no vegetation after 50+ years of no use. The Ministry of Water, Land and Air Protection has prepared an Environmental Site Assessment of the Yankee Girl and found that it holds and releases enough contaminants to be considered a contaminated site. As a result, the Federal Dept. of Fisheries and Oceans has filed an 'order' to The Ministry of Sustainable Resources to put together restoration plans (this year) and carry out those plans next year. This is a great success for our watershed! SWSS has put together an $8000.00 trust fund to contribute to the restoration, and is encouraging the Ministries involved to hire locally for this project. In this way local contractors will benefit in pocket and develop the skills necessary to do this kind of work.

The awareness work we have been doing has been very rewarding and a lot of fun. From the simple info posters we have been generating, to the conferences we have presented at, we've had good, valuable times. Our display shown in Trail on Sept. 28 for BC Rivers Day, was built around our 'The River Speaks' Awareness Campaign was well received. We also organized a clean up of leftover creosoted ties and tie fragments along the old BNR Trail. Four large truckloads full of ties were removed from Quartz Cr. to almost Wesco Rd. We learned that there are many more of these potential water polluters between the rail bed and the river and look forward to cleaning them up in the future.

The federal government has also climbed on the 'Rivers Day' bandwagon and declared June 8th their day. To celebrate this year, we had a Raft the Salmo River draw that was great fun for the 2 successful winners, Rebecca and Dave. The contest will be repeated in 2004 so watch for the draw boxes around town the third week in May!

SWSS has recently won a 'B.C. Environmental Steward' Award from the Ministry of Water, Land and Air Protection. This award needs to be shared with our community who clearly loves the environmental quality that we have here. We take it as another testament to the partnering focus that we use.

SWSS produced a CD of the 'No Boundary Concert' that we organized at the Transboundary Conference in Spokane last year. The conference was about looking toward a Columbia River watershed-based approach to aquatic ecosystem health. We are proud that the conference organizers felt that a group from the Salmo Watershed should be recognized with such distinction. The conference was attended by 800 scientists and political representatives from Canada and the U.S.

This year Streamkeepers will continue with our commitment to sit on the Action Planning Group and Chair the Communications Sub-committee for the multi agency Sturgeon Recovery Initiative. We will try to help in any way that we can to increase the health of our watershed and by extension the health of our community.

Please come and share your insights at the Watershed-based Fish Sustainability Plan Open House on Mon. Nov. 17th. It could set the priorities for fish sustainability in this watershed for years to come, and we want this process to be inclusive and positive. The plan could make a huge difference in the Salmo Watershed, both in creating partnerships and in setting directions. SWSS feels honoured that the agencies involved would see the Salmo watershed as the first area in the Columbia Basin to put a plan like this in place.

Thanks to all of you that have contributed your time and energy. We hope that you will support us in our activities, as you know we are a non-profit charitable organization and could very much use your help. We also hope that you will continue to see that our river is a vital and valuable 'character' in our watershed.

Most of all, we hope that you take some time from your busy schedules to go down and enjoy a few moments by the Salmo River.

Thank you for your time! Cheers! Gerry Nellestijn

Coordinator: Salmo Watershed Streamkeepers Society

Remember, We're All Downstream.

SALMO WATERSHED Streamkeepers SOCIETY

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www.streamkeepers. bc.ca ■ gerry@streamkeepers.bc.ca

June 1st, 2004

Dear Mainstem Property Owners and Members,

Once again SWSS has been busy with our many partners to try to improve the aquatic ecosystem health in our watershed. We wanted to write to give an update on what we've accomplished in 2002/03, and to let you know what we are looking forward to in 2004.

The Salmo Watershed Fish Sustainability Plan (WFSP) is perhaps the most challenging project we have been involved with to date. Our multi-stakeholder group comprised of industry, landowners, government and fisheries agencies and interests of all sorts have put together some healthy initiatives for us to look at to reach fish sustainability. We are now circulating a draft report of Stage II. The 'Watershed Planning Team' (WPT) wants to reflect economic, social (community), as well as environmental concerns and include an 'adaptive' approach that will change as new information becomes available. The WPT has identified ten strategic options to help us increase the health of our system. These options begin with promoting strong stewardship of the watershed and moves toward restoration efforts which mimic how nature would shape a river. Please call or access (by July 15th) the WFSP Stage II report at www.streamkeepers.bc.ca or, in hard copy at the Salmo Library or the Ymir Store for a more detailed look at where efforts for fish sustainability will take us.

The B.C. Hydro Fertilization Project will begin in Sheep Cr. This year. You may recall that we have been involved with Hydro to assess Sheep Creek and the South Salmo River. These assessments took into account collecting 'periphyton samples' to identify the type and rate of growth of aquatic plants (mosses) that we have in those specific streams. As well we looked at water quality, an invertebrate sampling element and did fish inventory work on a number of sites. This information was used to determine that Sheep Cr. would be a good candidate for fertilization. The fertilization process has been working successfully in lakes and more recently in other rivers; it is known to lead to an increase in fish size and numbers. The system used to fertilize Sheep Cr. has never been used before, a drip system that is 'state of art', described as the 'best system in the world'

For three years SWSS has teamed up with Beaumont Timber, Columbia Kootenay Fisheries Renewal Partnership, Columbia Basin Trust, Columbia Basin Fish & Wildlife Compensation Program, the BC Ministry of Water, Land and Air Protection as well as BC Hydro to fund and participate in the 'Salmo River Rainbow Trout Population Size and Habitat Use Study'. This is a Radio Telemetry project to discover where rainbow overwinter and spawn as well as to make determinations as to how many fish of specific size ranges there are in our system. Radio tags were implanted in 30 rainbow trout over 40cm. These radio tagged fish were 'floy' tagged with a coloured tag placed in the dorsal fin area, while other rainbows of appropriate size were 'floy tagged' with other colours. Swimmers accompanied by a tracking boat could ID tagged fish. A 'sightability' determination could be made against radio tagged fish, floy tagged fish as well as untagged fish to calculate estimates of how many fish of various size categories there are in the system. Sounds complicated, but it is giving us an idea of rainbow life history and numbers here. This research indicates that there are 200 + or – spawning aged rainbow trout in our system. Predicting possibility of extinction is the primary focus of Conservation Biology. Predicting extinction risk is tricky business at best. In the genetics-based approach conservation minimum population size is generally set by the risk of having injurious genes available or by not having sufficient genetic diversity to ensure allowing the population to evolve. From a population-based approach it is considered that a number of individuals greater than 50 is necessary to prevent inbreeding damage. A recommended number of 250 spawning adults is felt to be necessary to minimize risk of extinction especially if populations may fluctuate greatly due to environmental disaster or unusual pressure from human activity, angling or other.

You may recall that in 2000, SWSS produced an Inventory of Mine Tailings Piles and Ponds in the Salmo Watershed. As a result, we identified the Old Yankee Girl site across from Ymir as our priority concern and have focused on working toward a community based 'restoration' activity for these orphaned (abandoned by the company) tailings. At 2+ hectares, the Yankee Girl site still has no vegetation after 50+ years of no use. The Ministry of Water, Land and Air Protection has prepared an Environmental Site Assessment of the Yankee Girl and found that it holds and releases enough contaminants to be considered a contaminated site. As a result, the Federal Dept. of Fisheries and Oceans has filed an 'order' to The Ministry of Sustainable Resources to put together restoration plans and to carry out those plans later this year. This is a great success for our watershed! SWSS has put together a trust fund to contribute to the restoration, and is encouraging the Ministries involved to hire locally for this project. In this way local contractors will benefit in pocket and develop the skills necessary to do this kind of work.

This year Streamkeepers will continue with our commitment to sit on the Action Planning Group and Chair the Communications Sub-committee for the multi agency Sturgeon Recovery Initiative. We will try to help in any way that we can to increase the health of our watershed and by extension the health of our community.

It's fishin' season soon, the Salmo supports a wide variety of fish species but in low numbers. At 150 +or- spawning adult bull trout and 200 +or- spawning adult rainbow trout we need to practice restraint in our angling pleasure. Although all bull trout are catch and release only in the Salmo River, there is a 1 per day rainbow limit from Sheep Cr. to the South Salmo (everywhere else is catch and release). We encourage catch and release everywhere in the system to promote more fish . When you think about it a couple of good anglers could virtually wipe out our entire adult rainbow spawning population! Barbless hooks work well too, they are legal (barbs are not), a bit more of a challenge but you do get used to them.

In the fall we will be hosting a public meeting with the Columbia Kootenay Fisheries Renewal Partnership to share our insights about the Watershed-based Fish Sustainability Plan, we hope you'll be able to attend!

Thanks to all of you that have contributed your time and energy. We hope that you will support us in our activities, as you know we are a non-profit charitable organization and could very much use your help. We also hope that you will continue to see that our river is a vital and valuable 'character' in our watershed.

Most of all, we hope that you take some time from your busy schedules to go down and enjoy a few moments by the Salmo River.

Thank you for your time! Cheers! Gerry Nellestijn

Coordinator: Salmo Watershed Streamkeepers Society

Remember, We're All Downstream.

Salmo River

Watershed-based Fish Sustainability Planning

Please Join Us for an Open House and Information and Feedback Meeting at the KP Hall in Salmo Mon. Nov 17th
Open House at 6 PM Meeting at 7-9PM

Coffee and donuts will be available.

Open House Advertisement placed in the
Salmo Valley Newsletter

Salmo River Watershed-based Fish Sustainability Planning

Please Join Us for an
Open House, Information and
Feedback Meeting at the
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Monday, November 17, 2003
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Open House Advertisement placed in the
Pennywise

Salmo River Watershed-based Fish Sustainability Planning

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Monday, November 17, 2003
Open House at 6 PM
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Coffee and donuts will be available.

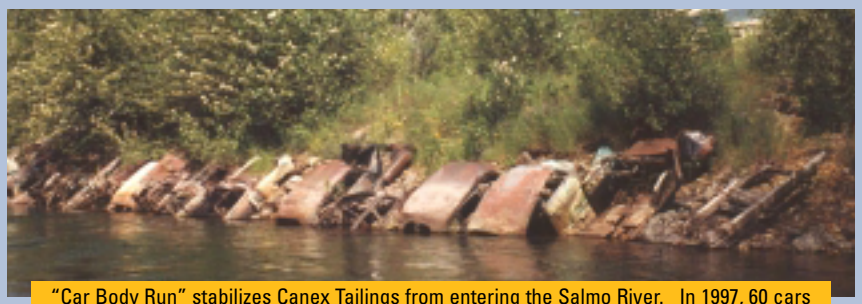
Salmo River Watershed-based Fish Sustainability Plan

Open House

Monday, November 17th, 2003

6:00 - 9:00 pm in the KP Hall, Salmo

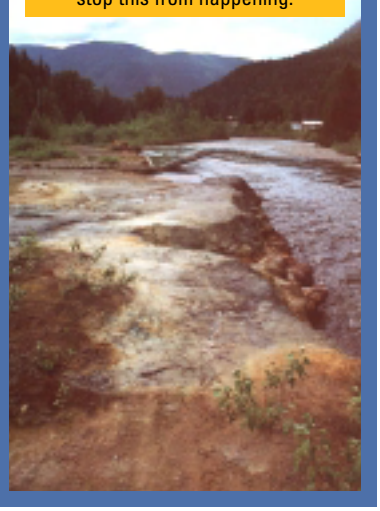
Presentations & Info Sharing begin at 7:00 pm



"Car Body Run" stabilizes Canex Tailings from entering the Salmo River. In 1997, 60 cars stabilized the bank. In 2003 there are 30. Stabilization breached – what should be done?

Yankee Girl Tailing Site across from Ymir is leaching contaminates into the Salmo River.

This community has the skills to stop this from happening.



Come participate in an evening of presentations and information sharing about Watershed-based Fish Sustainability Planning.

■ Review the Watershed and Riparian Profiles – produced for you with guidance from the Watershed Planning Technical & Planning Team. ■ Read the Salmo River Story Pole and help us with our watershed history. ■ More info – 357-2630.

HOSTED BY

Columbia Kootenay Fisheries Renewal Partnership

Salmo Watershed Streamkeepers Society

POSTER DESIGN COURTESY OF FRANK COMMUNICATIONS INC.

Salmo River
Watershed Based Fish Sustainability Plan

Open House
Mon. Nov. 17th/03 6:00pm- 9:00 PM

The K.P. Hall, Salmo, B.C.

DRAFT AGENDA

6:00-7:00	OPEN HOUSE	
7:00	Introductions	Pat Field
7:15	Purpose of Event - Known Issues/Concerns	Pat Field
7:30	Origin of SWFSP - Process/Roles/Origins	Bill Green
7:50	Review of Instream Projects - Past Summerize Watershed & Riparian Profiles Possible Future Instream Projects	Gerry Nellestijn
8:20	Proposed Next Steps - Opportunities for Input	Pat Field

General Information Sharing and Discussion

Meeting Adjourned when Discussion is over.

For Further Information or Copies of the Watershed or Riparian Profiles Contact:

Gerry Nellestijn, Salmo Watershed Streamkeepers Society, Box 718, Salmo, BC
Tel (250) 357-2630; email gerry@streamkeepers.bc.ca.

Please access the following WWW address for a copy of the Watershed-Based Fish Sustainability Planning Guidelines:

http://www.dfo-mpo.gc.ca/Library/255159.pdf

A Review of the Status of Rainbow Trout in the Salmo River Watershed

Rainbow Trout Biology

- Rainbow trout are easily identified by the dark spots on their body and red slash on the side of their silvery body.
- They are a moderately long lived species that mature at age 5 (at around 45 cm in Salmo River). Rainbow trout are largely insect eaters, but they can be piscivourous.
- Rainbow trout spawn in the spring as water temperatures and flows increase. They require cold clean water, overhead cover, and suitable gravel for spawning. Like bull trout they do not die after spawning.
- Rainbow trout are the target of a sport fishery in the Salmo River and are vulnerable to overharvest.

Salmo River rainbow trout captured during spawning period

Radio tag being surgically implanted into Salmo River rainbow trout

A side channel in Salmo River used for spawning by rainbow trout

Radio tagged Salmo River rainbow trout being released

Radio Telemetry Study

- Total of 50 rainbow trout radio tagged in 2001, 2002, and 2003. Tracking to spawning, summering, and overwintering areas. Habitat use, migratory timing and spawning timing identified.
- For this study fish were captured by angling, anaesthetized, and a uniquely coded radio tag was surgically implanted. Fish were also Floy tagged prior to release.
- Trout were tracked throughout the year from both the ground and air with intensive tracking in spring during spawning.
- Mainstem areas of Salmo River used in summer. Habitat predominantly deep pools where several fish concentrated.
- No fish migrated to the reservoir and all overwintered in the mainstem Salmo River in areas of reduced flows with pool, wood, or overhead cover.
- Rainbow trout spawned (Figure 1) in the mainstem Salmo River (86%) and lower ends of two tributaries (14%) from early May to mid June.
- Side channel areas in mainstem Salmo River were important for spawning. In periods of high water during spawning period, off channel habitat used for refuge.

Population Estimate Study

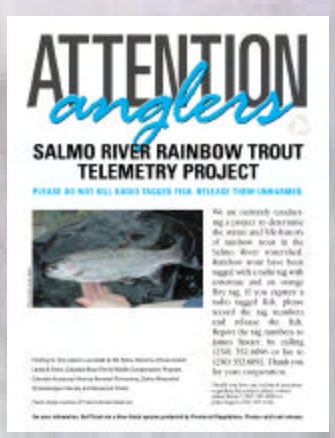
- In summer of 2001, 2002, and 2003 the population size of rainbow trout >30 cm and >40 cm has been estimated for the mainstem Salmo River through snorkel surveys and observing Floy tagged and untagged trout.
- Combination of Floy/radio tagged trout allows us to determine what proportion of trout we are seeing (expansion factor).
- Estimate for 2001 (n=191), 2002 (n=159), and 2003 (n=194) for trout >40 cm suggests potential conservation concern (<200 spawners). As a result of estimates, a catch and release zone has been implemented and harvest has been reduced to one trout >30 cm in areas open to harvest.
- Monitoring will continue for several years to evaluate regulation change.

Rainbow trout with Floy tags hiding in cover

Figure 1. Confirmed rainbow trout spawning locations in the Salmo River watershed

Education

- Poster for community awareness, school field trip, discussion with anglers/groups.



Poster

Future Directions

- Continued population estimates to monitor response to regulation changes
- Additional radio tracking during spawning in 2004
- Potential instream habitat projects
- Watershed-based fish sustainability planning

Acknowledgements

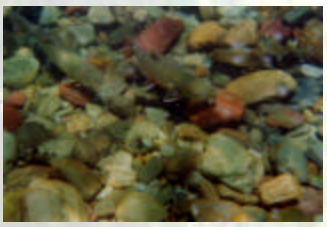
- Funding provided by a number of groups

-Salmo River Streamkeepers Society
-Columbia-Kootenay Fisheries Renewal Partnership
-Columbia Basin Trust
-BC Hydro
-Columbia Basin Fish and Wildlife Compensation Program
-Beaumont Timber
-BC Ministry of Water, Land and Air Protection

A Review of the Status of Bull Trout in the Salmo River Watershed

Bull Trout Biology

- Bull trout are a char not a trout, and have white spots on their body and white leading edges on the fins on the bottom of their body.
- They are a long lived species that mature at age 5 (at around 30 cm) and are highly piscivourous (eat fish).
- Bull trout spawn in the fall in cold headwater areas of the streams in which they live. They require cold clean water, overhead cover, and suitable substrate at their spawning sites. Unlike salmon, bull trout do not die after spawning.
- The area used for spawning is known as a redd, and the same areas are used in successive years. Typically these sites are areas of groundwater upwelling that provide protection from freezing in the winter.
- Bull trout can be impacted by introduced non-native species (brook trout), are susceptible to habitat destruction, and are vulnerable to overharvest.



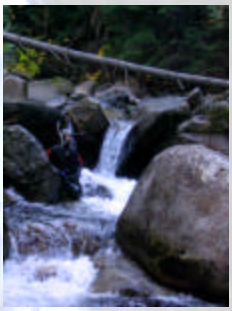
Two mature bull trout swimming upstream to spawn

A mature bull trout hiding under a log in a spawning tributary

A bull trout spawning area (redd)

Radio tag being surgically implanted into Salmo River bull trout

Radio tagged Salmo River bull trout recovering in river prior to release



Radio tagged bull trout migrated over this chute to access spawning area

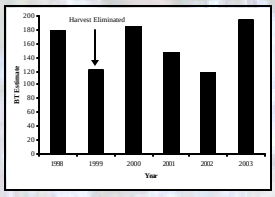
Radio Telemetry Study

- Twenty bull trout were radio tagged in 1999/2000 in the Salmo River, and were tracked to summering, spawning, and overwintering areas. Migratory timing, spawning timing, and repeat spawning percentage were also identified.
- For this study fish were captured by angling, anaesthetized, and a uniquely coded radio tag was surgically implanted.
- Fish were allowed to recover, were released, and then tracked throughout the year from both the ground and air.
- Bull trout spawned in four main headwater areas (Clearwater Creek, upper Salmo River, Sheep Creek, South Salmo River) with some fish spawning in the US portion of the South Salmo River.
- No fish migrated to the reservoir and all overwintered in the mainstem Salmo River.
- 80% of the fish tagged in 1999 spawned again in 2000. Some fish returned to the same areas for spawning in both 1999 and 2000.

Escapement Monitoring

- From 1998 to 2003 we have conducted annual redd and spawner enumeration.
- Involves walking and swimming streams, and counting all redds and fish.
- Number of spawners (escapement) is estimated by expanding the count of redds and fish.
- Bull trout escapement less than 200 spawners in years surveys conducted, resulted in elimination of harvest in 1999/2000.

Snorkelling to enumerate bull trout in cover



Bull trout escapement estimate over time for Salmo River watershed

Posters

Children observing a bull trout surgery

Education

- SWSS focussed on community education through a poster campaign and press releases.
- Education of school children through field trips and contest.
- Collaborative effort of industry, community, government and non-government organizations. Showed groups with different ideas could work together to complete projects, and community given more control and involvement in projects.

Future Directions

- Continue with escapement monitoring
- Protect key habitats
- Potential instream habitat projects
- Stream fertilization project
- Watershed-based fish sustainability planning
- Community involvement and education
- Catch and release maintained if no response

Acknowledgements

- Salmo Watershed Streamkeepers Society
- BC Hydro
- Columbia-Kootenay Fisheries Renewal Partnership
- Ministry of Water, Land and Air Protection
- Columbia Basin Fish and Wildlife Compensation Program
- Baxter Environmental, Mountain Water Research, John Hagen and Associates
- Other people we've missed

A Story Pole Of the Salmo Watershed

Compiled for the Salmo Watershed Streamkeepers Society

PLEASE HELP COMPLETE THIS STORY WITH YOUR CORRECTIONS AND ADDITIONS

Early accounts of forest harvesting indicate logging was the initial form of resource extraction from the Salmo watershed. Sinixt peoples used the Salmon River for fishing and the Salmon Valley as a route to Grohman area on the Kootenay River.

Early accounts suggest the Salmo basin was primarily composed of old-growth western red-cedar and hemlock, prior to european arrival.

1807-1811 – D. Thompson travelled to the Kootenay, as well as the full length of the Columbia River.

* First white man to explore region.

1825 – Fur trader Alexander Ross noted abundance of Salmon, along with other accounts of a significant harvest site at the mouth of the Pend d'Orielle River.

* Salmonids included; Chinook, the first to arrive in the spring, Sockeye would arrive in July, and Coho where the last in October.

* Historical and ethnographic sources indicate salmon and steelhead were primary subsistence for early tribes using the area.

1856 – Hudson's Bay Company discovers placer gold at mouth of Pend d'Orielle river (onset of gold rush)

* Signify significant land clearing in this area, planned but uncontrolled burns to provide easy access to bedrock.

* Affects surface drainage, overland flow, landslide activity and general hydrology.

1857 – Ft Pend d'Orielle later Ft. Shepard begin construction

* A Sinixt settlement site was located here prior, consisted of and old village and burial ground.

1868 – Gold rush of Forty-Nine Creek in West Kootenay for two years (also documented as 1876)

1871 — Ft. Shepard closed.

* Signified end of the fur trade era in Kootenays.

Photo Credit: Bernarine Stedile – Family Collection

* Loss of influence of beaver habitat creation and modification, likely profound effect on habitat and biodiversity of riparian and aquatic ecosystems (Steeger et al. 2003).

* Within 50-70 years since the first Europeans arrived the pristine ecology of the watershed would have been almost completely transformed to support economic development and resource extraction.

1885 – Ymir claim staked on Ymir creek.

* Forest Fire swept through region

1886 – First Lode claim for silver ore on Toad Mountain (Silver King mine)

* 15 man gold prospecting expedition up Salmon River from Colville, Washington.

1887 – 30 claims staked on Toad Mountain (Silver King)

1888 — Silver King Mines begins exploration for hard rock mines.

* Signify land clearing up western slopes of watershed.

1890 – Present day Ymir established as Quartz Creek Camp

* Late 1800's and early 1900's logging activity by horse logging to remove cedar and western white pine. Numerous forest companies operated, timber used for boards/planks and shingles. Sawmills located on Clearwater, Lost, Erie creeks and in Salmo area. (Westslope, 2003)

1892 – Nelson and Fort Shepard (N&FS) Railway granted 10, 240 ac of land per mile of laid railway

1893 – N&FS Railway lay to Mountain Station and onto Ft. Shepard

* Salmon Siding opened as a lumbering operation.

* Historical wetland exists near Apex Creek area. West side may have affected by railway via infilling, riparian logging ,10% loss - (Steeger et. al. 2003).

* Permanent and ephemeral wetland (4 ha) lost between mouth of Hall creek and Spilker's property (Hall Siding), including some bank stabilization.

* Permanent and ephermeral wetlands (5 ha) compromised on Barrett Creek, including channelization (compromised down stream ephemeral wetland).

* Permanent and ephermeral wetlands (2 ha) compromised by bank stabilization and channelization of Quartz creek (some wetland remnants still exist).
* Ephemeral wetlands on east and west side of Hidden creek compromised.
* Labyrinth Mill site ephemeral and permenant wetland (6 ha) compromised.
* Area between Salmo and railway lands historically patchy ephemeral wetlands.
* Channelization is described in terms of ecological and aesthetic damage, second only to impoundment. (Hooton and Reid 1975)

1894 – Record snow accumulation of 22 feet

* Significant flooding in region.

1895 – Significant prospecting on south side of Iron Mountain

1896 – London and BC Goldfields Ltd. produces Ymir Mine at Quartz Creek.

1896 – F.R. Rotter Lumber Company and F. Lavins Salmo Lumber Mills shut down (unknown location)

* May indicate surround areas of the mills exhausted timber resources.

Gold discovered up Sheep Creek, Queen Group staked.

Ymir Hotel and Saloon erected

1897 – Salmon Siding renamed Salmo.

Nelson population estimated at 3,000

Fern Mill installed on Hall Creek and Porto Rico Mine property on Barrett Creek each consisted of a 10 stamp amalgamation mill and cyanide plant.

* These were powered by wood fired boilers (timber cut and hauled from lower elevation). Loss of riparian structure and likely significant alteration to channel morphology.
* Corresponding loss of habitat complexity.

1898 – Second Relief mine staked

Quartz Creek camp population 1,100

* Indicates significant alteration to confluence of Quartz Creek and Salmo River.

Settlement of Petersberg 4kms up Wildhorse Creek

1899 – Sheep Creek camp opening of Yellowstone Mine (vein) including HB and Aspen groups

Settlement at Erie Lake grew to 200 people, settlement begins at Second Relief Mine.

* Course of Erie Creek changed 0.5 km to the south, infilling of extensive wetlands, dyking and channelization.
* Historic inundated floodplain lost to settlement development.

HB mine first to hire women, construction of 4000 foot tunnel to transport sulphide ore.

* Cominco still owns the mineral rights, and is obligated to monitor the tailing ponds.

1900 – Yellowstone mine installs 10 stamp mill

Ymir population estimated at 600.

Ymir mine extracts 43,000 tons via 80 stamp amalgamation plates, concentrate tables and 'state of the art' sand leaching cyanide plant.

* Powered by wood, steam and water, likely significant alteration to Wildhorse Creek.

Queen property begins production, ore treated by amalgamation at the Yellowstone Mill

1902 – Yellowstone mine exhausted, shuts down

* Total production estimated at 80,000 tons for all producing mines (including Ymir, Yellowstone, Wilcox, Arlington, Fern, Tamarac, Spotted Horse properties).

1903 – Kootenay Shingle Company begins operations in Salmo.

* Indicates renewed land clearing for mining and prospecting, population growth.

Ymir Gold mines acquires Ymir mine processes 54,000 tons (11 oz gold, 5,000 oz silver, 515 tons lead)

1905 – J. Waldbeser develops Emerald mine property near Salmo

Second relief Mining acquires property near Erie (cyanide press gold recovery plant)

1905 – Hall Mining and Smelting initiates BC Standard Mining Company to produce Hunter V property

1906 – First lead ore mined at Emerald property.

* Canex mine tailings covers 3-4 ha historic wetland (some patches still exist)

1908 – Queen Group of Sheep Creek (4 claims) erects 20 stamp mill crushing 60 tons ore/day.

1909 – Ymir mine slows production, fades from attention as big producer.

* Tailings are known to sit directly on SW bank of Wildhorse Creek.

Kootenay Belle begins production via 4 stamp mill.

Ft. Shepard destroyed by fire.

1911 – Yankee Girl (Yankee Boy) begin production (considered stalwart of the region).

1912 – Salmo Hotel erected

* Mt. Katami in Alaska erupts, ash cloud settles on Kootenays four days later
* HB mine produces 742 tons lead carbonate

1913 – Arlington mine shuts down

1914 – Last year of mining the Silver King

Placer operation on Sheep Creek to recover gold tailings from Queen Group mines deposited directly into creek from Yellowstone mill.

* Significant factors of turbidity and suspended solids in Sheep Creek along with countless other toxic compounds.

1915 – Motherlode ran steady from 1906 produced 61,336 tons ore. Consisted of 100 ton stamp cyanide mill erected on Sheep Creek

* First of its kind in BC, processed 125 tons ore/day.

1916 – End of Sheep Creek production (fixed gold prices, cost of production)

1918 – Relief Gold mining ceases operations at Second Relief mine

1919 – Iron Mtn. Ltd. Completes concentrator mill on Emerald property produces 1100 tons galena

* 40 stamp mill and flotation separator located at Second Relief camp destroyed by fire, including the camp.

1920 – Ymir population reduced to 300

Photo Credit
Courtesy of Salmo Museum

1922 – From 1907, Nugget Mine produced 21409oz gold, 4836 oz silver and 36,665 tonnes ore.

1923 – Emerald mine produces 223 tons galena

1924 – 1930 Brook Trout stocked (108227 fry; eyed) into Salmo River and tributaries.

Cutthroat trout stocked (6000 eyed egg) into Salmo River and tributaries.

1926 – Large forest fire in upper Salmo Valley (destroys timber Porto Rico Timber hadn't yet cut)

1927 – Second Relief revives production via diamond drilling for galena.

* Oscarson Mining Company builds 75 ton mill which used elemental Hg in an amalgamation gold extraction process.

1928 – Kootenay Shingle Company ceases operations

* May signify loss of economic production, or timber resources after forest fire.

Consolidated M&S takes 12000 tons of ore from Hunter V

1928 – Emerald mine renews gold production.

1929 – Operations suspended at Second Relief and Arlington mines

Yankee Girl ceases production (producing only 1, 200 tons ore).

* If the dates of Yankee Girl operation are correct, the tailings pile has been a point source of contaminants directly into the Salmo River for more than 70 years.

1929 – Reno Gold mine installs 30 ton/day cyanide processing plant (extracts $400,000 of ore)

1930's – Estimated that 111 houses at town site up Sheep Creek at confluence of Waldie Creek.

* Today a forest recreation site exists near the old town site location along with several relicts of concentrator mills. Town site built partially on tailings. Sheep Creek would have experienced extensive alteration over the course of mine production.

1931 – West Kootenay Power strings up 63kv #7 line, provides electricity to Ymir and Salmo.

Forest Fires revenged Rocky Mountain trench.

* Remaining riparian vegetation along the main stem burned off (forest fire, exposing bedrock)

* Signify loss of channel stability, morphology, and nutrient status.

1931-1934 – Rainbow trout fingerlings (25000) stocked in Salmo River and tributaries.

* Stocking since the 1920's may indicate a conscious effort to revive the fishery resource. It is unknown the impact of stocking on resident species.

1932 – Motherlode Mill reconditioned to ball mill to treat Reno ore.

* Accounts suggest tailings were washed directly into Sheep Creek.

1934 – Great Forest Fire in BC.

Iron Mtn and Reno Mines surface plants burned by forest fire

Crowsnest pass between Medicine Hat and Vancouver complete 942 miles.

* Effectively provided ease of access to the valley.

Last known ocean salmon caught near Nelson at Slocan Pools.

* Signify extreme shift in ecology of entire watershed based on the nutrient recycling capacity of anadromos fishes after spawning. (interior rainforest ecology).

* Total annual consumption of salmon by Kalispel Tribe estimated to be at least 71,000 lbs. (approximately 3,800 fish at 18.5 lbs/fish) on lower Pend d'Oreille River, head of Salmo River and other portions of territory. (Scholz et al. 1985)

1935 – Cyanide processing plant added to Second Relief Mill, in operation until 1948.

1936-1953 – Rainbow trout stocked (461000 fry, 370000 eyed egg) in Salmo River and tributaries.

1939 – Grand Coulee Dam construction complete, permanently blocking salmon runs.

* Era of Boundary Water Commission and flood control efforts on the Kootenay River at Grohman and Granite.

Forest Fire rips through Beaver Creek Valley near Fruitvale.

Emerald mine producing 200 ton/day tungsten during war time.

1940 – Dundee Mine ore treated by 50 ton concentrator at 1000m elevation on north side of Oscar Creek.

* Estimated 360,000 tons of waste material was produced.

1940 – 1941 Kokanee stocked (170000) eyed egg stage in Salmo River and tributaries.

1940 – 1942 Brook Trout Stocked (80000 eggs) into Salmo River and tributaries.

Expansion of the forest industry resulted in construction of road networks, farther into hills.

* Signify changes in runoff, sedimentation, creek crossing and functional riparian habitat.

1940-1950's – Construction of dams in US (Albeni Falls Dam and Box Canyon dam), Kalispel Tribe contends caused shift in fishery resources to a greater portion of roughfish (squawfish, perch, sucker).

* Loss of resident rainbow fishery.

1941 – Great Northern suspends passenger service on N&FS railway

1945 – 1949 Brook trout stocked (50000) into Salmo River and tributaries.

1946 – Arlington mine production ceased.

Salmo incorporated as a village.

1948 — Great floods in BC, extensive damage caused along Columbia from Trial to Oregon.

* Presumed to have caused flood damage to channel morphology and hydrology in Salmo Watershed.

1949 – Spruce Beetle infestation in southern Kootenays.

* May signify loss of forest health in the region due to significant alteration (fire suppression), shift in ecology and species composition.

Canex ceases milling Tungsten at Emerald mine, converts to concentrate lead and zinc as well

1951 – HB camp constructs 1000 ton/day concentrator at confluence of Sheep and Aspen creeks.

Cominco initiates Waneta dam.

* Extensive flood control efforts in the area to moderate flow and channel characteristics within the southern portion of the watershed.

Last Gold Mine closed.

1953 – Consolidated Mining and Smelting completes Waneta Dam on Pend d'Oreille River (500m above C.)

* Salmo River watershed drainage and fish populations completely isolated.

CM&S completes concentrator mill at HB mine

1958 – Canex shuts down Emerald mine and mill

1960's – Fishery bag limits on the Salmo river were known to be 15 fish/day.

1966 – Cominco shuts down HB mining operations

1970 – Sheep Creek waste piles of the Queen, Motherlode and Yellowstone are shipped to Trail Smelter for silica extraction.

1971 – Canex ceases operations at Jersey mine

1972 – Flooding due to above average snowpack.

* Second highest max daily flow @ 351 cubic meters per second - cms

1973 – Jersey townsite auctioned off piece meal, mine reclaimed

1978 – HB camp and mine closed

1979 – Seven Mile dam completed (reservior >1000ac)

* Lower several km of Salmo River transformed into a reservoir. Lead to increased water temperatures and extreme changes in aquatic biodiversity (increased non-sport fish), alteration to the hydrological regime. May signify impoundment requirement through dyking and channelization.

1980's – Several more tailings piles are shipped to Trial smelter.

1985 – Fires ravenge Rocky Mountain trench

1988 – Seven Mile Reservoir reaches full pool.

1993 – Jersey Emerald Mine closed

1994 – Report by Klohn Crippen of Second Relief Mine tailings (mercury ontamination)…considered contamination conditions typical of abandoned mine sites throughout the Kootenay region.

* Private land logging in the headwaters of Porcupine Creek can be said to be a complete disregard for Mtn. caribou habitat via clear cutting also causing a shift in the hydrology of the headwaters in terms of sediment deposition and overland runoff.

* History of logging in the watershed would appear to have come full circle over 100 years.

2000 — MOE conducts water and sediment sampling of Yankee Girl tailings…exceed several parameters of water quality and drinking guidelines.

* Portions of the tailings pond seasonally flooded during freshet, leading to contaminant flushing into Salmo River. Elevated levels of cadmium, arsenic, iron, manganese, and zinc all exceeded provincial Water Quality Guidelines.

2003 – Report to be prepared in cooperation with URS Canada, in partnership with DFO regarding restoration of Yankee Girl tailings.

* This timeline or story pole has been prepared with respect to completing a cumulative assessment of impacts over the last 200 years in the Salmo Watershed. Currently a Watershed Fish Sustainability Plan is being developed for the area.

It is anticipated the current pilot habitat sensitivity water allocation mapping initiative will enhance a tool for the WFSP.

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MORE FISH IN THE SALMO RIVER!?

The Columbia Kootenay Fisheries Renewal Partnership and the Salmo Watershed Streamkeepers Society are looking for residents of the Salmo Watershed to help design a Watershed Based Fish Sustainability Plan.

Interested volunteers will be selected to participate in a broad-based Watershed Planning Team (WPT). The WPT will be working to a method described in the newly developed, '*Watershed-Based Fish Sustainability Planning: A Guidebook for Participants*'. This team will be comprised of watershed residents, stakeholder agencies, local, provincial and federal government delegates, resource industries, as well as business and stewardship representatives who want to work to sustain fish populations and aquatic ecosystems in our watershed.

If you are interested, please send a letter describing your interest in the Salmo watershed and fisheries sustainability, and the perspective you would like to bring to the Watershed Planning Team. This letter should be received by April 30th by mail, fax or email. Volunteers must be able to commit to 6-8 meetings over a 12-18 month period working in a consensus -based format.

PLEASE APPLY BY APRIL 30TH/02

Contact CKFRP stewardship coordinator Les Brazier (Ph. 1-250 304-1771, Fax 250-304-1771, lbrazier@telus.net), 197A Columbia Ave., Castlegar B.C.V1N 1A8

Columbia Kootenay Fisheries Renewal Partnership

SALMO WATERSHED Streamkeepers SOCIETY

MORE FISH IN THE SALMO RIVER!?
The Watershed Based Fish Sustainability Planning Effort

Is a stakeholder approach to increasing the depleted fish populations in the Salmo River. A Watershed Planning Team (WPT) has been built with participation from relevant federal and provincial agencies, local industry, forestry, mining and local and regional government as well as business and stewardship representatives who want to work to sustain fish populations and aquatic ecosystems in our watershed.

The plan has a well rounded stakeholder input but there are still places at the table for a youth representative as well as folks from the upper watershed. This activity is being facilitated by the Columbia Kootenay Fisheries Renewal Partnership (CKFRP) and co-hosted by them and the Salmo Watershed Streamkeepers Society. To date, 2 meetings have taken place, the 1st meeting introduced the plan structure as well as listened to recommendations from those present as to how to fill out stakeholder participation. The second meeting incorporated these recommendations and began to put together a watershed technical team (WTT) tasked with drawing a watershed profile. A more holistic approach to the watershed plan taking a broader look at uphill and riparian zone (the zone of influence between the land and the water) concern was suggested at this meeting.

The WPT will be working to a method described in the newly developed,*Watershed-Based Fish Sustainability Planning: A Guidebook for Participants*'. The teams have committed to 6-8 meetings over a 12-18 month period working in a consensus -based format.

Our 3rd meeting , will be held at the Ymir Hall on Tues. Oct. 22nd. We will host guest speaker Mike Wallace from the Salmon River Round Table from the Okanagan who will speak to the WPT about their own successes and challenges putting together a Watershed Based Fish Sustainability Plan based on the same format as ours. We will also look at and revise a tentative 'Table of Contents' approach to our watershed profile as presented by the project biologist involved in our Plan.

To become involved or for more information please call,

CKFRP stewardship coordinator Les Brazier (Ph. 1-250 304-1771,
Fax 250-304-1771, lbrazier@telus.net), 197A Columbia Ave.,
Castlegar B.C.V1N 1A8
Or Gerry Nellestijn, Coordinator, the Salmo Watershed Streamkeepers Society.
357-2157
To view the guideline please ask at the library or look at the Ymir store or go to www.bcfisheries.gov.bc.ca

Columbia Kootenay Fisheries Renewal Partnership

SALMO WATERSHED Streamkeepers SOCIETY

MORE FISH IN THE SALMO RIVER!?
THE SALMO WATERSHED-BASED FISH SUSTAINABILITY PLANNIG EFFORT!

Fish sustainability has a more positive outlook in the Salmo Watershed lately!

A Watershed-Based Fish Sustainability Plan (WFSP) is being supported by the Columbia Kootenay Fisheries Renewal Partnership (CKFRP) and co-hosted by them and the Salmo Watershed Streamkeepers Society (SWSS).

A Watershed Planning Team (WPT) has been formed with participation from community members, relevant federal and provincial agencies, local industry, forestry, mining and local and regional government as well as business and stewardship representatives. All these individuals and organizations have agreed to work to sustain aquatic ecosystems and increase fish populations in our watershed. Since our last meeting the WPT team has gained advantage with the addition of a youth representative, this persons' perspective completes a well-rounded multi-stakeholder group.

As well we have put together a Watershed Technical Team (WTT) tasked with drawing a watershed profile. A holistic approach to the watershed plan, it takes a broader look at the uphill and the riparian zone (the zone of influence between the land and the water). Westslope Fisheries has been contracted to draw a watershed profile and we are lucky to have Pandion Ecological Research, a local company, to draw our riparian profile. The WTT met in December to begin to engage various stakeholders and assign specific responsibilities to address the watershed and riparian profiles. They will meet again in February. to combine information, identify information gaps and to begin to draw the picture of our watershed.

Recently the WPT invited Mike Wallace from the Salmon Watershed Roundtable in the Okanagan to present on their efforts to complete watershed planning. Our teams were able to learn from the methods and mistakes that the Roundtable has experienced using the same guideline as we are. We look forward to the time that we begin to implement our plan as the Roundtable has. When completed our process will prioritize projects that will increase this community's ability to effectively bring fish sustainability in sight. This community-based planning activity is an important beginning for us to increase the health of our aquatic ecosystem and point a direction to sustain a viable fish population for us and for future generations.

To become involved or for more information please call,

CKFRP stewardship coordinator Les Brazier (Ph. 1-250 304-1771,
Fax 250-304-1771, lbrazier@telus.net), 197A Columbia Ave.,
Castlegar B.C. V1N 1A8

OR
The Salmo Watershed Streamkeepers Society Coordinator. Gerry Nellestijn
Ph/fax. 357-2630. E-mail gerry@streamkeepers.bc.ca

To look at the Guideline being used go to http://www-heb.pac.dfo-mpo.gc.ca/english/publications.htm#Guidelines.

or ask for it at the Salmo Public Library or the Ymir Store.

STREAMKEEPERS 2003 PROJECTS

This issue of the paper contains an information and membership brochure for the Salmo Watershed Streamkeepers Society (SWSS). We hope you will enjoy the information it contains and we also hope that you will support us in our continuing efforts to make the Salmo Watershed a better Place to Live.
Please return it to us today!

Here's a brief outline of projects for this year.

On March 13th Streamkeepers hosted a public meeting in the Ymir Communiity Hall to outline the conclusions of the "Environmental Impact Assessment of the Yankee Girl Tailings Summary Report"
(available at www.streamkeepers.bc.ca or the Salmo Library). Attended by 85 community members the history, legacy and restoration options for the Yankee Girl were outlined by SWSS and discussed by the community. The Ministry of Water Land and Air Protection talked about the implications of their study and offered their suggestions. SWSS hopes to work with a community-based partnership to contain and cover the Yankee Girl site to minimize the river activated erosion and rain and snow-melt activated leachate into the River. The community of Ymir will then have the opportunity to work with their partners to decide on the sites' future landuse. Watch for notices for a Yankee Girl Restoration FUNd-raising dance coming soon!

This year SWSS will work with the Columbia Kootenay Fisheries Renewal Partnership, the Ministry of Water Land and Air Protection, B.C. Hydro and Beaumont Timber to complete the 3rd year of the Salmo River Rainbow Trout Inventory and Radio Telemetry Study. This work is finding rainbow trout in our system are a conservation concern. Indications are that, give or take, there are only 200 breeding adult rainbows (over 40 cm) that live in our river. At the completion of this activity SWSS and project biologists will explain the methods, operation and conclusions of their work to those who are interested.

The Salmo Watershed-based Fish Sustainabilty Plan (WFSP) is an exciting multi-stake holder approach that's been ongoing here for a while. A Watershed Planning Team (WPT) made up of landowners, community members the RDCK, Village of Salmo as well as industry (mining, private Forestry etc.) and the appropriate Federal and Provincial government agencies drive this process. A broad-based Technical Team (TT) provides the necessary biological expertise to ensure biological insights are provided. Co-hosted by the Columbia Kootenay Fisheries Renewal Partnership and SWSS this effort follows the Watershed-based Fish Sustainability Planning Guidelines developed by DFO and the former Ministry of Environment. Salmo Watersheders are lucky to be in one of two interior watersheds to be piloting this planning approach. With successful planning following these guidelines the Salmo Watershed will have a major advantage toward fish sustainability! SWSS will be sending out a newsletter soon to outline the completion of stage 2 (of 4), - the Watershed profile and the Riparian profile.

If you would like to help or have any questions about any of these projects please call 357-2630. And please fill in your membership and return it to us today.

MORE FISH IN THE SALMO RIVER!?

THE SALMO WATERSHED-BASED FISH SUSTAINABILITY PLANNING EFFORT!

Fish sustainability has taken a step closer to reality in the Salmo Watershed lately!

A Watershed-Based Fish Sustainability Plan (WFSP) funded by the Columbia Basin Trust is being co-hosted by the Columbia Kootenay Fisheries Renewal Partnership (CKFRP) and the Salmo Watershed Streamkeepers Society (SWSS).

The Watershed Planning Team (WPT) with participation from community members, relevant federal and provincial agencies, local industry, forestry, mining and local and regional government as well as business and stewardship representatives have recently completed Stage II of the WFSP. Stage II has resulted in a watershed Profile and a Riparian Profile both designed to let the Salmo Watershed community know the state of the area as it relates to fish sustainability. These two efforts have provided us with a number of recommendations that will help us to restore habitat necessary to boost fish populations. As well, a soon to be completed Stage II report outlines a strategic direction and ten strategic options to guide an approach to a healthier aquatic ecosystem. These options begin with promoting strong stewardship of the watershed and moves toward restoration efforts that mimic how nature would shape a river. The WPT wants to reflect economic, social (community), as well as environmental concerns and include an 'adaptive' approach that will change our directions as new information becomes available. As a result of all the hard work that went into Stage II of the WFSP we've been able to fund a prescription to restore the riverbank at the 'Car Body Run'. The Car Body Run' is a 1960's bank stabilization project put together by Canex Mines to hold back the Canex Tailings from entering the river. It has deteriorated to such an extent that tailings erosion into the river is once again threatening aquatic health. The prescription will give us guidance to put together a more permanent protection. Soon we will be able to look for partners to make sure further damage to the river is prevented. The 'Car Body Run' restoration is a necessity, the WPT hopes that community support will be strong in correcting deterioration there, especially recruiting skills from people with mining know how.

There will be many projects over the years to come to bring our community a healthier aquatic ecosystem. For more information please call call 357-2630 or access the WFSP Stage II report at www.streamkeepers.bc.ca or this fall in hard copy at the Salmo Library or the Ymir Store for a more detailed look at where efforts for fish sustainability will take us.

Salmo River Watershed-based Fish Sustainability Planning Participant List

WPT - Watershed Planning Team WTT - Technical Team KI - Keep Informed

	First Name	Last Name	Job Title	Affiliation
1 WPT TT	Steve	Arndt	Fisheries Biologist	Columbia Basin Fish & Wildlife Compensation Program
2 WPT TT	James	Baxter	Fisheries Biologist	BC Hydro
3 KI	Julia	Beatty	Biologist	Ministry of Water, Land and Air Protection.
4 TT	John	Bell	Fisheries Biologist	Ministry of Water, Land and Air Protection
5 WPT	Phil	Berukoff	Community Member Former Mayor	Village of Salmo
6 KI	Trent	Biggs	Manager	Porcupine Wood Products
7 Consultant	Jon	Bisset	Fisheries Biologist	Interior Reorestation (Formery with Westslope Fisheries)
8 WPT	Sid	Box	Salmo River Landowner	Community Member Ymir
9 KI?	Rick	Bundschuh	Salmo River Landowner	Salmo River Ranch
10 WPT TT	Jeff	Burrows	Sr. Fisheries Biologist	WL&AP Nelson
11 KI	Albert	Chirico	Regional Fisheries Hab-inv Biologist	Ministry of Sustainable Resource Management
12 WPT? KI?	Donny	Clark	Anglers Group Salmo Working Group	Salmo Community Member
13 WPT	Fred	Critchlow	Community Member Landowner	Mining Interest (Chamber of Mines)
14 WPT	Grant	Crookes	Salmo Community Member	Mining Interest
15 WPT	Hans	Cunningham	Chairman of the Board	Regional District of Central Kootenay
16 KI	Dean	Denbiesen	Environmental Tech. Specialist	BC Hydro
17 WPT TT	Norm	Deverney	Assistant rep for BC Gas	Deverney Engineering

18 WPT TT	Bill	Duncan	Biologist (Enviroment & Health)	Tech Cominco
19 KI	Jacques	Dupas	District Manager, Central Kootenay	Ministry of Transportation And Highways
20 KI	Kathy	Eichenberger	Regional Director	Ministry of Sustainable Resource Management
21 WPT TT? KI	Ted	Evans	Planning Forester Arrow Forest District	Ministry of Forestry
22 WPT TT	Brian	Ferguson	Senior Habitat Biologist	DFO
23 WPT? KI?	Annette	Gallatin	Coordinating Member	Salmo Protection Committee
24 WPT	Al	Gerun	Mine & Quarry Owner	Gerex Developments Ltd.
25 WPT TT	Bill	Green	Coordinator	Columbia Kootenay Fisheries Renewal Partnership
26 WPT TT? KI	Jim	Guido	Planning Forester Arrow Forest District	Ministry of Forestry
27 WPT TT	Bruce	Gunn	Planner	Regional District of Central Kootenay
28 KI	Don	Harasym	Planning Manager	Regional District of Central Kootenay
29 WPT? TT? KI	Hanne	Heintz	Chair	Kootenay Trails Council
30 KI	Craig	Herman	Planning Manager Beaumont Timber	Beaumont Timber Co. Ltd Private Forest Landowners Association
31 WPT TT	Jacqueline	Herodek	Rep	Beaumont Timber (PFLA)
32 WPT	Henry	Huser	Community Member	Salmo Chamber of Commerce
33 WPT	Horst	Klassen	Community Member	Chambe r of Mines
34 WPT TT	Kim	Klassen	Youth Rep.	Ymir Community Member
35 KI	Ron	Lee	Community Member	Community Member

36 WPT TT	Bruce	MacDonald	Head of Columbia Section	Fisheries and Oceans Canada
37 KI	Marlene	Machmer	Executive Member	Salmo Watershed Streamkeepers Society
38 KI	Shawn	Maliu	Health Officer	Ministry of Health
39 WPT	Kevin	Maloney	Community Memder Landowner	Champion Consulting
40 KI	Jim	Mitchell	Community Member	4 Leaf Logging
41 WPT TT	Gerry	Nellestijn	President / Coordinator	Salmo Watershed Streamkeepers Society
42 WPT TT	Ron	Ozanne	Forester	Atco Lumber Ltd.
43 WPT TT KI	Dan	Palesch	Area Manager	Ministry of Transportation and Highways
44 WPT TT KI?	Ian	Parfitt	GIS Coordinator Instructor	Serkirk College
45 KI	Dan	Phillips	Project Manager	BC Gas
47 WPT	Rollie	Read	Salmo River Landowner	Community Member
48 KI	Tom	Shuhda	Fisheries Biologist	US Member US Forest Service
49	Pat	Field	Facilatator	A Boulder Institute
50 KI	Al	Solonsky	Fisheries Biologist	US Member Seattle City Light
49 Consultant	Chris	Steeger	Wildlife, Habitat Research Biologist	Pandion Ecological Research Ltd
50 KI	Heather	Street	SalmoRDCK Economic Development	Chamber Rep.
51 KI	Todd	Torra	Community Member	Community Member
52 KI	Wendy	Verburg	Salmo Pump	Manager
53 KI	Dave	Wahn	Assisstant Planning Manager	RDCK
54 KI?	Andrew	Whale	Regional Manager	Ministry of Mines
55	Mike	White		Lower Kootenay Indian Band

56 KI	Diane	Wunder	Development Coordinator	Atco Lumber
57 KI	Steve	Wuschke	District Manager	Ministry of Mines
58 WPT	Gerald	York	Placer Miner, President	West Kootenay Placer Miner Association
59 WPT/TT	Rhiannon	Daloise	Administrative Manager	A Boulder Institute

theflow
Salmo Watershed-based Fish Sustainability Plan Newsletter
NOVEMBER 2003

What is Watershed-based Fish Sustainability Planning and How Does it work?

Watershed-based Fish Sustainability Planning (WFSP) is a new way to achieve management of fish populations and their habitat. The WFSP was developed in British Columbia by the Department of Fisheries and Oceans (DFO) and the former Ministry of Environment with the help of community, stewardship groups, First Nations, industry and other stakeholders. This type of planning is about bringing community stakeholders together to have a look at fish conservation and enhancement.

That's just what has been going on in the Salmo River Watershed for sometime now. Stakeholders include all the levels of agencies who have fish interests in the area. They have gotten together with First Nations, forestry interests, mining people, political representatives, landowners and other community members to look at our watershed. We've tried to look at what we know, what we should get to know (identify information gaps), and we've tried to look at how we can work closer together to make the Salmo Watershed a healthier aquatic ecosystem. We've been following the 4 stage WFSP guideline to give us the structure to do this.

Salmo River Chinook Salmon
Photo courtesy TheSalmo Museum

Why Are We Doing This?

The people of the Village of Salmo, Ymir and Area G have clearly identified that they cherish living in a healthy environment. Folks in the Salmo Watershed admire the fish and wildlife they've always had here, they know that fish in the river are a quality of life item that they are losing. They want to stop and reverse that loss.

Stages

Four stages are generally recommended for Watershed-based Fish Sustainability Planning. In the case of the Salmo watershed, Stage I, Establishing Regional Priorities is not necessary as the Salmo Watershed was proposed by the Columbia-Kootenay Fisheries Renewal Partnership (CKFRP) as a priority watershed within the Columbia-Kootenay region. The remaining 3 stages for the Salmo WFSP are:

- Stage II: Establishing Watershed Priorities
- Stage III: Develop an Action Plan
- Stage IV: Implementing and Improving the WFSP

We are in Stage II. As suggested in the guide a Watershed Planning Team (WPT) and a Watershed Technical Team (WTT) was established. Over the last year plus, both teams have been meeting to move the plan forward. To date we have developed a Watershed Profile and at the request of the WPT we've written a Riparian Profile. Riparian refers to the zone of influence between the river and the upland areas, and it is characterized by unique fish, wildlife and plant life that we find near the river.

Who are the Watershed Planning Team and the Watershed Technical Team, and what do they do?

The WPT is a stakeholder group made up of landowners, community members, stewardship groups, First Nations, industrial interests, forestry, local and regional government as well as government agency representatives.

The WPT is responsible for developing and implementing a detailed fish and aquatic ecosystem sustainability plan for the Salmo watershed. In Stage II, the WPT will:

- Work closely with other parties with an interest in fish and aquatic ecosystem sustainability in the Salmo watershed;
- Develop a strategic overview of local values and resources;
- Establish the overall strategic directions for management;
- Establish specific management objectives, targets and strategies;
- Develop a monitoring and assessment framework; and
- Bring a proposed Stage II plan to the community and governments for review and approval.

The WTT is comprised of local planners, fisheries and wildlife biologists, foresters and others with technical knowledge of our watershed.

In Stage III, the WPT will:

- Identify ways to achieve the objectives, targets and strategies identified in Stage II, including programs and processes;
- Identify and contact appropriate organizations and

continued on next page

IN THIS ISSUE

individuals to determine their capacity and willingness to assist in implementation and monitoring;
- Work with other stakeholders to establish specific commitments regarding implementation and monitoring, including timelines;
- Develop a detailed, multi-year fish and aquatic ecosystem sustainability action plan based on these commitments; and

During Stage IV, the WPT will:
- Oversee delivery of the fish sustainability action plan;
- Meet annually or more often as needed to review performance and effectiveness, and to identify emerging issues;
- Report annually or more often as needed to the public and governments regarding progress in delivering the plan.

The WTT is appointed by the WPT and comprised of local planners, fisheries and wildlife biologists, foresters and others with technical and local knowledge of our watershed.

The WTT is responsible for technical tasks related to the development of the Salmo WFSP as directed by the WPT. In Stage II, the WTT will:
- Coordinate the collection and analysis of data about the watershed;
- Develop a watershed profile;
- Identify strategic management options consistent with fish and aquatic ecosystem sustainability; and
- Identify appropriate indicators of effectiveness.

In Stage III, the WTT will:
- Identify appropriate monitoring and assessment options;
- Identify appropriate research, data collection, and analytical activities.

During Stage IV, the WTT will:
- Assess research and monitoring data; and
- Report new information to the WPT.

Principles for Salmo WFSP Collaboration, Consensus-Building and Outreach

1. Decisions of the WPT and WTT will be made by consensus.
2. Consensus is defined as: (preferred): unanimous agreement among all WPT or WTT members; or (required): general agreement by all members on a package of decisions, recognizing that some members may not agree with some decisions but that they can support the entire package. Members may stand aside on specific decisions to avoid blocking consensus.
3. WPT and WTT members are committed to sharing information and addressing problems that may arise in a respectful manner.
4. WPT and WTT members are committed to resolving issues through interest-based discussion and negotiation.
5. The WPT may delegate resolution of specific issues to small task or working groups.
6. The WPT may engage the services of a facilitator if needed.
7. The WPT will use a range of mechanisms to seek input from the general public and First Nations. ●

Did You Know?

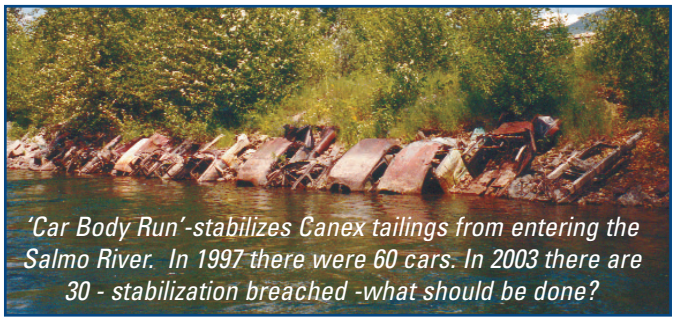
Water is the most abundant substance on Earth but only .003% of it is available for use. The rest is locked in polar or glacial ice is too salty too deep in the ground or too polluted.

WATERSHED PROFILE SUMMARY

The first task of the watershed technical team (WTT) was to produce a detailed watershed profile. It outlined information to help WFSP participants to identify management options for the Salmo Watershed and the best ways to maintain or restore fish populations. Jon Bisset of Westslope Fisheries developed this report with feedback from the WTT. As outlined in the WFSP guideline the group wanted to assess fish populations, habitat and identify factors affecting their health and productivity. Specific objectives were to paint a historical and current picture with maps and other means, assess the status of fish populations and key/critical habitat for individual species, look for information gaps and recommend ways to improve fish numbers and keep them sustainable. A literature review (hardcopy and internet/data-based) as well as consultation with those with local knowledge and experts accomplished this task.

It was recognized that the Salmo Watershed has a strong and supportive extended community, the biological, chemical, physical foundations of a healthy system are still present, the area has a strong and committed watershed group (Salmo Watershed Streamkeepers Society) and a number of studies here provide good information to start with.

Concerns around perceived decline in fish populations center around a number of factors. Mining, exploration and processing minerals likely had broad impacts on water quality, aquatic habitat and landuse throughout the watershed. Large Woody Debris (LWD) 'recruitment' into our river has been significantly reduced/altered or lost, LWD is associated with important deep pool habitat. Channelization and dyking have minimized habitat diversity necessary for specific age ranges of fish. The loss of salmon and steelhead from our river drastically changed the nutrient character it had historically. Development in sensitive riparian areas, point source pollutants and sediment loading may be of concern, as are low summer flows.



'Car Body Run'-stabilizes Canex tailings from entering the Salmo River. In 1997 there were 60 cars. In 2003 there are 30 - stabilization breached -what should be done?

The report recommends that in accordance with best management practices we should protect existing sensitive habitat such as known spawning and overwintering locations. Work to produce an awareness campaign to familiarize folks with aquatic ecosystem information. Continue to work to be proactive instead of being reactive, keep gathering information about the watershed. Reclamation and enhancement activity such as bank stabilization (where appropriate), habitat complexing, side channel flow augmentation, wetland restoration and stream fertilization should be considered. The WFSP should be 'adaptive,' as more is learned or developed – change to use that knowledge. ●

Summary of Salmo River Riparian Zone Profile

The Riparian Ecosystem Profile was written at the request of the watershed planning team. They felt that it was important that folks could begin to get an idea of what it used to look like in the Salmo Watershed. They wanted to hear a description of what it looks like now. They wanted to begin to understand environmental impacts that either have, or may in the future compromise the health of the Salmo River riparian zone.

Yankee Girl Tailings - contaminated site - leaches and erodes directly into the Salmo River. We can stop this.

With the lead of local wildlife biologist Chris Steeger from Pandion Ecological Research the authors used a new and innovative state-of-knowledge way to look at riparian ecosystems generally and 'The Place Where We Live' specifically.

This profile takes us on a walk down the river and gives us a view of 135 species from the outlook of wildlife-habitat relationships and a look at their key ecological functions, especially with wildlife-fish interrelationships. It tells us about the ecological condition and human-induced impacts of the riparian zone of the Salmo River mainstem and its major tributaries. An overview of these conditions are described resulting from the study of air photos, forest cover maps and by accessing professional and local knowledge.

In this profile *Riparian zones are defined as the three-dimensional zones of direct physical and biotic interactions between terrestrial and aquatic ecosystems; boundaries of the riparian zone extend outward to the limits of flooding and upward into the canopy of streamside vegetation (Kauffman 2001).*

Our walk down the Salmo River uncovers a riparian zone and floodplain area, although appearing wild, that is heavily altered. Historically these alterations come from mining, railroad and road building and to a limited extent agriculture, trapping, rural residential/urban development, inappropriately located and operated dump sites, excessive channalization and dyking. Some of these impacts are ongoing and the report points out others that will come our way such as excessive fishing or back-country and riparian area motorized vehicle use. The Profile urges proactive thinking about future impacts.

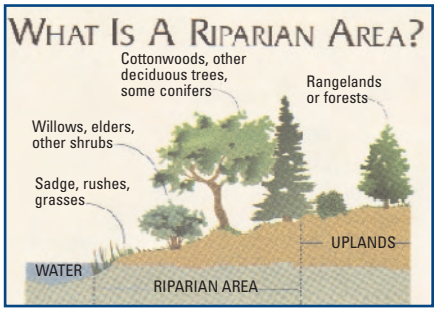
It's interesting to note that before Europeans came our riparian zone was probably 50-70% covered in old growth cedar.

The results of the riparian profile analysis indicate that habitat in need of attention include wetlands, marshes, wet meadows, bogs, and swamps. We need large wood in the river, snags, and large-sized mature trees for river wood and leaf litter recruitment. Shade is important to keep water temperatures down and healthy. Other impacts are reviewed.

This report not only looks at and explains impacts but makes recommendations that we can all work with to gain a wider understanding of our riparian zone and improve it. With guidance from the Profile we need to fill remaining information gaps, set strategic management direction, work together with willing landowners and others in voluntary activities to improve the opportunity for riparian zone health (stewardship). In this way we can increase the possibility for fish sustainability and meet the needs of landowners, industry and others that may impact riparian zones. Specific recommendations for completing the Salmo Riparian Profile address:

- identification of site-specific management needs through a comprehensive GIS mapping analysis;
- identification, protection, and restoration of riparian wetland components;
- inventory of current and potential future levels of riparian and in-stream Coarse Woody Debris and identification of restoration efforts where appropriate;
- conservation and recovery of Species at Risk (i.e. rare, sensitive, threatened and endangered species);
- identification, mapping, and protection of Environmentally Sensitive Areas within the aquatic, riparian and upland zones;
- integration of environmental conservation objectives with the local Rails To Trails initiative;
- development of an "Impact Database" to restore historical environmental contamination sites and to prevent future contamination events; and
- identification of an appropriate approach to habitat stewardship on private and public lands in the Salmo River Watershed.

Have a look at the Riparian and Watershed Profiles, a bit technical maybe but interesting 'walks' through the 'Place Where We Live'. There's lots more detail in the reports than in these summaries. They are available in the Salmo Public Library and the Ymir Wild & Wooly Store. ●



Thoughts on Watershed-based Fish Sustainability Planning

Hans Cunningham, Regional director of Area G, Grant Crookes, creek and riverside landowner and member of SLIP, James Baxter a fish biologist who has gathered a great deal of knowledge about the Salmo Watershed as well as Gerry Nellestijn who coordinates the Salmo Watershed Streamkeepers Society share some thoughts on Watershed-based Fish Sustainability Planning (WFSP).


Hans


Grant


James


Gerry

They were all asked the same following questions:

Why is WFSP important?

Hans - Planning is important because it is necessary to be proactive rather than reactive in order to ensure the continuity of the resource. Trying to save the resource after it has disappeared is rather futile. As an example, witness the depletion of cod on the east coast and the attempts there to recover the resource at this late date.

Grant - So we can stop depletion of and enhance fish populations and in the process educate folks to be aware of what's necessary to make this a reality.

James - WFSP is an important process in that it summarizes the current status of the aquatic ecosystem in a given watershed and identifies the current limitations to production. It also plays a vital role in bringing together all the interested parties (public, private and regulatory) within a watershed to allow efforts to be focussed on projects that have the endorsement of all involved.

Gerry - It's important because it takes a watershed, holistic, not piecemeal view. It asks all stakeholders to get involved, with respect. It encourages common sense, voluntary, not regulatory action to increase the health of the Place Where We Live.

Is it just about fish?

Hans - It is about much more than fish. Fish, though important, are only one indicator of the health of our waterways. It also about protection of riparian areas, protection of other vertebrate and invertebrate species; in other words, we need to ensure the entire ecosystem is healthy.

Grant - I think it's more than that, it's about reasonably clean water and a riparian area to keep water cool.

James - Although ultimately the focus is on fish and the aquatic ecosystem, the relationships between the riparian, terrestrial and aquatic ecosystem ensure there are mutual benefits through projects initiated under this process.

Gerry - It takes a fish first direction but is clearly about people, the way we behave and the types of choices we make. What and how we do things is up to us, long term gain for fish is long term gain for us and our children as well.

What are the Priority issues?

Hans - In my mind, the major issues are the protection of watercourses, especially spawning and riparian areas, flood control through careful streambed engineering, as well as proper land use that can control silting and other stream damage.

Grant - Awareness of over fishing - over fishing is not advisable. Let folks know through studies what may be necessary.

James - The priority issues in the Salmo River watershed are ensuring the conservation of populations of bull trout and rainbow trout that are at low population levels. Identifying areas of habitat limitation in the mainstem river is also a priority in focussing enhancement efforts.

Gerry - Water quality/quantity and diversity of habitat, how people can meet our needs without impacting quality of life around them. Learning to partner effectively.

How do we make it work?

Hans - The first thing in making things work is proper broad spectrum analysis, followed by an overall plan that lists everything needed and also prioritizes and costs out what needs to be done. Next is completing one project at a time, carefully analyzing its effect as part of the entire process, and moving forward until the plan has been concluded. Last of course, is continual monitoring, to ensure a continued healthy ecosystem.

Grant - Only through a partnership with everybody. You just have to get people on board that's all.

James - The process will only work through a coordinated focussed effort of all those involved, and through being able to listen to others opinions.

Gerry - By working together to mimic or encourage what nature would do, especially in riparian areas. By increasing our knowledge of nature and how to 'not' affect it by our actions. By recognizing that water health should be part of the way we operate. ●

Everyone is invited to an Open House, Information Sharing Presentations and Community Feedback Evening on Mon. Nov. 17th at 6:00pm at the KP Hall.

Columbia Kootenay Fisheries Renewal Partnership

Thanks must be forwarded to the Columbia Kootenay Fisheries renewal Partnership (CKFRP) and The Salmo Watershed Streamkeepers Society (SWSS) for their continuing interest in enhancing fish populations and aquatic ecosystem health in the Salmo Watershed.

Special thanks go to all the individuals and organizations in the Watershed Technical Team and the Watershed Planning Team for all their efforts in making Watershed Fish Sustainability Planning a reality. We hope their efforts are translated into willing hands in our community once we start getting wet and dirty to do the actual studies and work necessary to bring about fish sustainability.

For further Information on the WFSP Process or copies of the Watershed or Riparian Profiles Contact: Gerry Nellestijn, Salmo Watershed Streamkeepers Society, Box 718, Salmo, BC; Tel. (250) 357-2630; email gerry@streamkeepers.bc.ca.

SALMO WATERSHED Streamkeepers SOCIETY

Please access the following WWW address for a copy of the Watershed-Based Fish Sustainability Planning Guideline: http://www.dfo-mpo.gc.ca/Library/255159.pdf

4.7 Government regulations and Policies relevant to Riparian Zones

Federal

Fisheries Act – The habitat provisions of the *Fisheries Act* regulate and forbid the harmful alteration , disruption or destruction of fish habitat, the deposit of deleterious substances, the destruction of fish and provide requirements for fish passage around or through man made structures. The riparian vegetation and structure are important habitat within a watershed for fish. The riparian area provides cover, food source,watercourse stability, thermal and hydrologic stabilityAs such any activities which could potentially harm or alter the riparian area around watercourses are subject to the provisions of the *Fisheries Act*. This act applies to private as well as crown lands and is intended to insure that habitat features required by fish to fulfillthe needs of their lifecycles remain intact thus ensuring that the fish present may successfully grow and reproduce. Fisheries and Oceans Canada (DFO) has produced the Policy for the management of Fish Habitat to provide further clarity on the DFO's interpretation of the habitat provisions of the *Fisheries Act*. The Act and policy may be found on the internet at http://www-heb.pac.dfo-mpo.gc/publications/publications_e.htm.

List Of Fish Related Publications Pertaining to the Salmo River Watershed (list incomplete) Nov./03

Title:	Floodplain Mapping Salmo River
Author:	Acres International Ltd.
Date:	1990
Report To:	Design Brief, prepared for Environment Canada – Inland Waters Directorate and BC Environment – Water Management Division
Species of Interest:	Habitat
Objectives and Results:	Design brief describing floodplain mapping for the Salmo River.
Community Involvement:	None.

Title:	Slocan and Salmo Rivers Temperature Monitoring Summer 1997
Author:	Arndt, S.K.
Date:	1998
Report To:	Columbia Basin Fish and Wildlife Compensation Program
Species of Interest:	Habitat/Water Quality
Objectives and Results:	Provides a summary of a water temperature monitoring program undertaken in the Slocan and Salmo Rivers by CBFWCP in the summer of 1997. Three sites were sampled in the Salmo River; however the temperature recorder (Ryan Instruments) placed at the initial site (near Salmo) was moved to the Slocan, to replace a missing recorder there. The second recorder was moved further downstream part-way into the study, as water levels receded. Vandalism was identified as a problem. As a result, the available temperature data for the Salmo River component of the study is limited.
Community Involvement:	None.

Title:	Bull Trout Studies in the Salmo River Watershed: 2002
Author:	Baxter, James and Baxter, Jeremy
Date:	2003
Report To:	BC Hydro
Species of Interest:	Bull Trout
Objectives and Results:	The report summarizes the 2002 results of ongoing monitoring of bull trout in the watershed through redd counts and index swims. The report also standardizes the escapement estimate over the past 5 years to allow annual comparisons.
Community Involvement:	The Salmo Watershed Streamkeepers Society has been involved with this program for the past 4 years.

Title:	Bull Trout Studies in the Salmo River Watershed: 2001
Author:	Baxter, James
Date:	2002
Report To:	BC Hydro
Species of Interest:	Bull Trout
Objectives and Results:	Summarizes bull trout studies completed in the Salmo River Watershed in 2001.
Community Involvement:	The Salmo Watershed Streamkeepers Society has been involved with this program for the past 4 years.

Title:	Summary of the Third Year Of Bull Trout (*Salvelinus confluentus*) Radio Telemetry in the Salmo River Watershed
Author:	Baxter, James
Date:	2002
Report To:	Columbia-Kootenay Fisheries Renewal Partnership, The Salmo Watershed Streamkeepers Society, and BC Hydro
Species of Interest:	Bull Trout
Objectives and Results:	Summarizes the third year of bull trout radio telemetry in the Salmo River Watershed.
Community Involvement:	The Salmo Watershed Streamkeepers Society has been involved with this program for the past 3 years.

Title:	Bull Trout Studies in the Salmo River Watershed: 2000
Author:	Baxter, James
Date:	2001
Report To:	BC Hydro
Species of Interest:	Bull Trout
Objectives and Results:	The report summarizes the results of studies undertaken by BC Hydro in 2000. The report focuses on documenting the status of the bull trout population in the watershed, and collecting data that can be used for habitat enhancement purposes. Provides some recommendations for stream fertilization, barrier/log jam removal, and additional studies .
Community Involvement:	The Salmo Watershed Streamkeepers Society has been involved with this program for the past 5 years.

Title:	Summary of the South Salmo River Bull Trout Enumeration Project (2000)
Author:	Baxter, James
Date:	2001
Report To:	Columbia-Kootenay Fisheries Renewal Partnership
Species of Interest:	Bull Trout
Objectives and Results:	An enumeration fence and traps were installed on the South Salmo River from September 11th to October 24th to enable the capture of post-spawning bull trout emigrating out of the watershed, and to capture five additional bull trout for the ongoing radio telemetry project. In total, seven males and eight females were processed through the fence. The project was also used as an educational tool for local elementary and high school students.
Community Involvement:	The Salmo Watershed Streamkeepers Society has been involved with this program for the past 5 years.

Title:	Aspects of the Biology of Bull Trout in the Salmo River Watershed as Identified Through Radio Telemetry (2000/2001 Data) and a Watershed Management Plan for the Species
Author:	Baxter, James
Date:	2001
Report To:	Columbia-Kootenay Fisheries Renewal Partnership and BC Hydro
Species of Interest:	Bull Trout
Objectives and Results:	Over two years (1999-2001) a total of twenty bull trout were implanted with radio tags in the Salmo River watershed to determine life-history and habitat use of the population. The specific objectives of the project were to identify major spawning, summering and overwintering areas, as well as to provide data on migration and spawning timing. A secondary objective was to determine if there was a migration to, or from, Seven Mile Reservoir by radio tagged bull trout. The report also summarizes the current status of the Salmo River bull trout population, and makes recommendations as to future management requirements.
Community Involvement:	The Salmo Watershed Streamkeepers Society has been involved with this program for the past 5 years.

Title:	Aspects of the Biology of Bull Trout in the Salmo River Watershed as Identified Through Radio Telemetry
Author:	Baxter, James and Nellestijn, Gerry
Date:	2000
Report To:	Columbia-Kootenay Fisheries Renewal Partnership
Species of Interest:	Bull Trout
Objectives and Results:	A total of ten bull trout (eight females and two males) were implanted with radio tags in the Salmo River watershed (nine in the mainstem Salmo River and one in Clearwater Creek). Bull trout were tracked during migrations to spawning areas and overwintering areas in the Salmo watershed. The report documents migration patterns and spawning/overwintering habitat for the bull trout tracked during the study.
Community Involvement:	The Salmo Watershed Streamkeepers Society has been involved with this program for the past 5 years.

Title:	Report on Non-Sportfish Abundance and Migration Patterns in the Salmo River
Author:	Baxter, James, and Nellestijn, Gerry
Date:	2000
Report To:	Columbia-Kootenay Fisheries Renewal Partnership, SWSS and Columbia Basin Trust
Species of Interest:	Non-Sportfish (Suckers, Northern Pike Minnow)
Objectives and Results:	Documents the seasonal abundance and migration patterns of non-sportfish species (suckers and northern pikeminnow) in the Salmo River below the town of Salmo. Discusses movement and distribution of those species in relation to the constructed fish barrier, and effects on sportfish populations.
Community Involvement:	The Salmo Watershed Streamkeepers Society.

Title:	Bull Trout Studies in the Salmo River Watershed: 1998 and 1999
Author:	Baxter, James
Date:	1999
Report To:	BC Hydro
Species of Interest:	Bull Trout
Objectives and Results:	The report summarizes the results of studies that have been undertaken in the Salmo River watershed by BC Hydro in 1998 and 1999. The work focused on documenting the status of bull trout population in the watershed, and on collecting data that can be used for habitat enhancement purposes. Specific components of the work included redd counts, snorkel surveys, water quality and temperature monitoring, and juvenile assessments.
Community Involvement:	The Salmo Watershed Streamkeepers Society has been involved with this program for the past 4 years.

Title:	Synoptic Bioreconnaissance of Bull Trout Distribution and Abundance in the Salmo River Watershed
Author:	Baxter, J.S., W.D. Coughlin, B.M. Pennington, and G.G. Oliver
Date:	1998
Report To:	BC Hydro
Species of Interest:	Bull Trout
Objectives and Results:	Study was commission by BC Hydro to determine the distribution and population status of the bull trout population in the Salmo River drainage. Specific objectives of the study included: 1) habitat and population assessment at index sites throughout the watershed; 2) identification of bull trout spawning locations; and 3) recommendation of possible habitat enhancement sites for consideration. The report documented the results of the study and provided preliminary recommendations.
Community Involvement:	None.

Title:	Assessment of a Constructed Non-Sportfish Migration Barrier on the Salmo River Using Radio Telemetry and Floy Tagging
Author:	Baxter, James
Date:	2001
Report To:	BC Hydro
Species of Interest:	Non Sport Fish / Habitat/ Non Sport Fish Barrier
Objectives and Results:	Provides an evaluation of the effectiveness of the constructed non-sportfish barrier on the lower Salmo River. Northern pikeminnow and adult suckers were observed to identify the effectiveness of the barrier. The report summarized the field studies and identified that currently the barrier was ineffective. The report provides a good discussion and evaluation of non-sportfish issues in the Salmo River Watershed.
Community Involvement:	The Salmo Watershed Streamkeepers Society.

Title:	Seven Mile Generating Station: Salmo River Fish Barrier
Author:	BC Hydro
Date:	1989
Report To:	BC Hydro
Species of Interest:	Non Sport Fish / Habitat/ Non Sport Fish Barrier
Objectives and Results:	Discusses the design and construction (including photographs) of the coarse fish barrier on the lower Salmo River.
Community Involvement:	None.

Title:	Seven Mile Unit 4 Mitigation and Compensation Plan for the Installation and Operation of Unit 4 at the Seven Mile Generating Station
Author:	BC Hydro
Date:	1996
Report To:	BC Hydro
Species of Interest:	Rainbow Trout and Bull Trout
Objectives and Results:	Describes the mitigation and compensation plan developed to address fish and fish habitat concerns as a required component for the installation and operation of a fourth turbine at the Seven Mile dam. Identifies off-site compensation projects for two species in the reservoir: rainbow trout and bull trout. Off-site compensation for rainbow trout consisted primarily of habitat/fish passage restoration in Tillicum Creek (not the Salmo). Off-site compensation for bull trout included undertaking a synoptic bioreconnaissance of bull trout in the Salmo River, and upgrade the coarse fish barrier. Provides summary of potential impacts and cost estimates for recommendations.
Community Involvement:	None.

Title:	Pre-Fertilization Monitoring of the South Salmo River and Sheep Creek, 2001 - Draft (Unpublished Report)
Author:	Decker, S., D. Quamme, and J. Baxter.
Date:	2002
Report To:	BC Hydro
Species of Interest:	Bull Trout
Objectives and Results:	Comprehensive study of fish populations (abundance), fish habitat, periphyton, macro invertebrates, and water quality in Sheep Creek and the South Salmo River completed to identify baseline conditions in the South Salmo prior to fertilization experiments. Summarizes field data collected, provides analysis of fish population data, calibrates models, and provides recommendations for subsequent evaluation of the effectiveness of fertilization in test and control areas.
Community Involvement:	None.

Title:	Environmental and Resource Management Studies: Seven Mile Project.
Author:	Envirocon Ltd. and Pearse Bowden Economic Consultants Ltd.
Date:	1975
Report To:	BC Hydro
Species of Interest:	Fishery resources in the Pend d'Oreille River
Objectives and Results:	Provides a general pre-construction summary and evaluation of fishery resources in the Pend d'Oreille River section to be impounded by construction of the Seven Mile dam. Includes a summary of fish species and brief discussion of the Salmo River. Snorkel fish counts were completed for the lower 10 miles of the mainstem Salmo River.
Community Involvement:	None.

Title:	Environmental Impact Report Seven Mile Project
Author:	Envirocon Ltd.
Date:	1973
Report To:	BC Hydro
Species of Interest:	General Environmental Impacts
Objectives and Results:	Technical report prepared for BC Hydro to identify potential environmental impacts of the proposed facility.
Community Involvement:	None.

Title:	Seven Mile Reservoir: Tributary Access
Author:	Gebhardt, D.J.
Date:	1998
Report To:	BC Hydro
Species of Interest:	Fish species found in the 7 Mile Reservoir
Objectives and Results:	Very brief (5 pages) discussion of tributary access (including the Salmo River) for fish species found in the reservoir. Limited discussion regarding the Salmo Watershed, other than to identify it as an important tributary with access for fish from the reservoir.
Community Involvement:	None.

Title:	Field Report for May 2001 Fish Assessment of Watercourses Adjacent to the Salmo River
Author:	Golder Associates Ltd.
Date:	2001
Report To:	BC Hydro
Species of Interest:	All Fish Species
Objectives and Results:	Report provides a summary of FDIS data and reports (site cards, fish cards) for a number of small tributaries downstream of the village of Salmo. Each of the identified tributaries was considered fish bearing, and there were no barriers to fish passage.
Community Involvement:	None.

Title:	Conservation Status of the Mainstem Salmo River Rainbow Trout Population
Author:	Hagen, J. and Baxter, J
Date:	2003
Report To:	Columbia-Kootenay Fisheries Renewal Partnership/Columbia Basin Trust, Columbia Basin Fish and Wildlife Compensation Program, BC Hydro, Salmo Watershed Streamkeepers Society, Beaumont Timber, BC Ministry of Water, Land and Air Protection
Species of Interest:	Rainbow Trout
Objectives and Results:	Summarizes the results of radio telemetry and population studies of rainbow trout (*Oncorhynchus mykiss*) in the Salmo River watershed initiated in 2001. Rainbow trout were radio tagged in the mainstem Salmo River and tracked over several seasons. Critical habitats (spawning, rearing, overwintering) were identified for the mainstem rainbow trout. Population estimates were derived through a repetitive mark-recapture estimate in an index section over the summer periods.
Community Involvement:	The Salmo Watershed Streamkeepers Society has been involved with this program for the past 3 years.

Title:	Salmo River Rainbow Trout (*Oncorhynchus mykiss*): Population Size and Habitat Use-Interim Report
Author:	Hagen, J. and Baxter, J
Date:	2002
Report To:	Columbia-Kootenay Fisheries Renewal Partnership and Columbia Basin Trust, BC Hydro, the Columbia Basin Fish and Wildlife Compensation Program, the B.C. Ministry of Water, Land and Air Protection, Beaumont Timber, and the Salmo Watershed Streamkeepers Society
Species of Interest:	Rainbow Trout
Objectives and Results:	Summarizes the initial field work and data collection of a project on the rainbow trout (*Oncorhynchus mykiss*) population of the Salmo River watershed. A total of 30 rainbow trout were radio tagged in the mainstem Salmo River in proportion to the abundance of rainbow trout >30 cm throughout the system. The radio tagged rainbow trout were used to derive a population estimate through a repetitive mark-recapture estimate in an index section over the summer.
Community Involvement:	The Salmo Watershed Streamkeepers Society has been involved with this program for the past 3 years.

Title:	Sheep Creek Bull Trout Spawning Platforms: Feasibility Study
Author:	Hagen, J. and Baxter, J
Date:	2001
Report To:	Columbia-Kootenay Fisheries Renewal Partnership
Species of Interest:	Bull Trout
Objectives and Results:	The report provides a review and assessment of bull trout spawning habitat in Sheep Creek, and reviews the feasibility of constructing spawning platforms and the placement of spawning gravel in Sheep Creek. Provides recommendations for potential placement sites and recommends additional assessment by a fluvial geomorphologist or hydrological engineer prior to construction.
Community Involvement:	None.

Title:	Inventory of Mine Tailings and Ponds In The Salmo Watershed
Date:	2000
Report To:	The Salmo Watershed Streamkeepers Society and The Community of Salmo & Area G.
Author:	Heinbuch, L. and G. Nellestijn.
Species of Interest:	Habitat
Objectives and Results:	Compiles an inventory and brief history of the historical mines, tailing piles, and ponds in the Salmo River Watershed. Provides a brief description of the location of mines and tailings throughout the watershed, and prioritizes them based on their size and proximity to watercourses. Provides recommendations for mitigation activities.
Community Involvement:	The Salmo Watershed Streamkeepers Society.

Title:	Erie/Beaverdale IWAP (Interior Watershed Assessment Procedure)
Author:	Kokanee Forests Consulting Ltd.
Date:	1997
Report To:	Atco Timber Ltd.
Species of Interest:	Habitat
Objectives and Results:	An IWAP was completed for portions of the Erie Creek and Beaverdale Creek watershed to assess the potential for impacts to both watersheds of mass wasting, surface erosion, and peak flows on riparian buffers and stream systems. Several tributaries were rated for high potential impacts (Beaverdale Creek, Craigtown, Grassy), while overall the Erie Creek watershed was rated as moderate.
Community Involvement:	None.

Title:	Salmo River Harlequin Duck Inventory, Monitoring and Brood Habitat Assessment
Author:	Machmer, M.
Date:	2001
Report To:	Columbia Basin Fish and Wildlife Compensation Program
Species of Interest:	Harlequin Ducks
Objectives and Results:	Pandion Ecological Research Ltd. and the Salmo Watershed Streamkeepers Society conducted pre-incubation and brood inventories for harlequin ducks (*Histrionicus histrionicus*) in the Salmo River Valley from May to August 2000. The report documents the methodology and data collection for completion of the study, and summarizes life history information for harlequin ducks within the Salmo River watershed, and provides recommendations for future monitoring, preservation, and enhancement activities.
Community Involvement:	The Salmo Watershed Streamkeepers Society.

Title:	Pre-incubation Inventory of Harlequin Ducks in the Salmo River Valley
Author:	Machmer, M. Pandion Ecological Research Ltd.
Date:	1999
Report To:	Columbia Basin Fish and Wildlife Compensation Program
Species of Interest:	Harlequin Ducks
Objectives and Results:	Pandion Ecological Research Ltd. and the Salmo Watershed Streamkeepers Society conducted pre-incubation and brood inventories for harlequin ducks (*Histrionicus histrionicus*) in the Salmo River Valley in 1999. The report documents the methodology and data collection for completion of the study, and summarizes life history information for harlequin ducks within the Salmo River Watershed, and provides recommendations for future monitoring, preservation, and enhancement activities.
Community Involvement:	The Salmo Watershed Streamkeepers Society was a partner and contributor.

Title:	Reconnaissance Fish and Fish Habitat Inventory Salmo River Tributaries
Author:	Masse, Sylvie
Date:	2000.
Report To:	Atco Timber Ltd.
Species of Interest:	All Fish Species
Objectives and Results:	Provides Phases 1-3 (pre-field planning activities) for completion of a 1:20,000 Reconnaissance Fish and Fish Habitat Inventory (RFFHI) for several tributaries to the Salmo River.
Community Involvement:	The Salmo Watershed Streamkeepers Society.

Title:	The Place Where We Live. Looking Back To Look Forward
Author:	Salmo Watershed Streamkeepers Society, Salmo Watershed Assessment Youth Team
Date:	1999
Report To:	Human Resource Development Canada, SWSS and the Community of the Salmo River Watershed
Species of Interest:	History of the Watershed.
Objectives and Results:	Provides an overview of the watershed, including history of first nations, mining, and forestry in the watershed. Also describes fish and wildlife in the watershed.
Community Involvement:	Mentored and published by The Salmo Watershed Streamkeepers Society.

Title:	Salmo River Inventory and Assessment.
Author:	Sigma Engineering Ltd. Prepared by Sigma Engineering Ltd., Vancouver, B.C.
Date:	1996
Report To:	Columbia Basin Fish and Wildlife Compensation Program
Species of Interest:	Habitat and Bull Trout
Objectives and Results:	Sigma completed an inventory and assessment of the mainstem and major tributaries to the Salmo River in 1995. The study also included an evaluation of the coarse fish barrier, a cursory assessment of the sport fishery, documentation of existing and projected land uses, and identification of limiting factors and enhancement opportunities in the watershed. The report summarizes the study findings and provides preliminary recommendations for the watershed, including the following topics: enhancement opportunities, coarse fish barrier effectiveness, angling regulations, stewardship and education, boulder creek fish stranding, and the South Salmo River fertilization study.
Community Involvement:	None.

Title:	Salmo River Sites 1 And 2. Fish Habitat And Erosion Protection Works Construction And Monitoring 2000.
Author:	Zimmer, Michael
Date:	2001
Report To:	Salmo River Protection Committee, Columbia-Kootenay Fisheries Renewal Partnership and BC Hydro
Species of Interest:	All Species/Habitat
Objectives and Results:	Summarizes river bank protection and restoration works completed at two locations in the Salmo River Watershed in September and October 2000. Eleven structures were constructed using graded rock and large wood material. The structures were designed to minimize bank erosion and reduce the risk of erosion on adjacent lands; additionally the works were designed to increase available fish habitat. As-built, the structures were stable and provided high fish habitat value. Further monitoring was recommended.
Community Involvement:	The Salmo River Protection Committee and The Salmo Watershed Streamkeepers Society.

Title:	Fish Stream Identification on Tributaries to the Salmo River and Big Sheep Creek
Author:	Timberland Consultants Ltd.
Date:	1999
Report To:	Ministry of Environment
Species of Interest:	All Fish Species
Objectives and Results:	Timberland consultants completed fish sampling as part of fish stream identification on three tributaries to the Salmo. No fish were captured at two of the sites. The ‘report’ is essentially the FDIS site cards, fish cards, and summaries (no maps).
Community Involvement:	None.

Salmo River Watershed
POSSIBLE PROJECTS Nov. 03

Watershed Profile:

Bank Stabilization c/w Fisheries Enhancement:

Salmo Mainstem
- -Yankee Girl site, confluence of Salmo River and Wildhorse Cr.
- -Porcupine tailings, confluence of Salmo R. and Porcupine Cr.
- -Center Star Tailings, Wesco Rd. area.
- -Continue Canex Tailings work -'the car body run'

Tributaries: Especially Sheep Cr., Erie Cr., and Wildhorse Cr., - Lost Cr should be looked at as well. Numerous sites both tailings restoration and other mine related materials.

Habitat Complexing:

Salmo Mainstem
- -Especially in channelized areas, various locations between upper Porto Rico Rd. Bridge and lower Porto Rico Rd Bridge.
- -Oscar Cr. To Wesco Rd.
- -Perhaps most importantly from Airport Rd Bridge to Hell Roaring Cr.

Tributaries: The lower sections of Hall Cr. Barrett Cr. And Erie Cr. Have been channelized. Especially Erie Cr. should be assessed for complexing to minimize concerns prevalent to Erie and how much affect it could have on the community of Salmo.

Side Channel Flow Augmentation:

Salmo Mainstem:
- -Steward Cr. Area.
- -Upstream of Ymir swimming hole
- -Wesco Rd. area (2 locations)
- -Labyrinth area
- -Hidden Cr. area - 2 locations)
- -also other significant location possibilities exist at the Stockdales place, the Biggs place, 1 location just upstream of Airport Rd., as well as locations at the Carney Mill Rd area and just downstream.

Stream Fertilization: Sheep Cr. South Salmo River experiment. Other opportunities beyond those locations could be considered.

Other Projects / Recommendations.

1. Complete Riparian Assessment.
2. Level 1 Fish Habitat Assessment (or agreed upon alternative) on the Salmo Mainstem.
3. Water Quality work - impacts on invertebrates and fish.
4. Monitor rainbow trout and bull trout populations - response to regulation change.
5. Study seasonal habitat use especially rainbow trout.
6. Begin comprehensive temperature monitoring of the Salmo mainstem.

7. Implement 'adaptive approach' - make changes to plan as we learn more.
8. Continue monitoring Non Sport Fish populations and assess impacts on other species.
9. Complete a comprehensive GIS database for the Salmo Watershed.
10. Complete and maintain the Salmo River Watershed-based Fish Sustainability Planning effort and other stewardship focuses.

Riparian Profile:

Project Recommendations:

1. Complete GIS mapping and information.
2. Look at ways to protect and restore wetland habitat components/side channels.
3. Increase large woody debris and possible recruitment of that debris in the future.
4. Integrate conservation objectives with Rail to Trail initiative.
5. Conserve and enhance Species at Risk.
6. Assess and protect Environmentally Sensitive Areas (ESA's) in riparian Zone.
7. Development of and 'Impact Database' to guide and prioritize management efforts.
8. Development of an incentive-based habitat stewardship program for private landowners.

Summary Report:
Salmo & Lower Pend d'Oreille River Watersheds (Lynn Betts)

The Working Group, with input from the Partnership, developed an initial list of potential renewal projects that could be completed in 2000. While there are other projects that could be done this year, (e.g., radio telemetry studies, and coarse fish tagging), the focus is on selecting and implementing renewal projects that could potentially involve community members as opposed to projects that are more study oriented and likely involving only a few biologists and others with related expertise.

The potential renewal projects for 2000 that were the basis for community input are:

1 **Riparian Planting & Bank Stabilization** – planting native vegetation along the shoreline. Areas to consider include Hall Siding, Lost Creek, South Salmo and others.

2 **Enhance Spawning Grounds –** improve spawning habitat in key areas (Sheep Creek, Clearwater Creek).

3 **Stewardship –** focus on prevention, clean up, and increase awareness related to litter and other materials that end up in the rivers.

4 **Habitat Diversification Projects** – create a variety of fish habitats in key locations on the river (Erie Creek where it enters the Village of Salmo, areas along Highway 3 between Salmo and Nelson, and others).

5 **Slope Stabilization –** stabilize slopes that have been degraded because of road construction and other activities. Areas of interest include the sloughs on Sheep Creek, Dolomite Mine Road and Lost Creek.

6 **Wetland Restoration –** restore natural wetlands in key areas (South Salmo, near the sewage treatment plant, between the Village of Salmo and the golf course and others).

Other:

- Continue radio tracking rainbow trout during spawning 2004
- Community education and involvement/stewardship.
- Initiate/support Stream Team at Salmo Secondary School.
- Remove old Railway ties and tie fragments from the riparian area along the Nelson Ft. Shepard RR.
- Continue road deactivation where appropriate.

Salmo Watershed Fish Sustainability Plan –

Mapping /GIS for the Salmo Watershed-Based Fish Sustainability Plan
"Blue Room" Civic Centre, Nelson
1 - 3 pm

In Attendance: Gerry Nellestijn-SWSS facilitator, Bruce Gunn-RDCK, Tanjie Zumpano-RDCK, Kim Klassen-SWFSP Youth Rep., Chris Steeger-Pandion Ecological Research, Ian Parfait,-CBF&WCP, Evan McKenzie, Jon Bissett-Westslope Fisheries, Les Brazier-CKFRP, Alice Nellestijn-SWSS-notetaker, Donna Delparte-Selkirk College, Tasha Kirby-CBF&WCP.
Regets: Jim Guido, Per Wallenius, Peter Lewis, Peter Holton, Brian Ferguson.

WFSP OVERVIEW TO DATE

Jon Bissett (Watershed Profile)
- Need to compile existing info and summarize, identify information gaps
- Work in conjunction with riparian profile report
- Some water quality information has been gathered, YG, land fill, BT telemetry, RT telemetry, Harlequin studies
- Some water quality information has been gathered on Sheep Creek with regard to fertilization planning project
- Most fish studies is current since 1996, not a lot of historical information
- Not a lot of GIS compatible information has been gathered to date, details should be worked out before proceeding: 1) compile data and put into useable format for management plan 2) determine whether data is good quality information and verifiable
- ATCO has done some mapping on Erie Creek, is other similar info available?

Chris Steeger (Riparian Profile)
- Riparian zone information is important and separate from overall watershed profile
- Columbia Basin Data Base profile - wildlife/aquatic habitat units indicated
- Data has species list attached to specific habitats
- To follow through with ecological and functional analysis, need map to indicate forest, urban, agricultural, etc locations
- When developing riparian zone profile - many gaps were identified and it became clear that larger mapping project should be undertaken
- Mapping could become extensive - should focus on base layers first

Gerry
- In the WFSP Planning Guide we are at the close of Stage II
- Public has presented consistent message - Make Profile Useable
- Map is a useful (Presentation) tool when working with public for identifying projects and project locations and for use as a monitoring tool
- There is no end to the amount of information that can be mapped, so let's put together a Wish List and then develop what we really need to include

DISCUSSION

Chris
- Physical characteristics of river - chart the river course

- What were the historical conditions of the river and riparian zone - this info would be useful in establishing where we came from to determine where we should go
- With the amount of old growth cedar stumps that appear in riparian zone - it is likely that this (historical old growth abundance) has an effect on the water quality
- Should define the baseline mapping layer

Ian
- Important to quantity things - what area should be included in the riparian zone, ie. floodplain, area cut off from floodplain by dyking
- Scale
- Species: fish/wildlife
- Structural specifics
- Habitat elements
- Instream elements - sandy, gravelly
- Impacts: eg. dykes, metering stations
- Historical conditions
- Water quality - what does this mean?
- How long will the planning process continue
- What is the life span of this project

Jon
- Identifying stream orders, ephemeral locations, physical topography
- Physical information - surface area, drainage, ground water information
- Use physical information to focus study
- Identify substrates, what is now - may identify what it was
- Use GIS and air photos to surmize

General
- Identify instream attributes - pool, riffle, LWD, etc
- Identify critical fish habitats - this information may cause problems if released OR information can be used positively when land use planning
- Identify mine tailings, mineral claims, etc.
- Benchmarks were completed on the mainstem and some tributaries in 1997, are likely to be done again this year
- It is a problem to do everything - expensive and time consuming
- Past approach to gathering information has not been extensive - gathered info that had direct affect on specific study area
- Some information is currently available that accurately represent watershed - available thru RDCK.
- Jim Guido, Arrow Forest district has offered data (to the quality and extent that he has) but is unsure about person hours
- Seems practical to separate into 2 categories: 1) watershed level information, ie. upland usage, etc; 2) riparian area information - might be most useful for public meetings
- Need to develop mapping criteria before a map can be produced
- The <u>focus of the map is for fish sustainability</u>
- 1:20 000 useful for identifying soils, urban planning, etc
- 1:250 000 currently available thru govt for regional planning
- multi-stakeholder means each stakeholder has their own use for maps
- how does forestry effect river flows - may reflect quality of data
- how will railbed trail affect system - we need to include sensitive areas

- cottonwoods used to be abundant - now identifiable as individual trees
- large areas of private land may affect river in the long term
- what is the riparian zone - floodplain? Up to where cottonwoods grow?
- Riparian identifiable as possible 3D approach - rivers edge to where floodplain ends to the tops of the trees
- Flooding may not occur just because of river flows, but because of water table rise, so just because a dyke is in place at the rivers edge it may not mean that it will be able to keep water out - the river and water table level may still flood the floodplain

- At this point, there was so much lively discussion and background chatter that this inexperienced note taker was overwhelmed and unable to effectively take notes - sorry!

DATA OWNERSHIP / MAINTENANCE

- CBF&WCP, RDCK, and Selkirk College the only mtg. Participants capable of managing/maintaining the data.
- This may be a dynamic process
- Salmo Watershed could be a pilot project
- Selkirk College may be interested in participating, many potential opportunities for 'real' student participation.
- Fraser Basin Council may have governance issues worked out - could we see how they managed thier information?
- Asked Donna Delparte to indicate what would be required to manage database

Unresolved Agenda Items:

How we incoporate terrestrial and aquaticdata to maximize effects for fish sustainabilty.
Realistic commitments from groups/orgs (who does what).
Funding possibilities
Time Lines.

Action:

Donna and Gerry to meet to discuss partnership possibility's

Request:

Please review mtg. Minutes and comment on items discussed.
Review 'Wish List' (below) and help us to focus.
Contribute references to any of the data discussed and any you may feel we've missed.
Have a look at unresolved agenda items and comment.

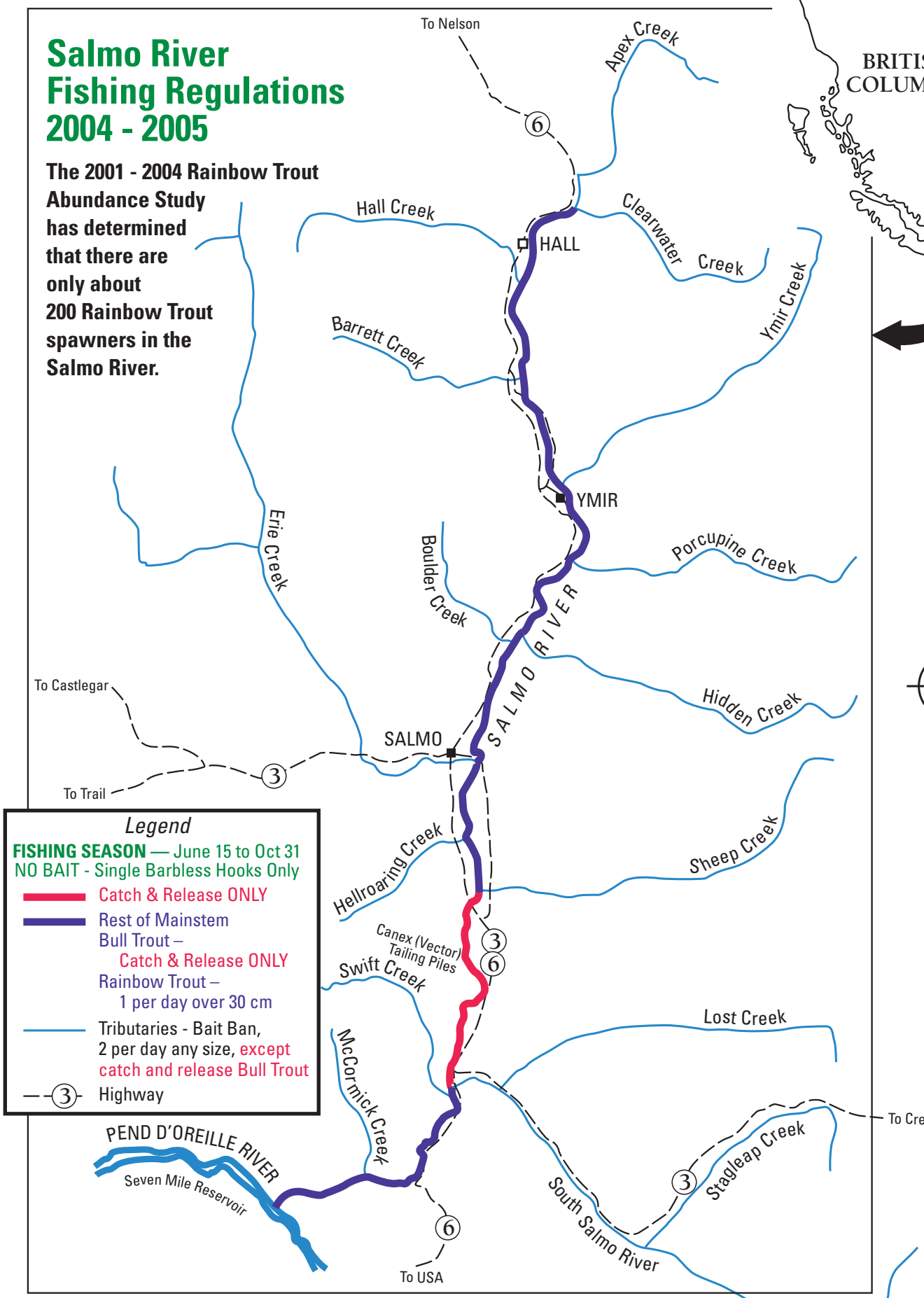
Meeting Adjourned at 3:15 PM

MAPPING WISH LIST

- Dominant plant communities
- Rivers edge
- Forest cover data
- Topography
- CWD abundance
- Geomorphology of river and riparian
- Terrain component
- Hydrology (have some data available)
- Soils
- Basic trim 1 : 20 000
- Roads
- Habitat mapping
- Ecosystem mapping
- (PEM) predicted ecosystem map (has been completed)
- ALR may have soils info available
- Some air photos are available
- Point source pollution
- POD (point of diversion) water removal
- Land use plan - zoning
- Fish and other aquatic creature location
- Tenures - mine, forest, recreation (SRM)
- Historical photos
- Flood plain mapping
- Land ownership
- BC gas
- Suggestion: pick a small area, gather data that seems pertinent to all stakeholders, then expand to include watershed

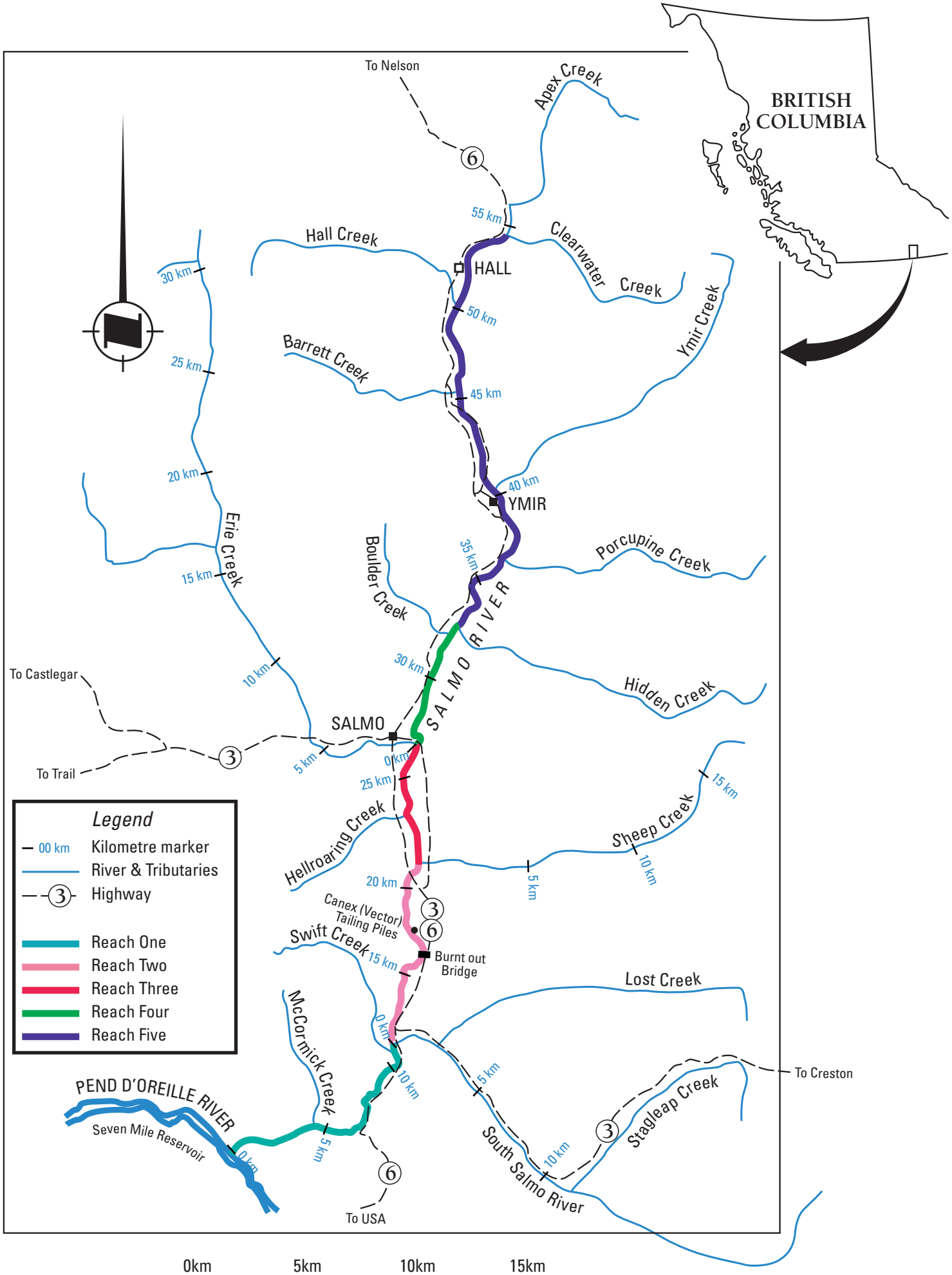
Salmo River Fishing Regulations 2004 - 2005

The 2001 - 2004 Rainbow Trout Abundance Study has determined that there are only about 200 Rainbow Trout spawners in the Salmo River.



0km 5km 10km 15km

SCALE 1:250 000


BRITISH COLUMBIA
To Nelson
Apex Creek
6
55 km
Hall Creek
HALL
Clearwater Creek
50 km
Barrett Creek
Ymir Creek
45 km
30 km
25 km
20 km
40 km
YMIR
Erie Creek
Boulder Creek
35 km
Porcupine Creek
15 km
SALMO RIVER
30 km
10 km
To Castlegar
Hidden Creek
SALMO
To Trail
3
5 km
0 km
25 km
Hellroaring Creek
Sheep Creek
15 km
10 km
5 km
20 km
Canex (Vector) Tailing Piles
Swift Creek
15 km
Burnt out Bridge
Lost Creek
McCormick Creek
0 km
10 km
5 km
PEND D'OREILLE RIVER
Seven Mile Reservoir
0 km
5 km
To Creston
Stagleap Creek
South Salmo River
10 km
To USA
Legend
00 km Kilometre marker
River & Tributaries
3 Highway
Reach One
Reach Two
Reach Three
Reach Four
Reach Five
0km 5km 10km 15km
SCALE 1:250 000

Salmo River Mainstem Channelization Mapping Project

The Salmo River once supported a diverse array of bottomland habitats including wetlands, shoreline and floodplains but throughout the years these habitats have been greatly altered by human activity. Channelization is the modification of a natural river channel by engineering works such as rip-rap bank protection, levees (berms), long culverts and other human activities.

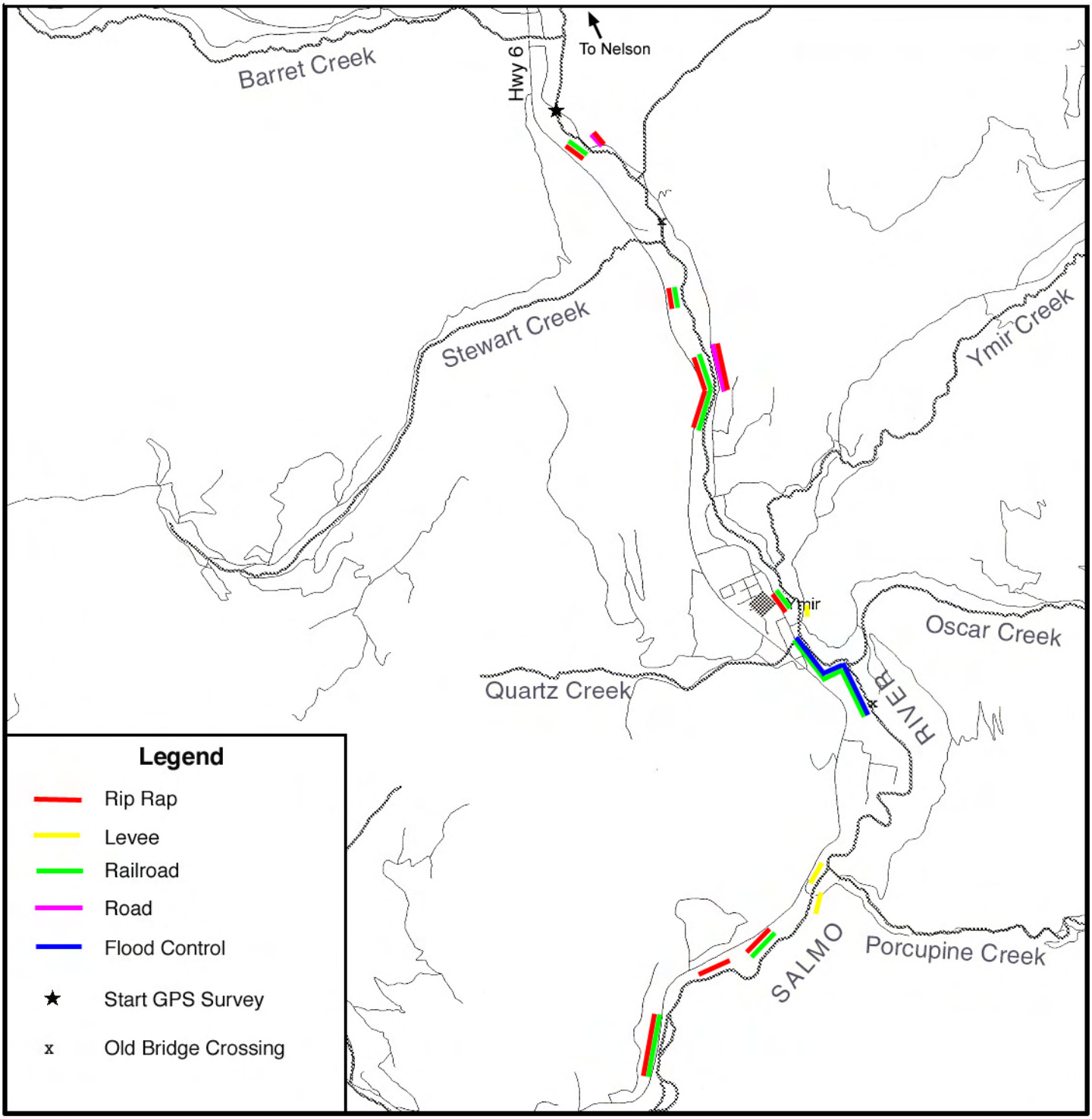
In August of 2004 a GPS survey was undertaken along the Salmo River from the Upper Porto Rico Bridge to the 'Burnt Out Bridge', across from the Salmo River Ranch. A total of 32.3 kilometers of river (64 km's of shoreline) were surveyed, out of these 13.9 were found to be channelized by either rip-rap bank protection or berms ***(See figure….map).***

The main reasons for these activities were found to be flood control and highway and railroad right-of-way protection. These modifications have greatly compromised habitat diversity and complexity altering both riparian and bottomland ecosystems.

Results from this project show that 24% of the Salmo River surveyed in August 2004 has been channelized. These astonishing results have led to the notion that a phased approach to fish habitat restoration could be carried out guided by the development of ecological restoration goals in an attempt to reestablish the ecological integrity of this system to aid the effort for fish sustainability in the Salmo River watershed.

Example of car body and rip rap channelization on the Salmo River.

Salmo River Channelization Mapping Project



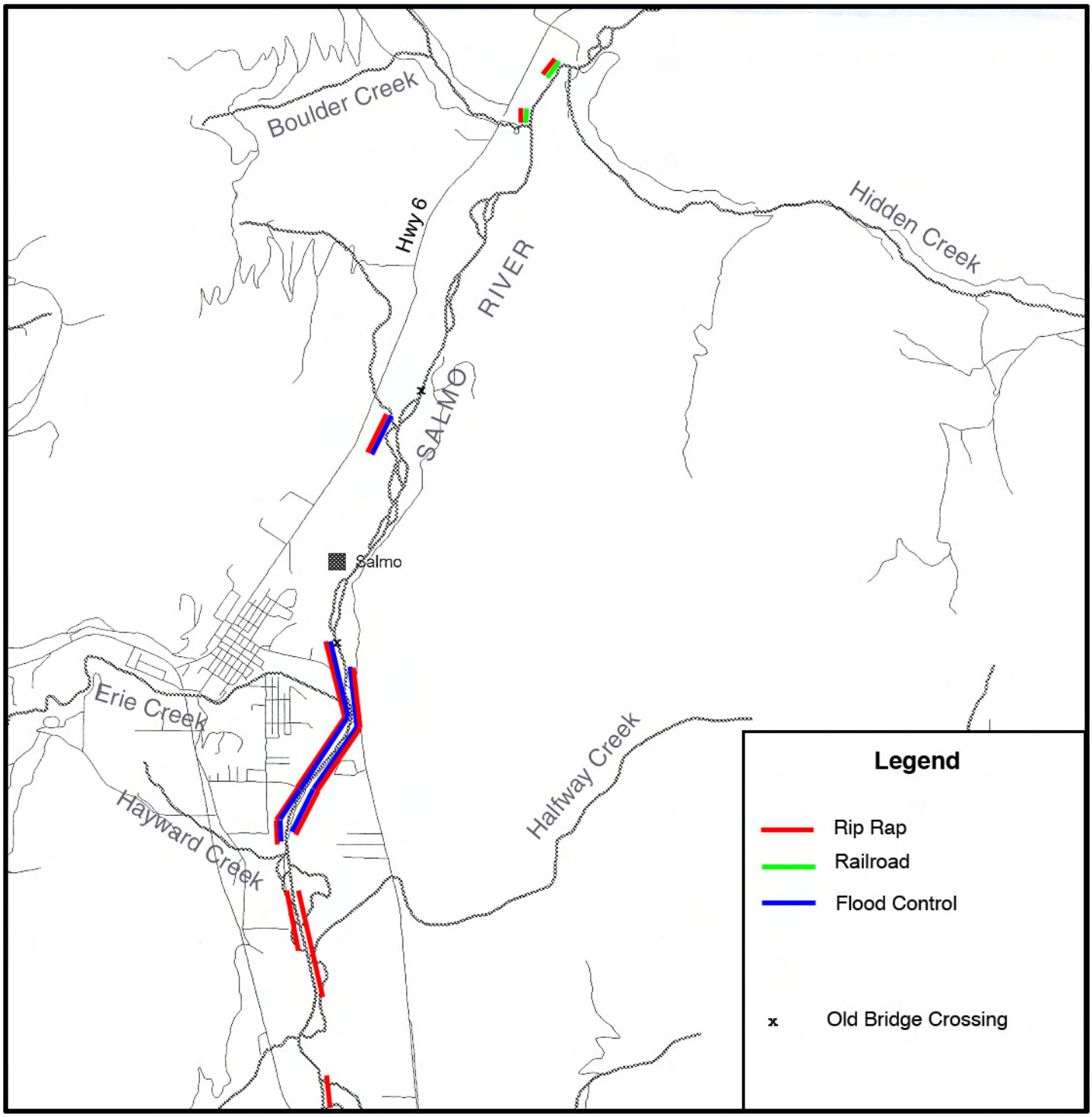
SCALE 1 : 50,000

1 0 1 2 3

KILOMETERS

N

Salmo River Channelization Mapping Project



SCALE 1 : 50,000

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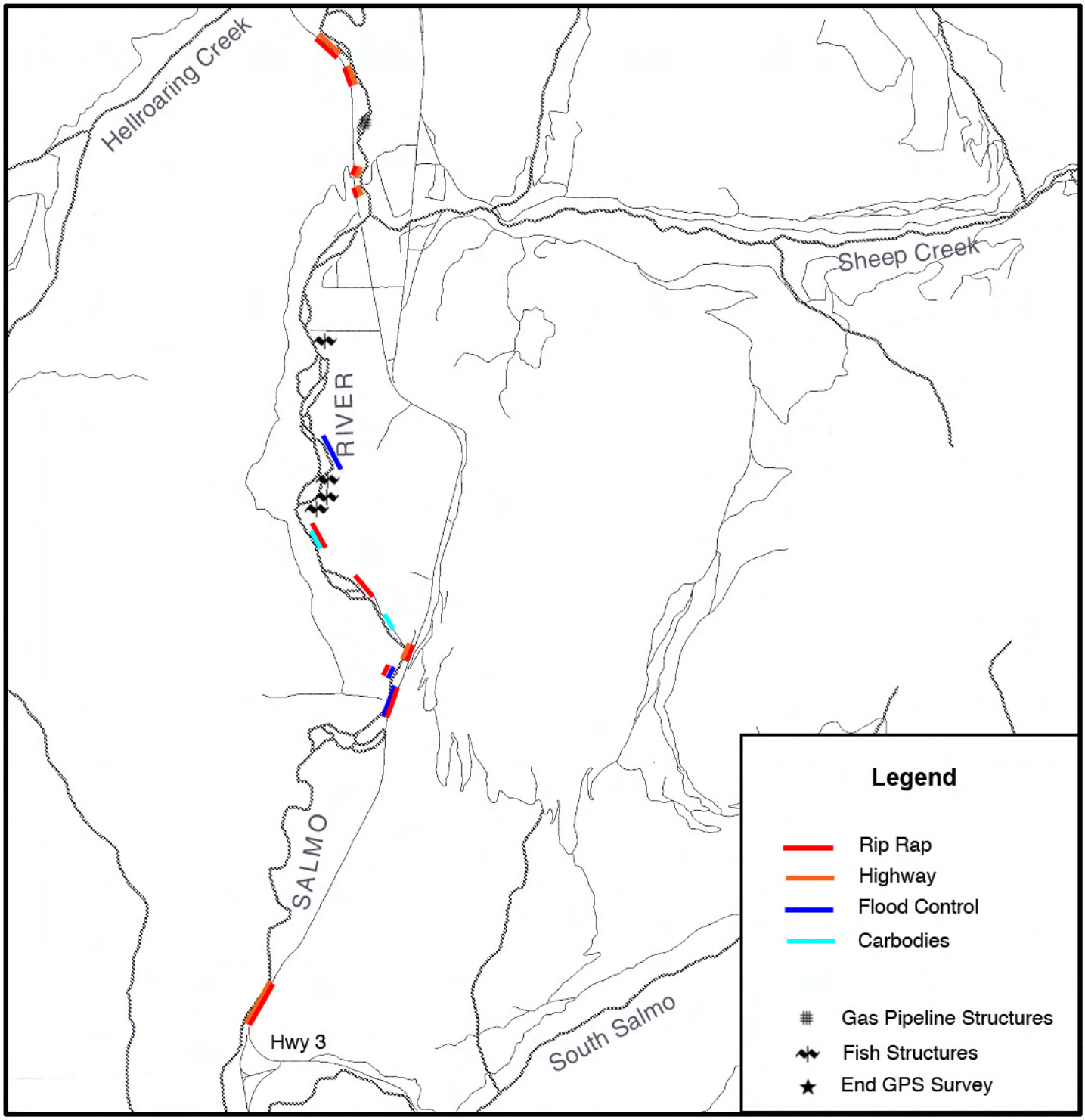
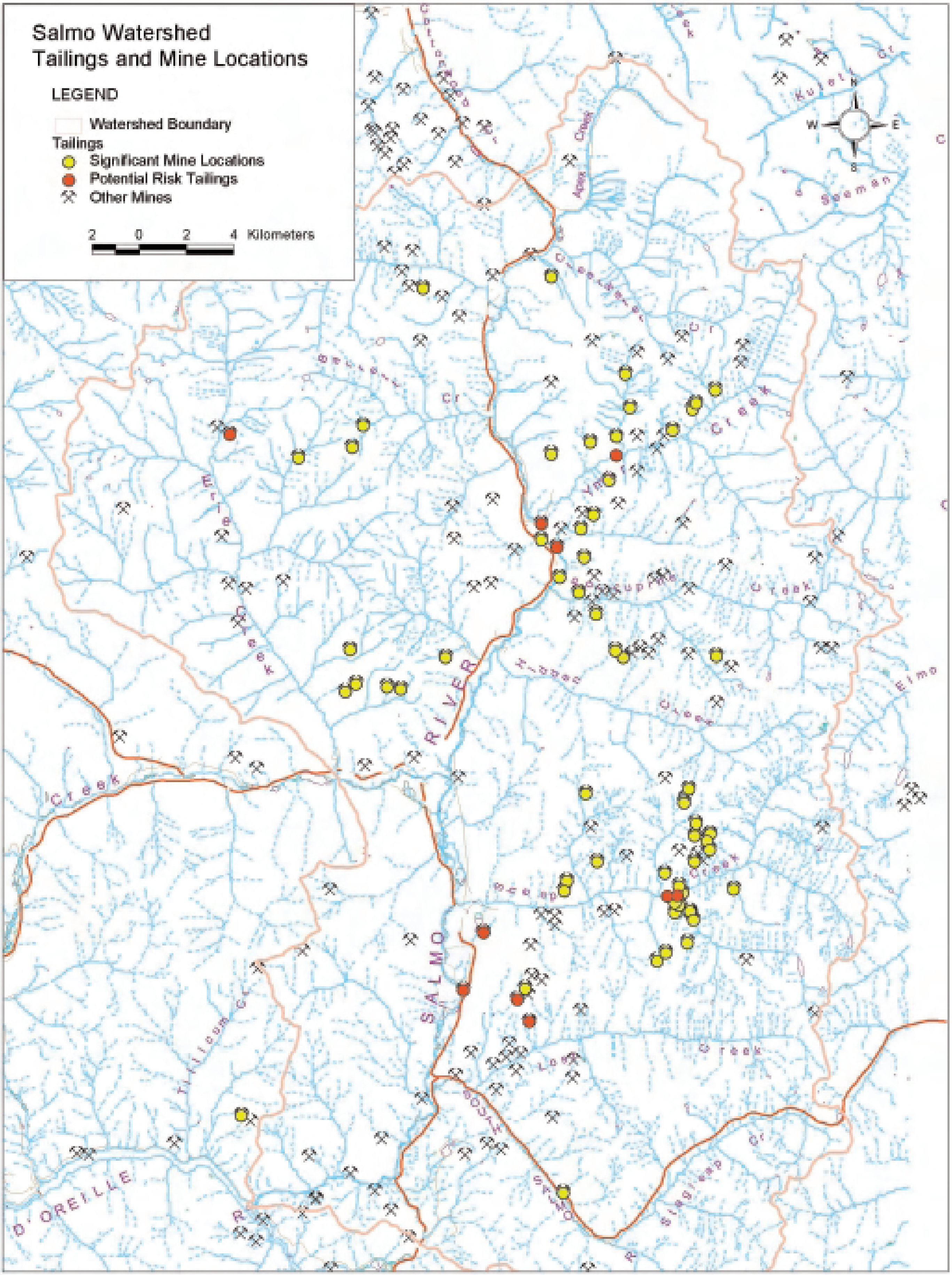
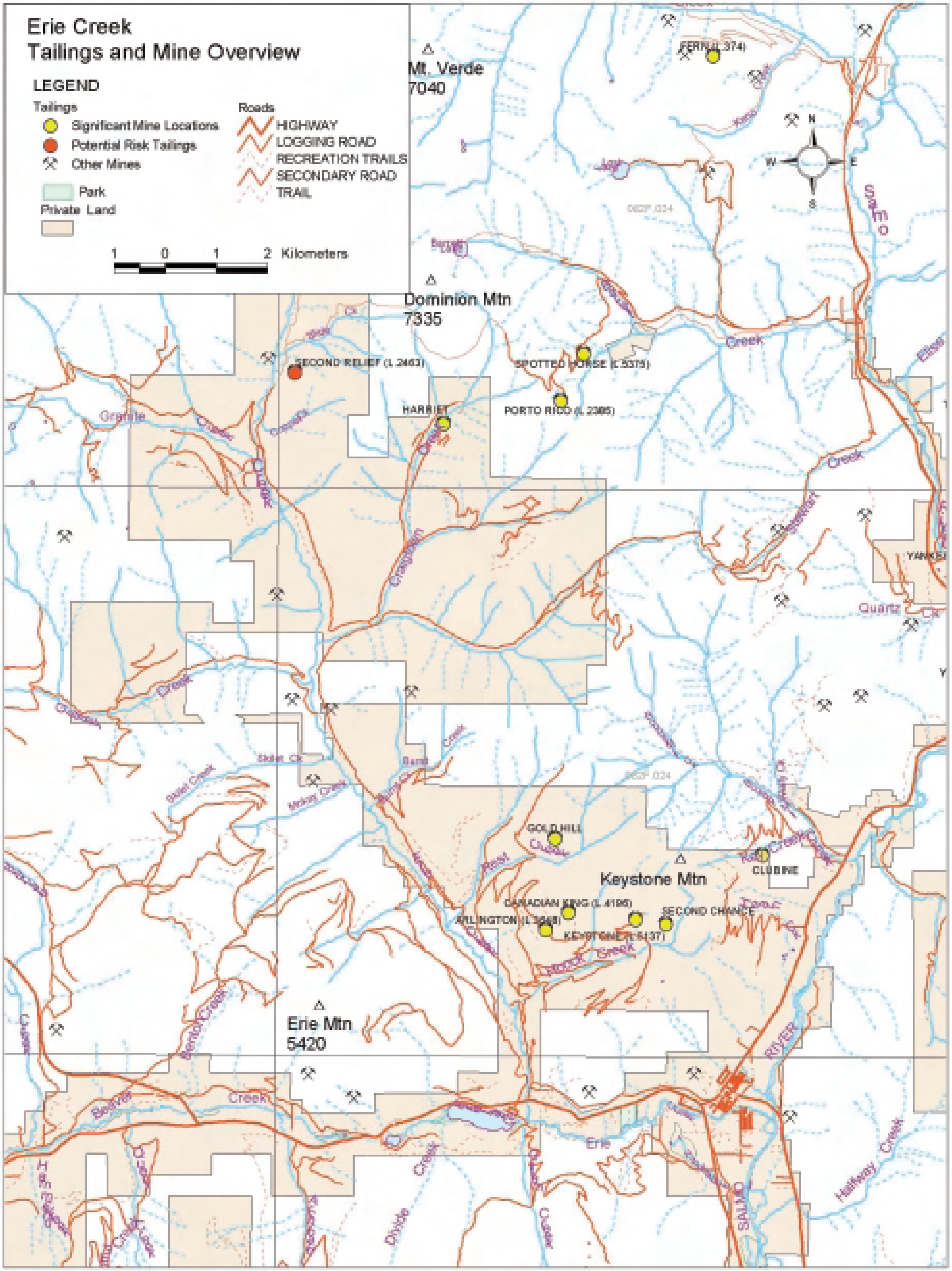
KILOMETERS

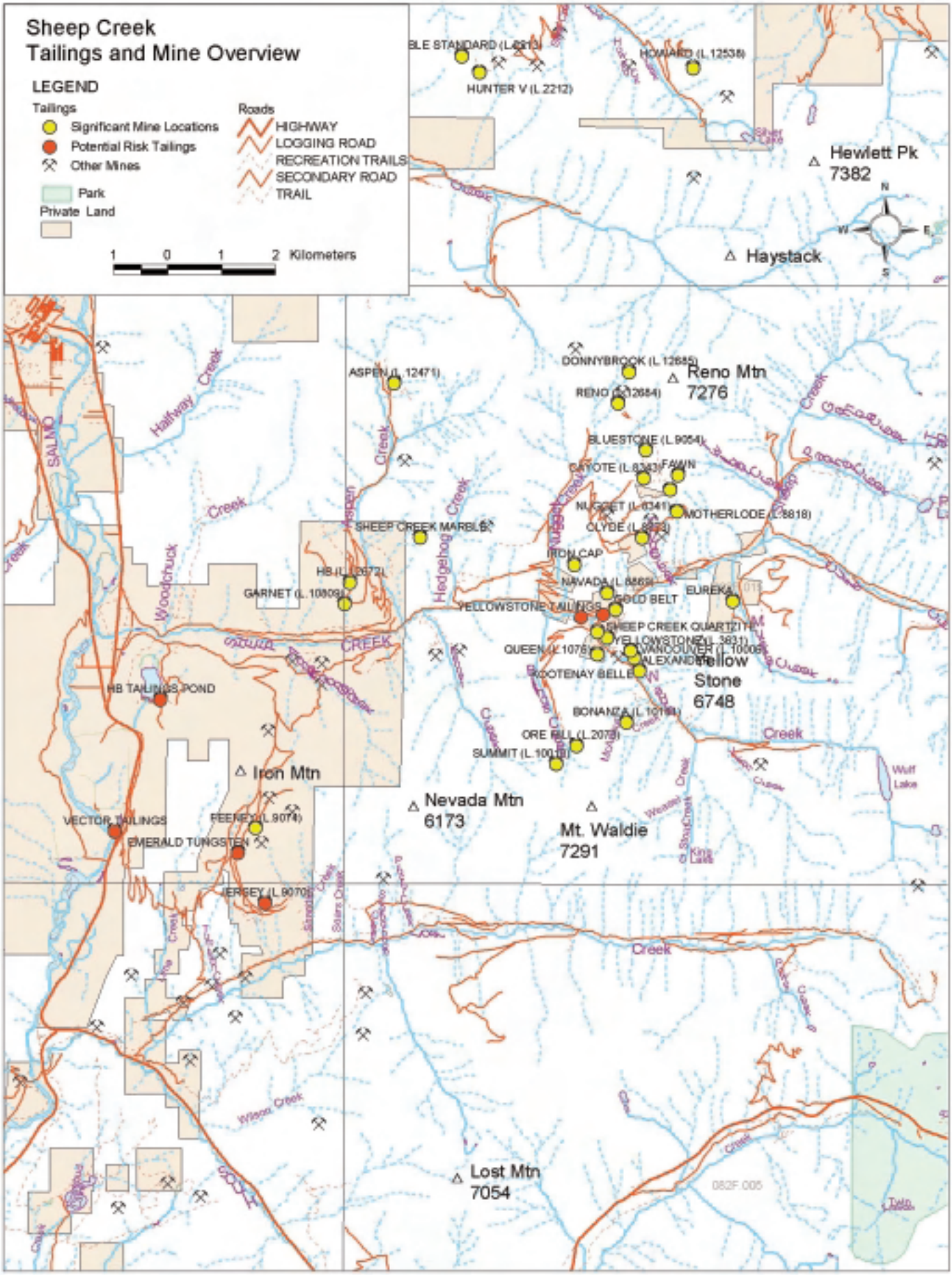
N

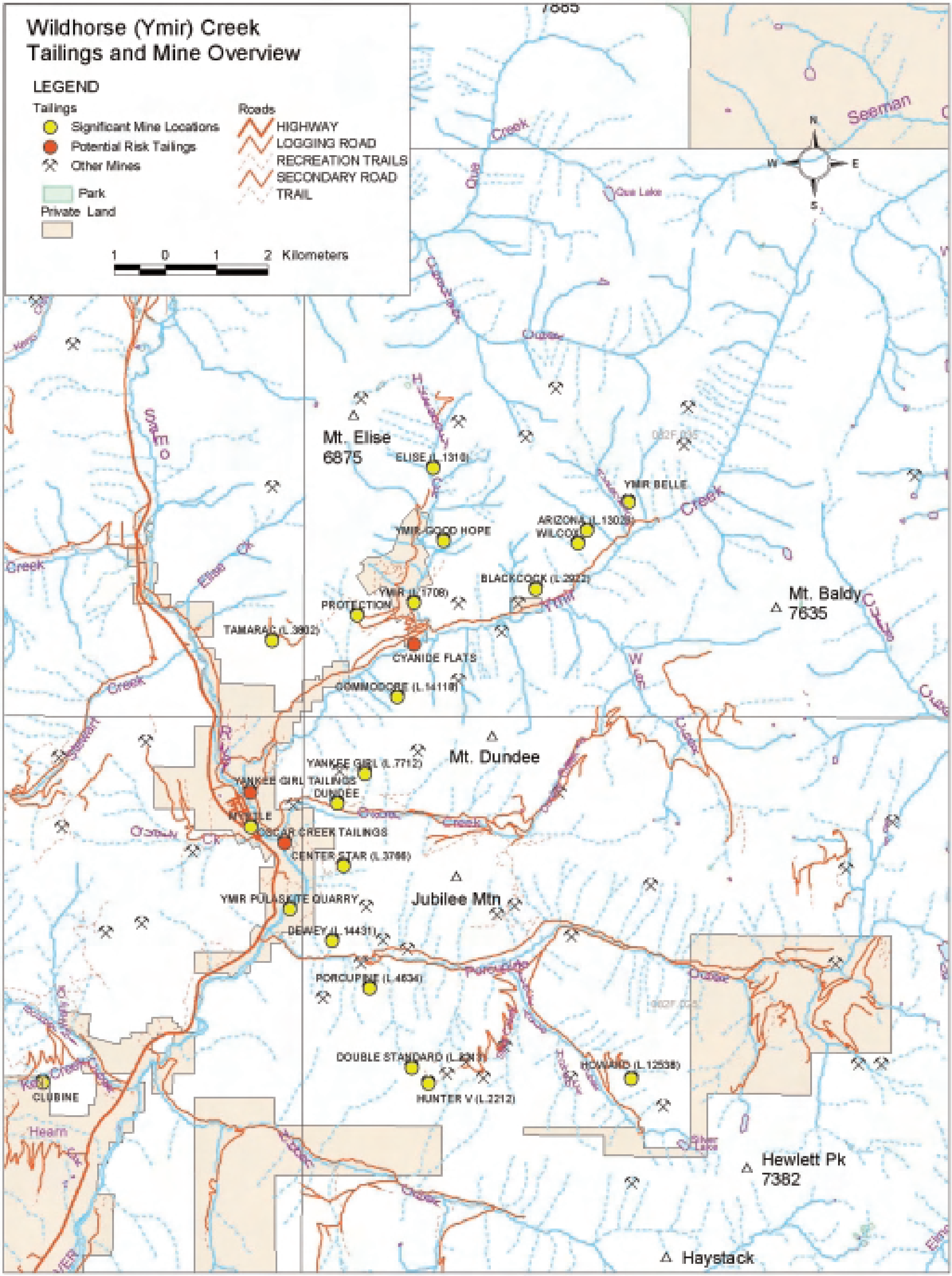
Salmo River Channelization Mapping Project

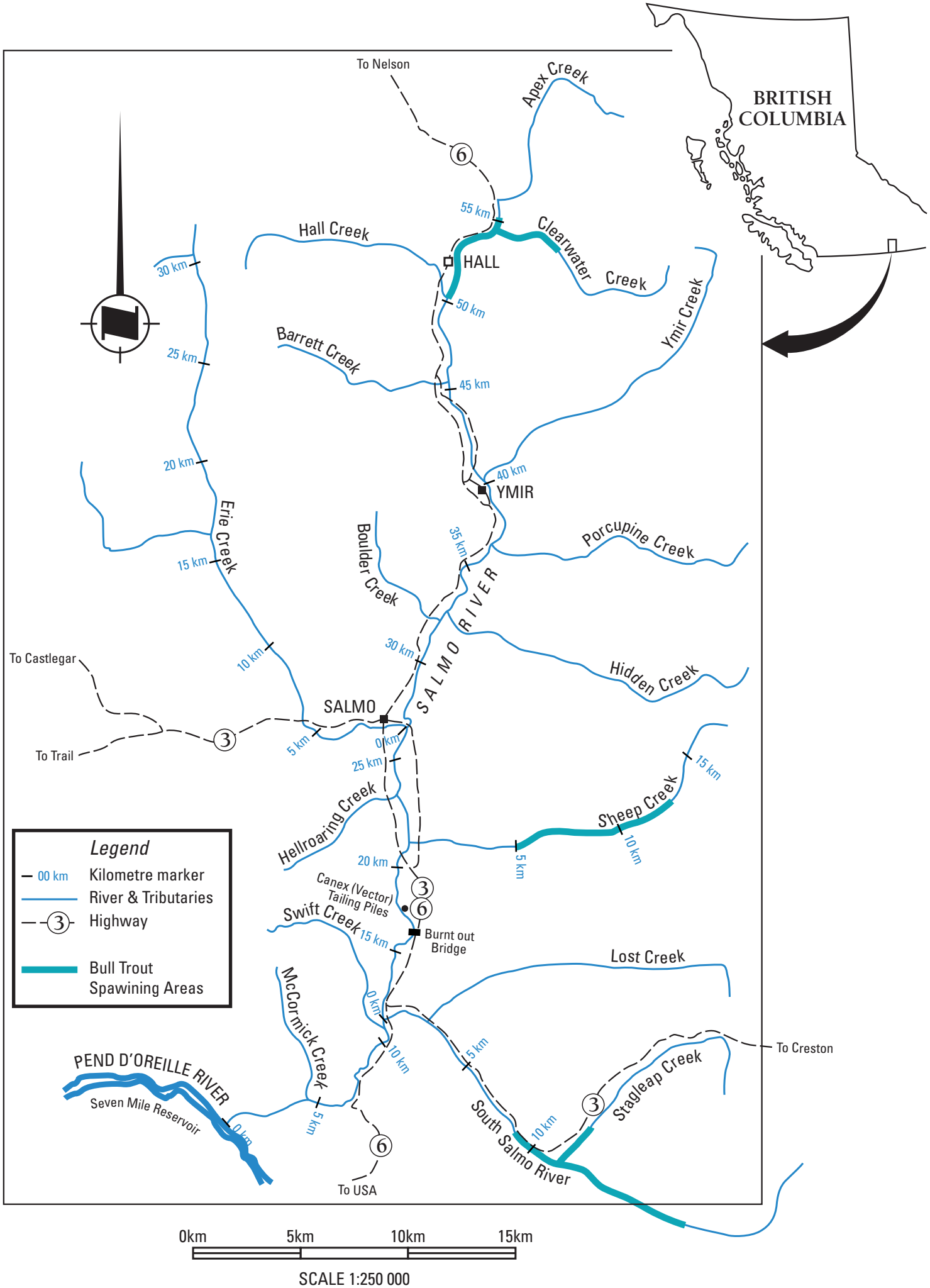


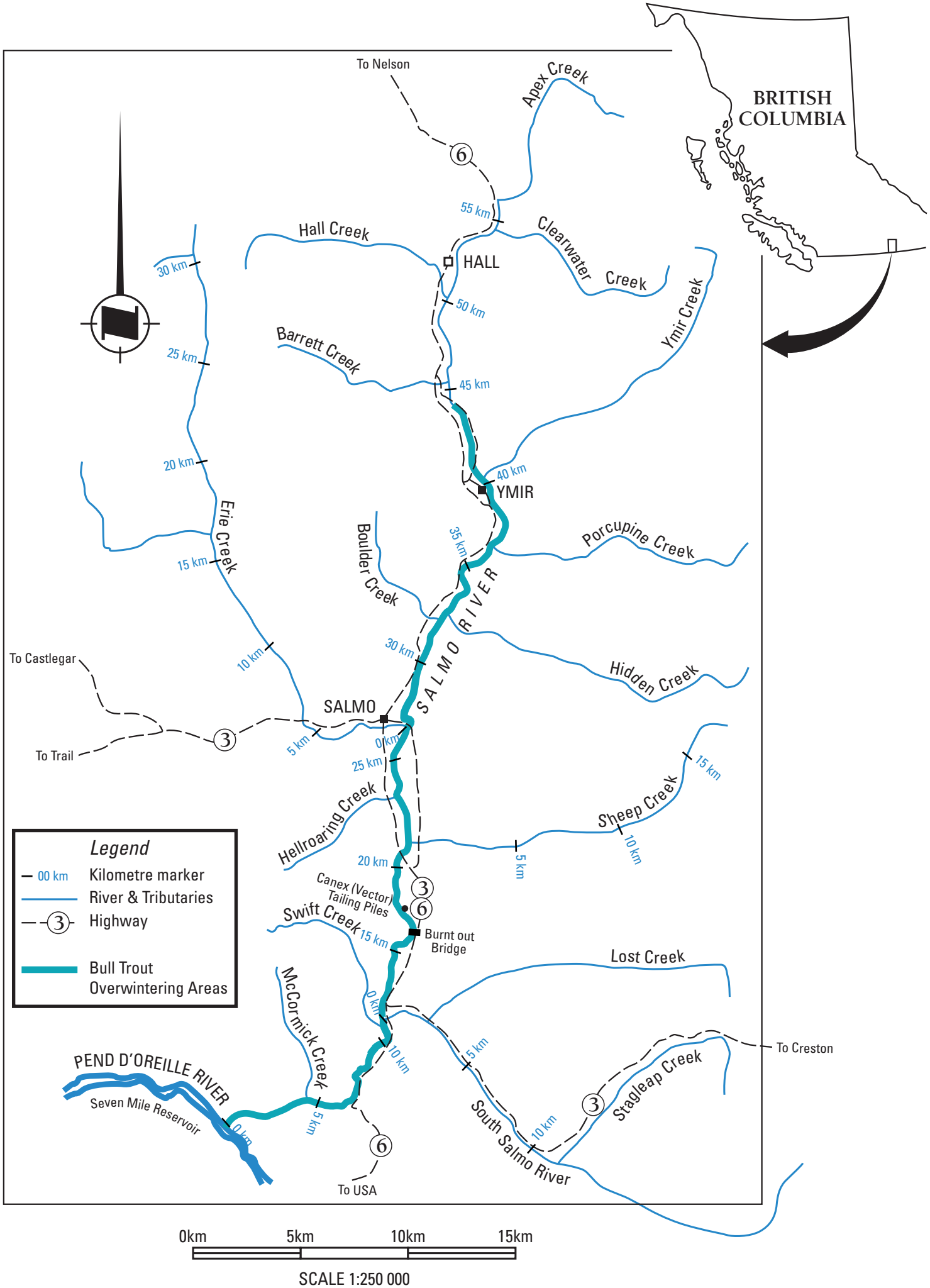

Salmo Watershed
Tailings and Mine Locations
LEGEND
Watershed Boundary
Tailings
Significant Mine Locations
Potential Risk Tailings
Other Mines
2 0 2 4 Kilometers
N
W
E
S
Apex Creek
Creek
Cr
RIVER
SALMO
Creek
D'OREILLE
Creek
Creek
Creek


Erie Creek
Tailings and Mine Overview
LEGEND
Tailings
Significant Mine Locations
Potential Risk Tailings
Other Mines
Park
Private Land
Roads
HIGHWAY
LOGGING ROAD
RECREATION TRAILS
SECONDARY ROAD
TRAIL
1 0 1 2 Kilometers
Mt. Verde
7040
Dominion Mtn
7335
Keystone Mtn
Erie Mtn
5420
SECOND RELIEF (L 2463)
SPOTTED HORSE (L 5375)
PORTO RICO (L 2385)
HARRIET
GOLD HILL
CLUBINE
CANADIAN KING (L 4196)
SECOND CHANCE
ARLINGTON
KEYSTONE (L 5137)
YANKEE
Quartz Ck
Erie
RIVER
SALMO
Halfway Creek
Divide Creek
Creek
Granite


Sheep Creek
Tailings and Mine Overview
LEGEND
Tailings
Significant Mine Locations
Potential Risk Tailings
Other Mines
Park
Private Land
Roads
HIGHWAY
LOGGING ROAD
RECREATION TRAILS
SECONDARY ROAD
TRAIL
1 0 1 2 Kilometers
BLE STANDARD (L 2213)
HUNTER V (L 2212)
HOWARD (L 12538)
Hewlett Pk
7382
Haystack
DONNYBROOK (L 12685)
Reno Mtn
7276
ASPEN (L 12471)
RENO (L 12684)
BLUESTONE (L 9054)
COYOTE (L 8383)
FAWN
NUGGET (L 8341)
MOTHERLODE (L 8818)
CLYDE (L 8873)
SHEEP CREEK MARBLE
IRON CAP
HB (L 10672)
GARNET (L 10809)
NAVADA (L 8868)
GOLD BELT
EUREKA
YELLOWSTONE TAILINGS
SHEEP CREEK QUARTZITE
YELLOWSTONE (L 3831)
QUEEN (L 10786)
VANCOUVER (L 10006)
ALEXANDER
KOOTENAY BELLE
Yellow
Stone
6748
BONANZA (L 10191)
ORE HILL (L 2078)
SUMMIT (L 10018)
HB TAILINGS POND
Iron Mtn
VECTOR TAILINGS
FEENEY (L 9074)
EMERALD TUNGSTEN
JERSEY (L 9070)
Nevada Mtn
6173
Mt. Waldie
7291
Lost Mtn
7054
Halfway Creek
Woodchuck Creek
Aspen Creek
Hedgehog Creek
Nugget Creek
Wuff Lake
King Lake
082F 005


Wildhorse (Ymir) Creek
Tailings and Mine Overview
LEGEND
Tailings
Significant Mine Locations
Potential Risk Tailings
Other Mines
Park
Private Land
Roads
HIGHWAY
LOGGING ROAD
RECREATION TRAILS
SECONDARY ROAD
TRAIL
1 0 1 2 Kilometers
N
W
E
S
Mt. Elise
6875
ELISE (L.1316)
YMIR BELLE
ARIZONA (L.13028)
WILCOX
YMIR-GOOD HOPE
BLACKCOCK (L.2922)
YMIR (L.1708)
PROTECTION
TAMARAC (L.3802)
CYANIDE FLATS
COMMODORE (L.14118)
Mt. Baldy
7635
Mt. Dundee
YANKEE GIRL (L.7712)
YANKEE GIRL TAILINGS
DUNDEE
MYRTLE
OSCAR CREEK TAILINGS
CENTER STAR (L.3766)
Jubilee Mtn
YMIR PULASKITE QUARRY
DEWEY (L.14431)
PORCUPINE (L.4634)
DOUBLE STANDARD (L.2913)
HUNTER V (L.2212)
HOWARD (L.12538)
CLUBINE
Hewlett Pk
7382
Haystack
Seeman
Creek
Qua Lake
Elise
Hearn


BRITISH COLUMBIA
To Nelson
Apex Creek
6
55 km
Hall Creek
HALL
Clearwater Creek
50 km
30 km
Barrett Creek
Ymir Creek
25 km
45 km
20 km
40 km
YMIR
Erie Creek
Boulder Creek
35 km
Porcupine Creek
15 km
SALMO RIVER
To Castlegar
10 km
30 km
Hidden Creek
SALMO
To Trail
3
5 km
0 km
25 km
15 km
Sheep Creek
Hellroaring Creek
10 km
5 km
20 km
Canex (Vector) Tailing Piles
3
6
Swift Creek
15 km
Burnt out Bridge
Lost Creek
McCormick Creek
0 km
10 km
5 km
To Creston
PEND D'OREILLE RIVER
Seven Mile Reservoir
0 km
5 km
3
Stagleap Creek
South Salmo River
10 km
6
To USA
Legend
00 km Kilometre marker
River & Tributaries
3 Highway
Bull Trout Spawining Areas
0km
5km
10km
15km
SCALE 1:250 000


BRITISH COLUMBIA
To Nelson
Apex Creek
6
55 km
Hall Creek
HALL
Clearwater Creek
30 km
50 km
Barrett Creek
Ymir Creek
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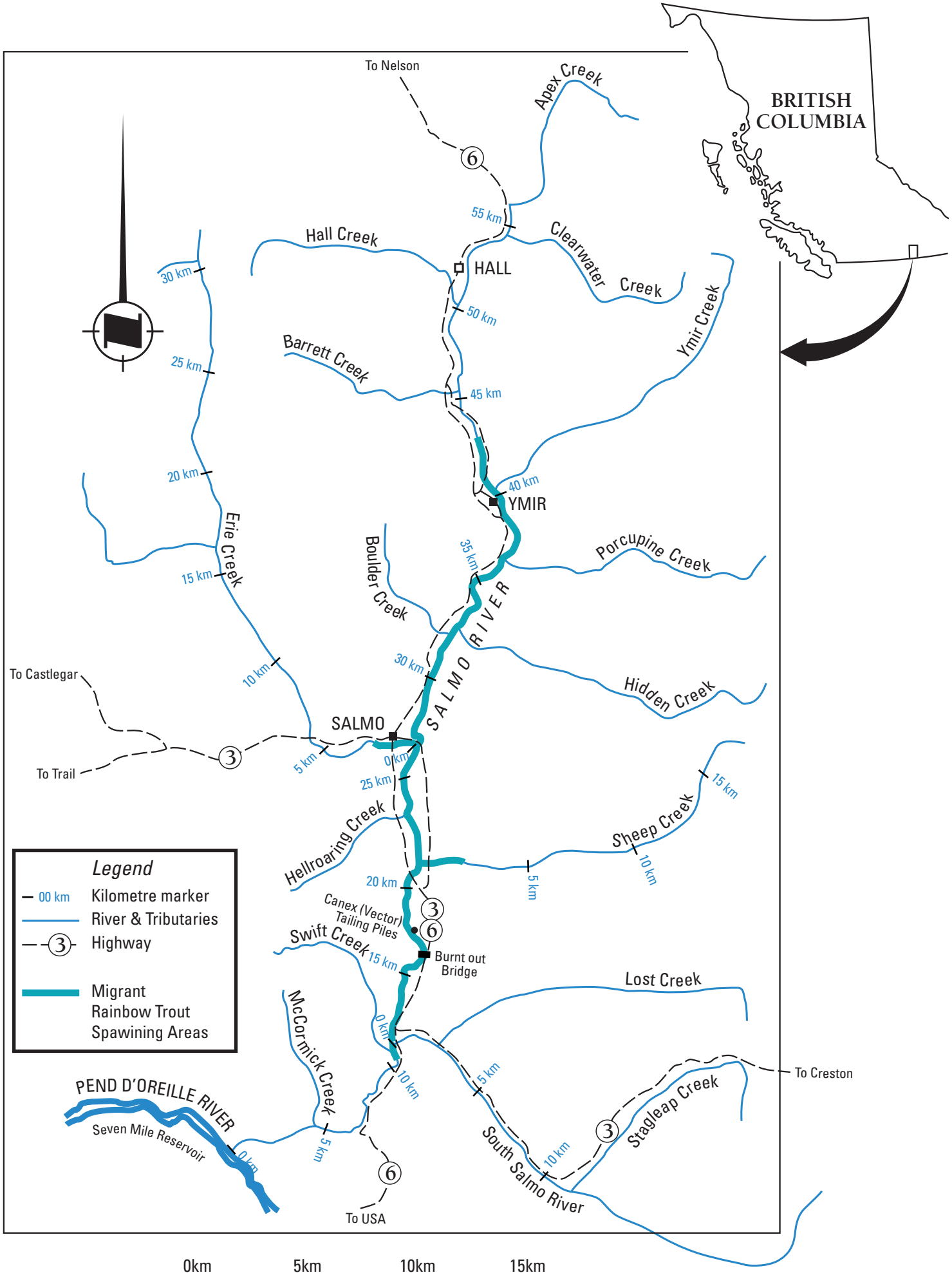
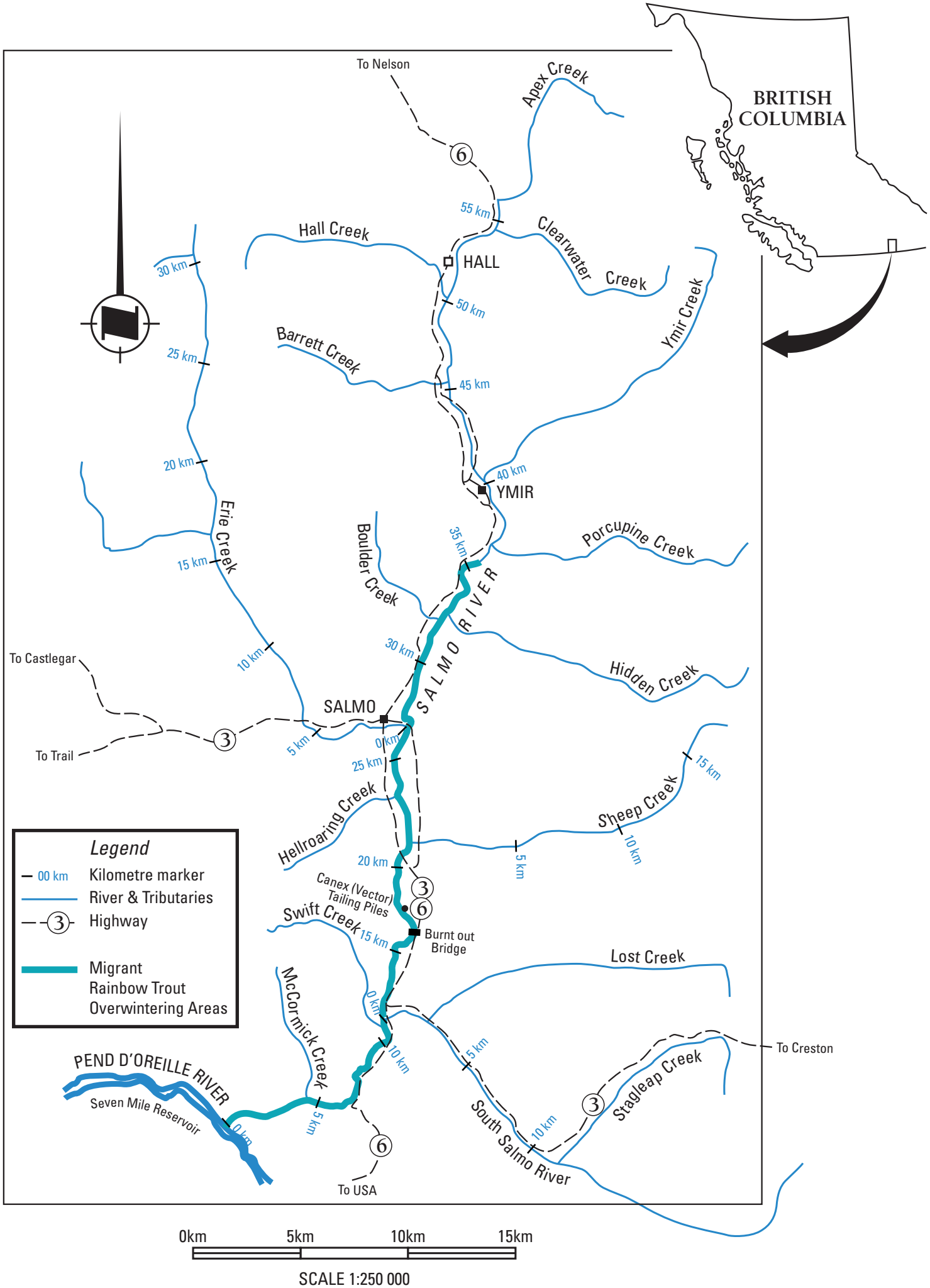
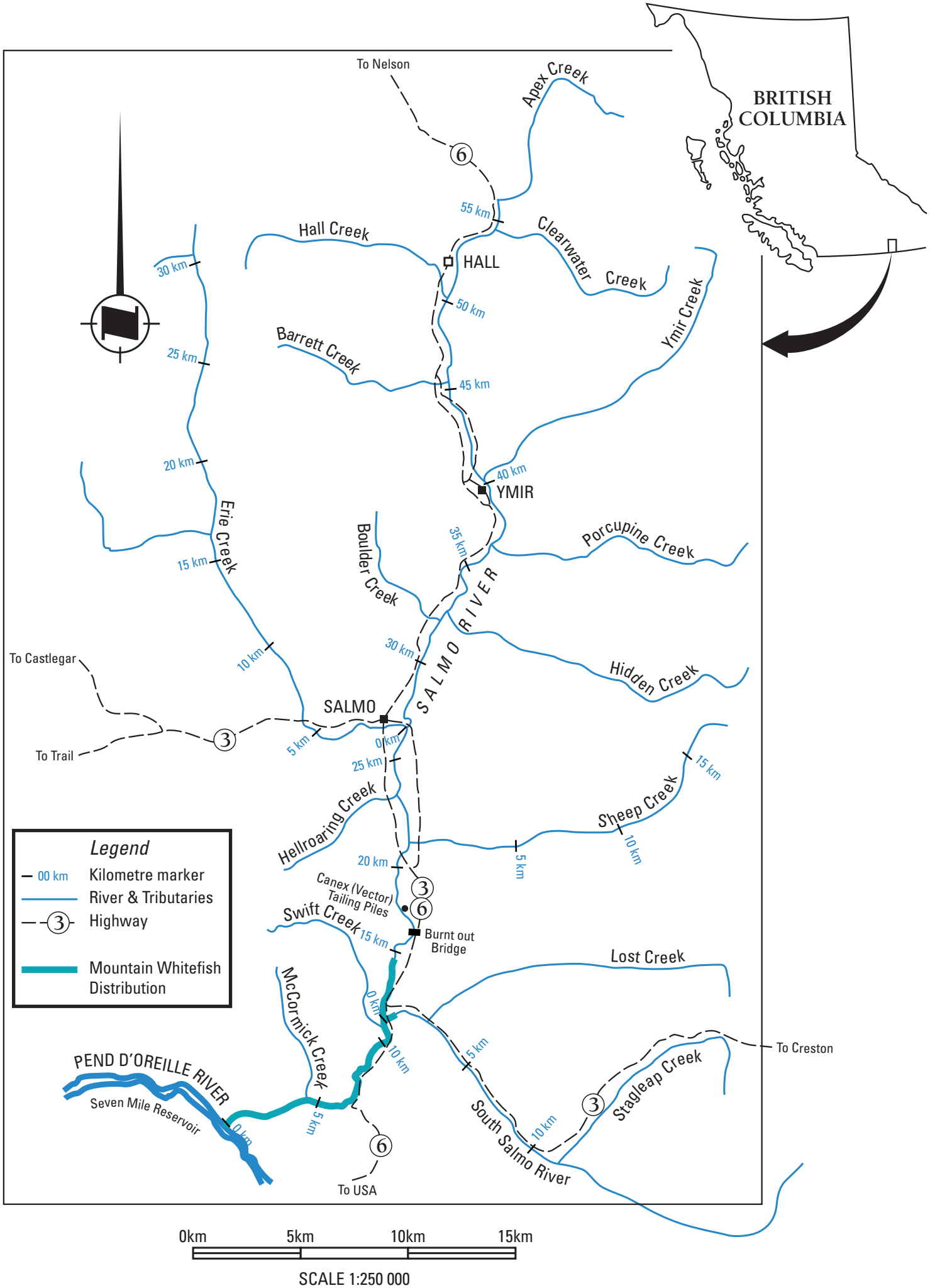
45 km
20 km
40 km
YMIR
Erie Creek
Boulder Creek
35 km
Porcupine Creek
15 km
SALMO RIVER
30 km
To Castlegar
10 km
Hidden Creek
SALMO
To Trail
3
5 km
0 km
25 km
Hellroaring Creek
Sheep Creek
15 km
10 km
5 km
20 km
Canex (Vector) Tailing Piles
Swift Creek
15 km
Burnt out Bridge
Lost Creek
McCormick Creek
0 km
10 km
5 km
PEND D'OREILLE RIVER
Seven Mile Reservoir
0 km
5 km
To Creston
Stagleap Creek
South Salmo River
10 km
To USA
Legend
00 km Kilometre marker
River & Tributaries
3 Highway
Bull Trout Overwintering Areas
0km 5km 10km 15km
SCALE 1:250 000


BRITISH COLUMBIA
To Nelson
Apex Creek
6
55 km
Hall Creek
HALL
Clearwater Creek
30 km
50 km
Barrett Creek
Ymir Creek
25 km
45 km
20 km
40 km
YMIR
Erie Creek
Boulder Creek
35 km
Porcupine Creek
15 km
SALMO RIVER
30 km
Hidden Creek
To Castlegar
10 km
SALMO
To Trail
3
5 km
0 km
25 km
Hellroaring Creek
Sheep Creek
15 km
10 km
5 km
20 km
Canex (Vector) Tailing Piles
3
6
Swift Creek
15 km
Burnt out Bridge
Lost Creek
McCormick Creek
0 km
10 km
5 km
To Creston
PEND D'OREILLE RIVER
Seven Mile Reservoir
0 km
5 km
6
3
Stagleap Creek
South Salmo River
10 km
To USA
Legend
00 km Kilometre marker
River & Tributaries
3 Highway
Migrant Rainbow Trout Spawining Areas
0km
5km
10km
15km
SCALE 1:250 000


BRITISH COLUMBIA
To Nelson
Apex Creek
6
55 km
Hall Creek
HALL
Clearwater Creek
30 km
50 km
Barrett Creek
Ymir Creek
25 km
45 km
20 km
40 km
YMIR
Erie Creek
Boulder Creek
35 km
Porcupine Creek
15 km
SALMO RIVER
30 km
Hidden Creek
To Castlegar
10 km
SALMO
To Trail
3
5 km
0 km
25 km
Hellroaring Creek
Sheep Creek
15 km
10 km
5 km
20 km
Canex (Vector) Tailing Piles
3
6
Swift Creek
15 km
Burnt out Bridge
Lost Creek
McCormick Creek
0 km
10 km
5 km
PEND D'OREILLE RIVER
Seven Mile Reservoir
0 km
5 km
6
To USA
South Salmo River
10 km
3
Stagleap Creek
To Creston
Legend
00 km Kilometre marker
River & Tributaries
3 Highway
Migrant Rainbow Trout Overwintering Areas
0km
5km
10km
15km
SCALE 1:250 000


BRITISH COLUMBIA
To Nelson
Apex Creek
6
55 km
Hall Creek
HALL
Clearwater Creek
30 km
50 km
Barrett Creek
Ymir Creek
25 km
45 km
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Erie Creek
Boulder Creek
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Porcupine Creek
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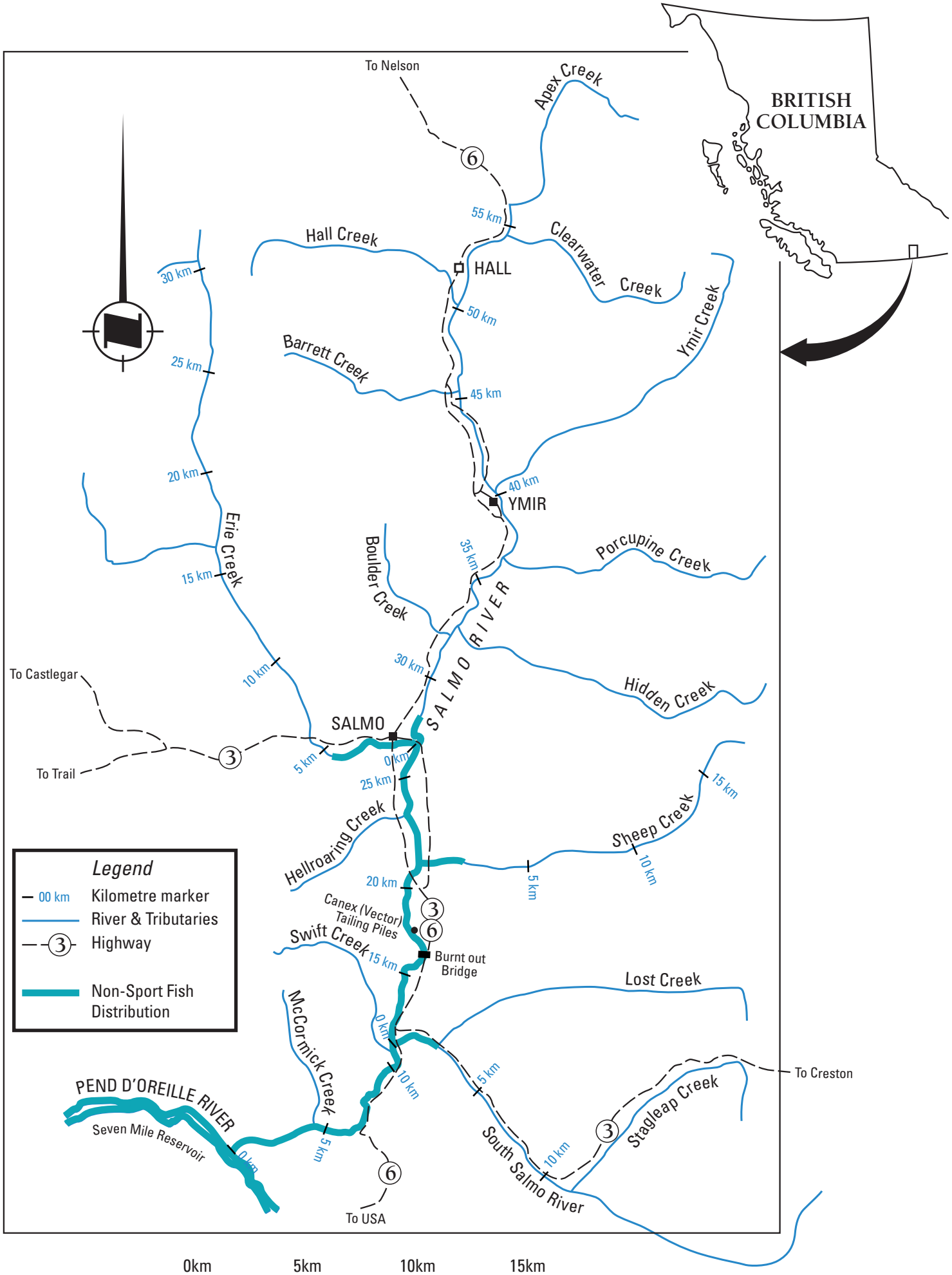
SALMO RIVER
30 km
Hidden Creek
To Castlegar
10 km
SALMO
To Trail
3
5 km
0 km
25 km
Hellroaring Creek
Sheep Creek
15 km
10 km
5 km
20 km
Canex (Vector) Tailing Piles
Swift Creek
15 km
Burnt out Bridge
Lost Creek
McCormick Creek
0 km
10 km
5 km
PEND D'OREILLE RIVER
Seven Mile Reservoir
0 km
5 km
To Creston
Stagleap Creek
South Salmo River
10 km
To USA
Legend
00 km Kilometre marker
River & Tributaries
3 Highway
Mountain Whitefish Distribution
0km 5km 10km 15km
SCALE 1:250 000


BRITISH COLUMBIA
To Nelson
Apex Creek
6
55 km
Hall Creek
HALL
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50 km
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40 km
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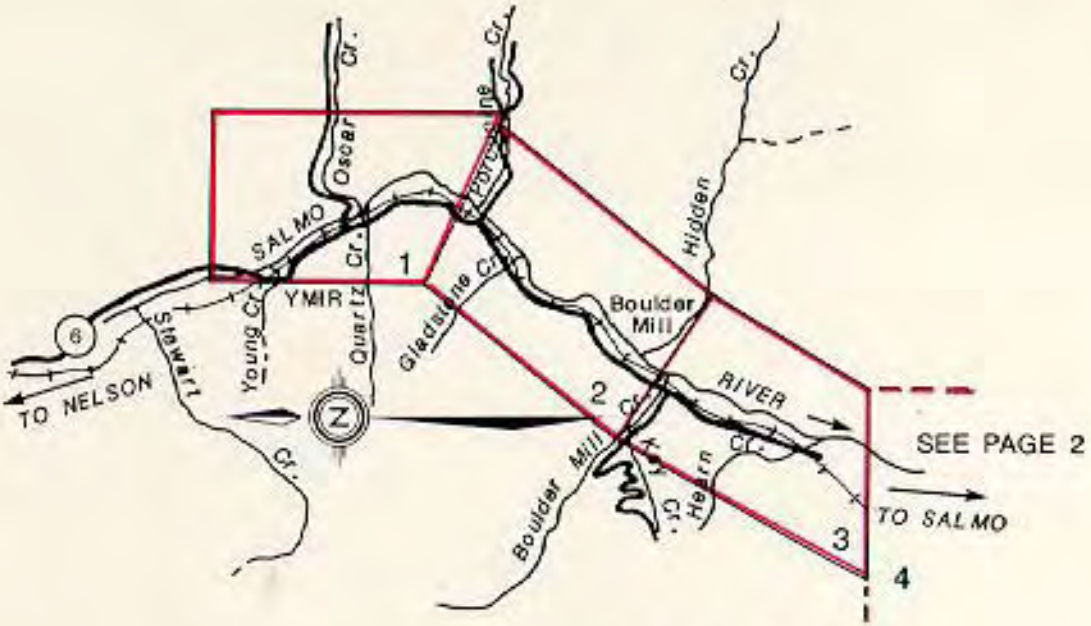
Erie Creek
Boulder Creek
35 km
Porcupine Creek
15 km
SALMO RIVER
30 km
Hidden Creek
To Castlegar
10 km
SALMO
To Trail
3
5 km
0 km
25 km
Hellroaring Creek
Sheep Creek
15 km
10 km
5 km
20 km
Canex (Vector) Tailing Piles
3
6
Swift Creek
15 km
Burnt out Bridge
Lost Creek
McCormick Creek
0 km
10 km
5 km
To Creston
PEND D'OREILLE RIVER
Seven Mile Reservoir
0 km
5 km
Stagleap Creek
3
South Salmo River
10 km
6
To USA
Legend
00 km Kilometre marker
River & Tributaries
3 Highway
Non-Sport Fish Distribution
0km
5km
10km
15km
SCALE 1:250 000

CANADA – BRITISH COLUMBIA

FLOODPLAIN MAPPING PROGRAM



SCALE 1:125 000

KEY PLAN

SALMO RIVER

YMIR TO SOUTH SALMO RIVER

(Including Erie Creek)

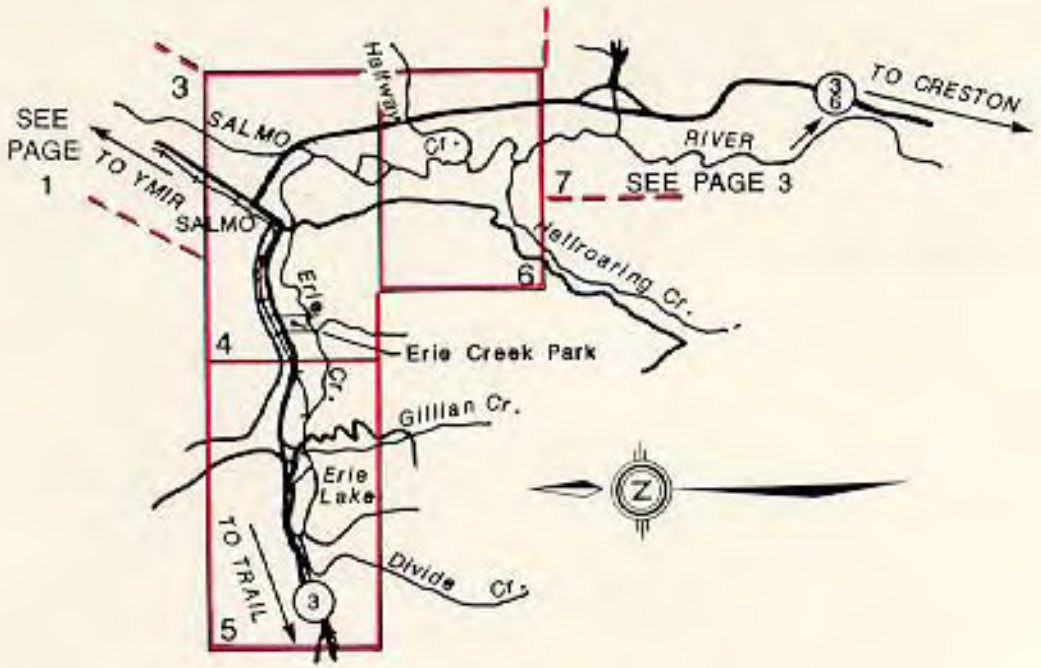
DRAWING NO. 90-32 SHEETS 1 TO 9

NTS REF. 82F/3,6

ISSUED SEPT. 1991

CANADA – BRITISH COLUMBIA

FLOODPLAIN MAPPING PROGRAM



1 km 0 1 2 3 4 5 6 7 8 km

SCALE 1:125000

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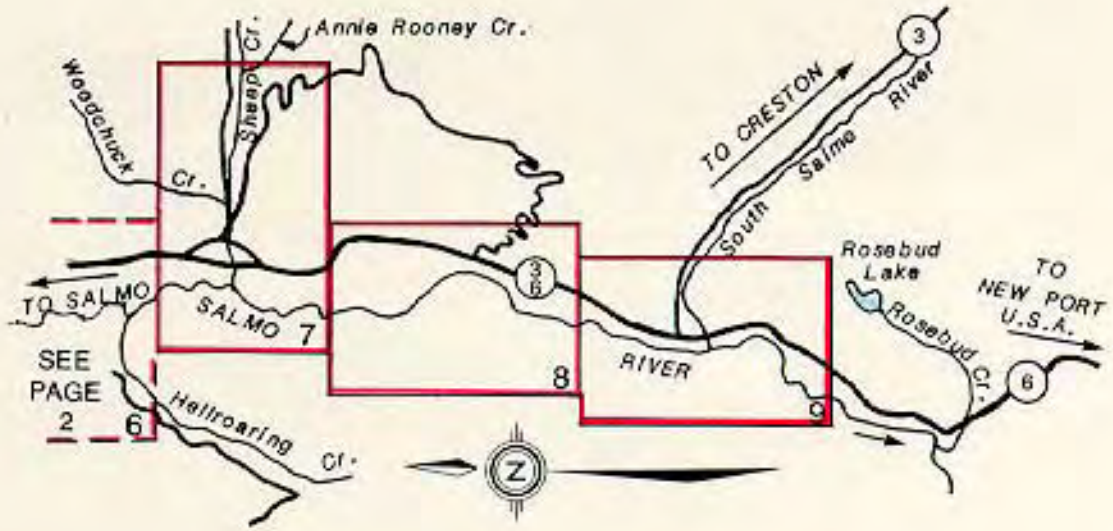

1 km 0 1 2 3 4 5 6 7 8 km

SCALE 1:125000

KEY PLAN

SALMO RIVER

YMIR TO SOUTH SALMO RIVER

(Including Erie Creek)

DRAWING NO. 90-32 SHEETS 1 TO 9

NTS REF. 82F/3,6

ISSUED SEPT. 1991

NOTES

Produced by: Acres International Limited
4 th Floor, 845 Combie St.
Vancouver, B.C. V6B 2P4 (Dec.,1990)

Survey: River survey done by Surveys Section, Water Management Branch, Projects 86RPP-4 (April,1986) and 88FDC-4 (Sept.-Oct., 1988)

a) Horizontal control based on provincial network.
b) Elevations are in metres and are referred to Geodetic Survey of Canada datum. (◉ Indicates Survey Monument).

Mapping: Base mapping done by Map Production Division, Surveys and Resource Mapping Branch, Project 88-023. (Nov., 1989)

a) Contour interval 1 metre and greater; spot elevatons shown to 0.1 metres, with accuracy to ± 0.3 metres, except where noted.
b) Grid origin referred to U.T.M. Projection Zone 11 .

FLOODPLAIN DATA

1. The floodplain areas as depicted on this map have been designated pursuant to the Canada/British Columbia Floodplain Mapping Agreement (1988) by the Minister of the Environment for Canada and the Minister of Environment for British Columbia.

   Flooding may still occur outside of the designated floodplain areas. The Ministers do not assume any liability by reason of the designation or failure to designate areas on this map.
2. The Designated Flood has a statistical frequency of occurrence of once every 200 years.
3. The flood levels were computed using a standard step method modelling technique, assuming open water flow conditions.
4. The floodplain limits assume the absence of all dykes.
5. The floodplain limits and flood levels include an allowance for freeboard.
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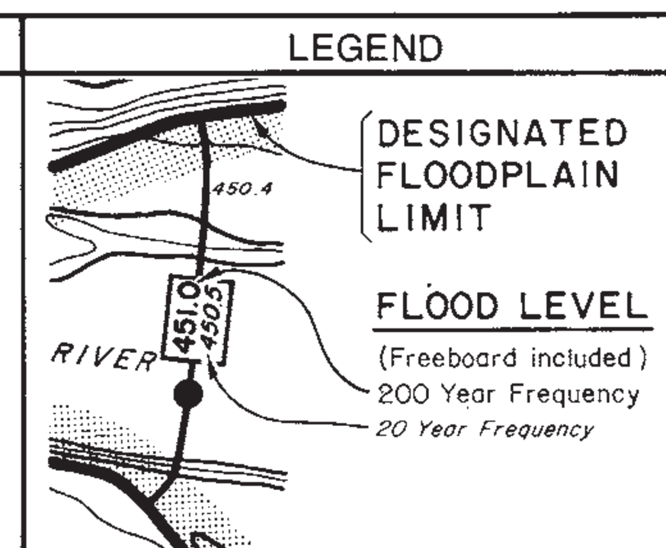
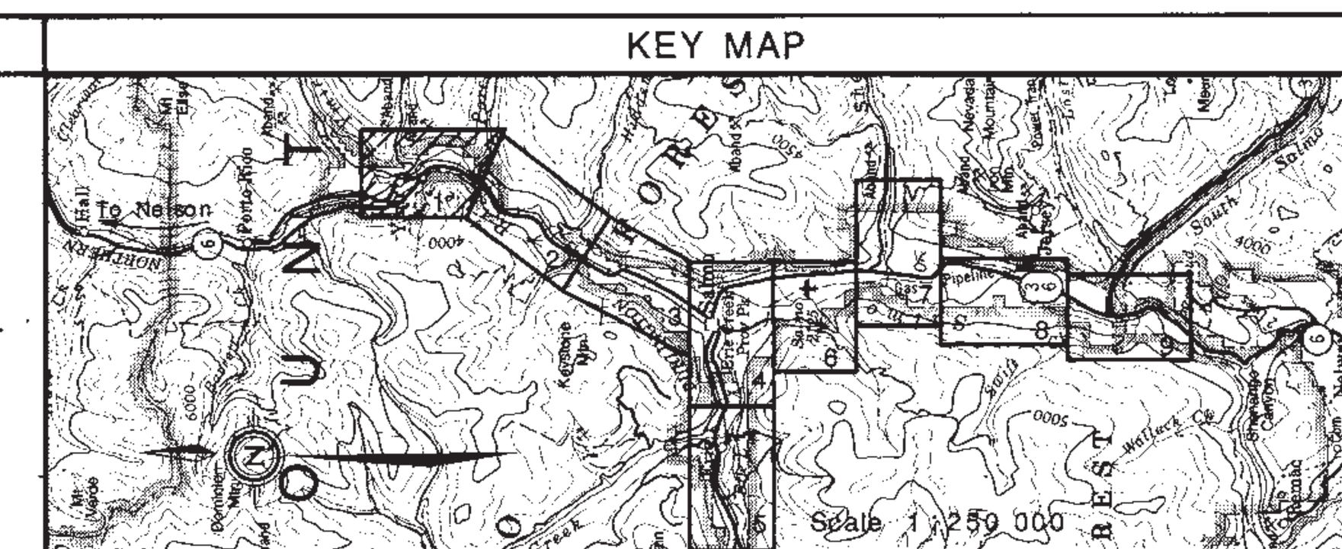
LEGEND



KEY MAP



REVISIONS

No.	DESCRIPTION	DATE

ISSUE OF MAPPING
DATE SEPT. 30, 1991

ENVIRONMENT CANADA INLAND WATERS / ENVIRONNEMENT CANADA EAUX INTÉRIEURES

BRITISH COLUMBIA MINISTRY OF ENVIRONMENT / COLOMBIE-BRITANNIQUE MINISTÈRE DE L'ENVIRONNEMENT

CANADA BRITISH COLUMBIA FLOODPLAIN MAPPING AGREEMENT / L'ACCORD CANADA COLOMBIE-BRITANNIQUE SUR LA CARTOGRAPHIE DES PLAINES D'INONDATION

DRAWN T. E.
CHECKED M.N.-P.
RIVER SURVEY T. M. D.
DESIGNED B. B.

FLOODPLAIN MAPPING
SALMO RIVER
YMIR TO SOUTH SALMO RIVER
(Including Erie Creek)

100m 0 100 200 300 400 500m
Scale in metres

ENGINEER
RECOMMENDED
APPROVED

FILE No. 33-0200-S.2
N.T.S.MAP No. 82F/3,6
SCALE 1 : 5 000
NEGATIVE No.
DRAWING No. 90-32-1 REV.
SHEET 1 of 9

DDfImg

NOTES

Produced by: Acres International Limited
4th Floor, 845 Cambie St
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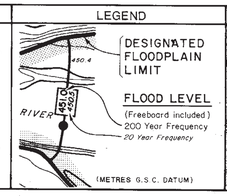
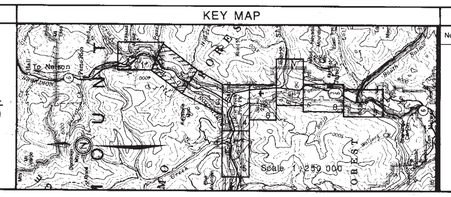
LEGEND



KEY MAP



REVISIONS

No.	DESCRIPTION	DATE

ISSUE OF MAPPING
DATE SEPT. 30, 1991

DRAWN T. E.
CHECKED M.N.-P.
RIVER SURVEY T. M. D.
DESIGNED B. B.
ENGINEER
RECOMMENDED
APPROVED

ENVIRONMENT CANADA INLAND WATERS / ENVIRONNEMENT CANADA EAUX INTÉRIEURES
BRITISH COLUMBIA MINISTRY OF ENVIRONMENT / COLOMBIE-BRITANNIQUE MINISTÈRE DE L'ENVIRONNEMENT
CANADA BRITISH COLUMBIA FLOODPLAIN MAPPING AGREEMENT / L'ACCORD CANADA COLOMBIE-BRITANNIQUE SUR LA CARTOGRAPHIE DES PLAINES D'INONDATION

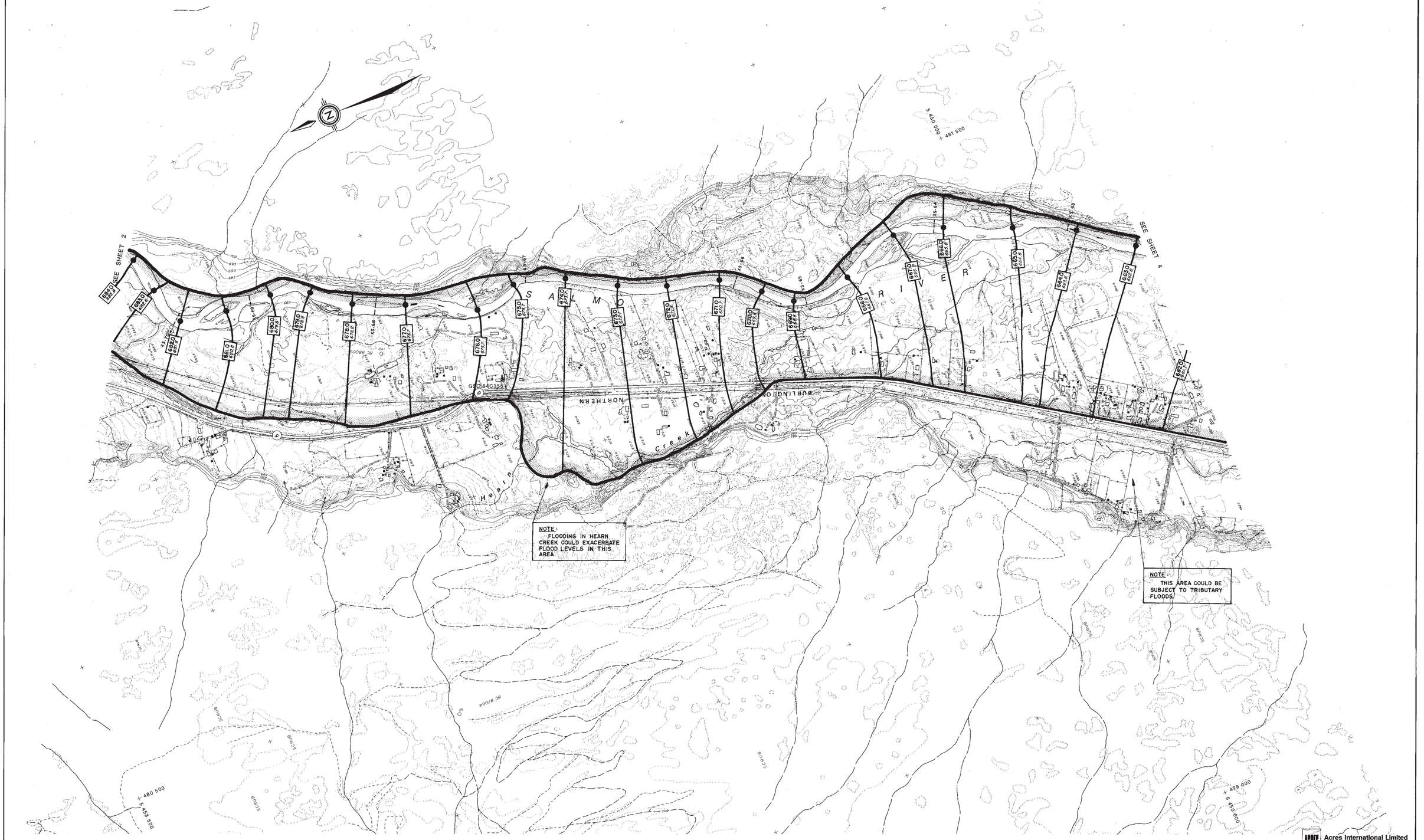
FLOODPLAIN MAPPING
SALMO RIVER
YMIR TO SOUTH SALMO RIVER
(Including Erie Creek)

100m 0 100 200 300 400 500m
Scale in metres

Acres International Limited
Vancouver, B.C., Canada

FILE No. 33-0200-S.2
N.T.S.MAP No. 82F/3,6
SCALE 1 : 5 000
NEGATIVE No.
DRAWING No. 90-32-2 REV.
SHEET 2 of 9

DDf1mg



NOTES

Produced by: Acres International Limited
4th Floor, 845 Cambie St
Vancouver, B.C. V6B 2P4 (Dec., 1990)

Survey: River survey done by Surveys Section, Water Management Branch, Projects 86RPP-4 (April, 1986) and 88FDC-4 (Sept-Oct, 1988)
a) Horizontal control based on provincial network.
b) Elevations are in metres and are referred to Geodetic Survey of Canada datum. (⊕ indicates Survey Monument).

Mapping: Base mapping done by Map Production Division, Surveys and Resource Mapping Branch, Project 88-023. (Nov., 1989)
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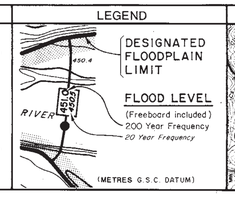
9. MAPS AVAILABLE FROM THE MINISTRY OF CROWN LANDS, SURVEYS AND RESOURCE MAPPING BRANCH, MAPS B.C. MAP AND AIR PHOTO SALES, VICTORIA, B.C.

LEGEND

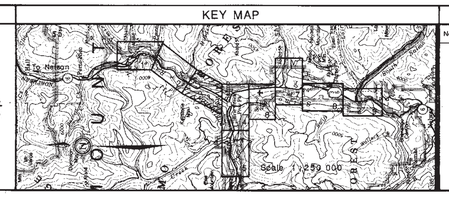


DESIGNATED FLOODPLAIN LIMIT

FLOOD LEVEL
(Freeboard included)
200 Year Frequency
20 Year Frequency

(METRES G.S.C. DATUM)

KEY MAP



REVISIONS

No.	DESCRIPTION	DATE

ISSUE OF MAPPING DATE SEPT. 30, 1991

DRAWN T. E.
CHECKED M.N.-P.
RIVER SURVEY T. M. D.
DESIGNED B. B.
ENGINEER
RECOMMENDED
APPROVED

ENVIRONMENT CANADA INLAND WATERS
ENVIRONNEMENT CANADA EAUX INTERIEURES

BRITISH COLUMBIA MINISTRY OF ENVIRONMENT
COLOMBIE-BRITANNIQUE MINISTÈRE DE L'ENVIRONNEMENT

CANADA BRITISH COLUMBIA FLOODPLAIN MAPPING AGREEMENT
L'ACCORD CANADA COLOMBIE-BRITANNIQUE SUR LA CARTOGRAPHIE DES PLAINES D'INONDATION

FLOODPLAIN MAPPING
SALMO RIVER
YMIR TO SOUTH SALMO RIVER
(including Erie Creek)

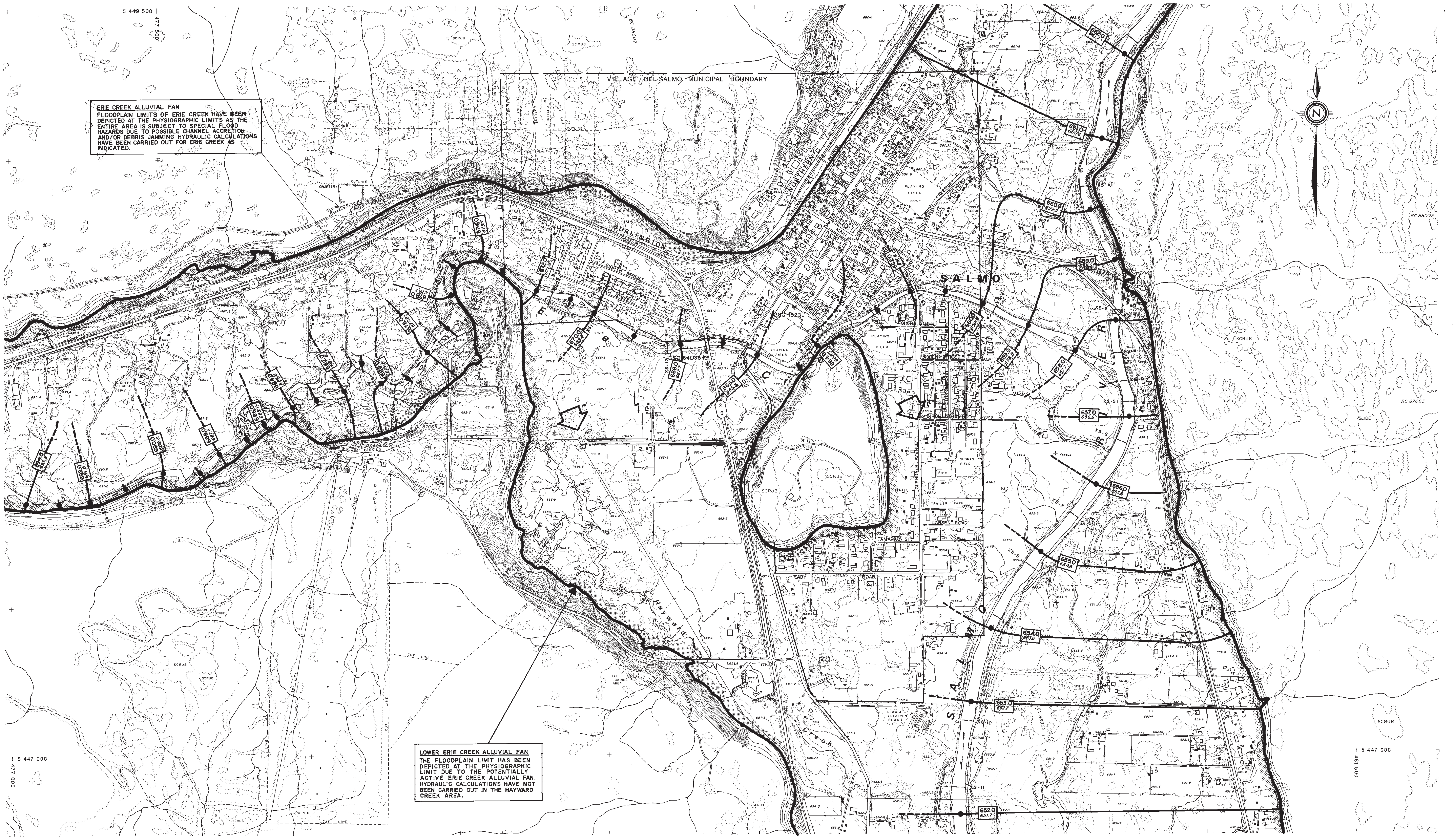
100m 0 100 200 300 400 500m
Scale in metres

Acres International Limited
Vancouver, B.C., Canada

FILE No. 33-0200-S.2
N.T.S.MAP No. 82F/3,6
SCALE 1 : 5 000
NEGATIVE No.
DRAWING No. 90-32-3
REV.
SHEET 3 of 9

DDfimg

SEE SHEET 3



SEE SHEET 5

SEE SHEET 6

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Vancouver, B.C., Canada

NOTES

Produced by: Acres International Limited
4 th Floor, 845 Cambie St.
Vancouver, B.C. V6B 2P4 (Dec., 1990)

Survey: River survey done by Surveys Section, Water Management Branch, Projects 86RPP-4 (April, 1986) and 88FDC-4. (Sept.-Oct., 1988)
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Mapping: Base mapping done by Map Production Division, Surveys and Resource Mapping Branch, Project 88-023. (Nov., 1989)
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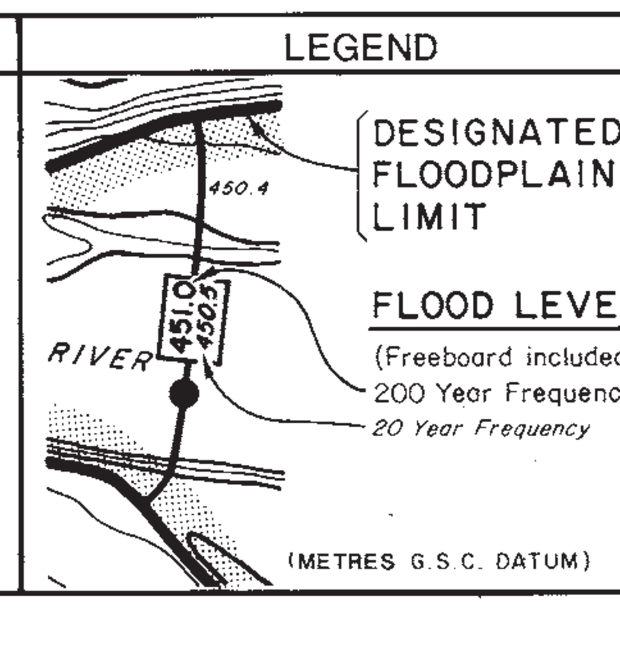
LEGEND

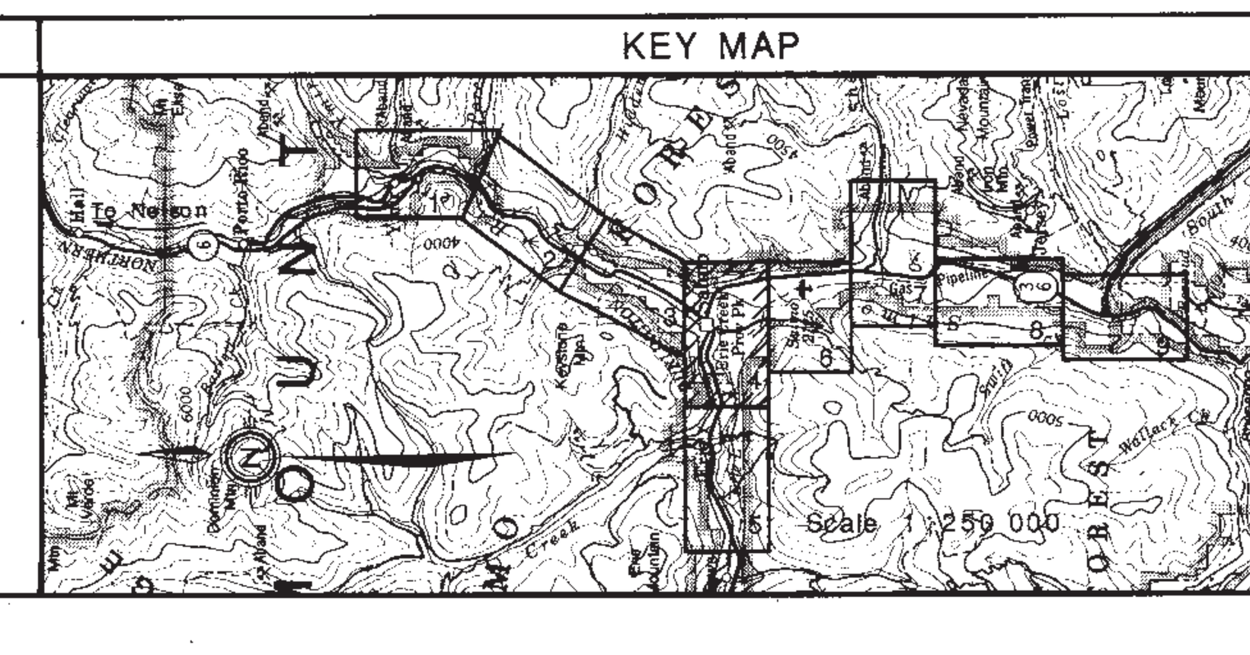


DESIGNATED FLOODPLAIN LIMIT

FLOOD LEVEL
(Freeboard included)
200 Year Frequency
20 Year Frequency

(METRES G.S.C. DATUM)

KEY MAP



REVISIONS

No.	DESCRIPTION	DATE

ISSUE OF MAPPING DATE: SEPT. 30, 1991

ENVIRONMENT CANADA INLAND WATERS / ENVIRONNEMENT CANADA EAUX INTÉRIEURES

BRITISH COLUMBIA MINISTRY OF ENVIRONMENT / COLOMBIE-BRITANNIQUE MINISTÈRE DE L'ENVIRONNEMENT

CANADA BRITISH COLUMBIA FLOODPLAIN MAPPING AGREEMENT / L'ACCORD CANADA COLOMBIE-BRITANNIQUE SUR LA CARTOGRAPHIE DES PLAINES D'INONDATION

DRAWN: T. E.
CHECKED: M.N.-P.
RIVER SURVEY: T. M. D.
DESIGNED: B. B.

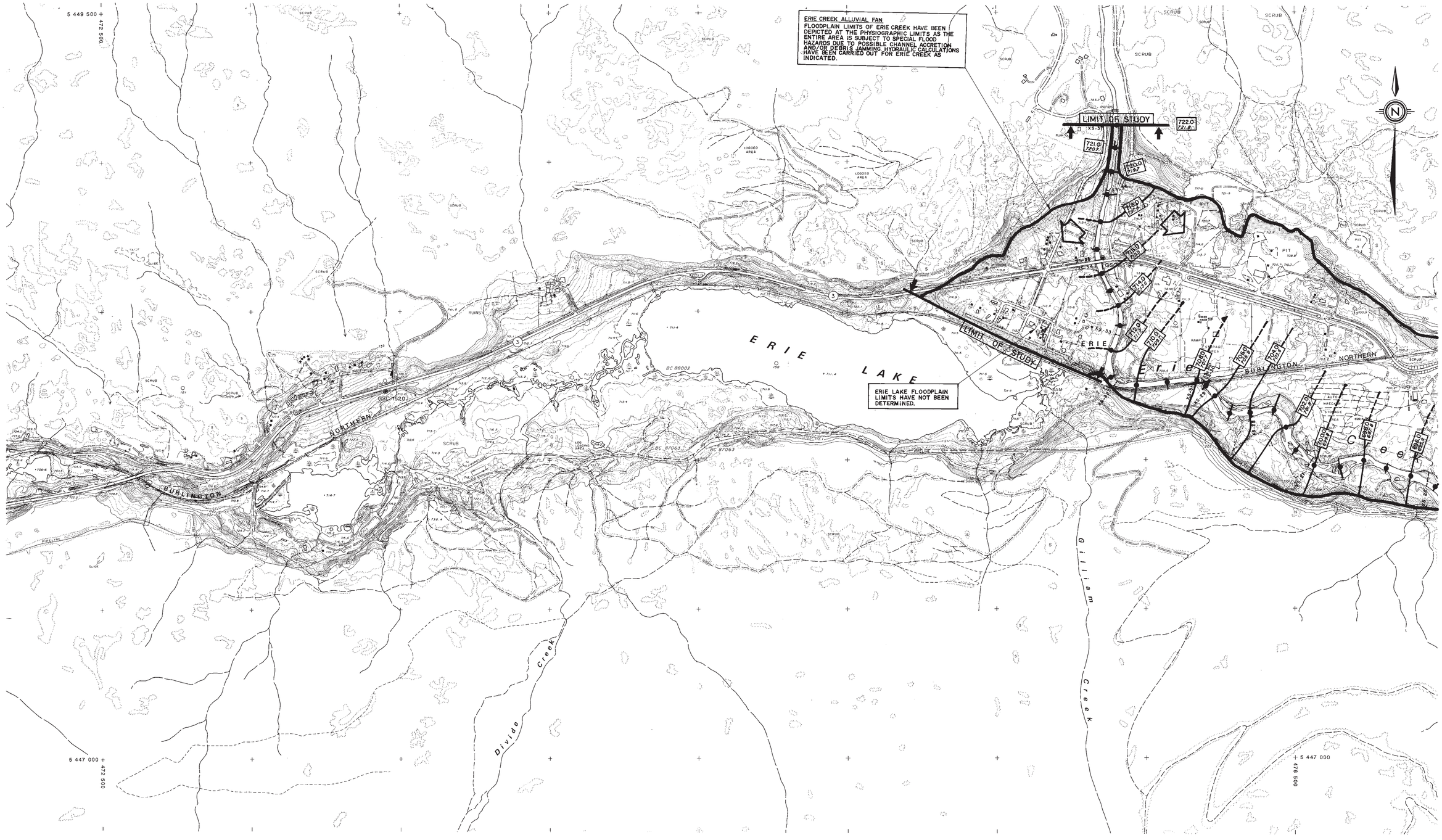
FLOODPLAIN MAPPING
SALMO RIVER
YMIR TO SOUTH SALMO RIVER
(Including Erie Creek)

100m 0 100 200 300 400 500m
Scale in metres

ENGINEER [signature] RECOMMENDED [signature] APPROVED [signature]

FILE No.: 33-0200-S.2
N.T.S.MAP No.: 82F/3,6
SCALE: 1 : 5 000
NEGATIVE No.:
DRAWING No.: 90-32-4 REV.:
SHEET 4 of 9

DDflmg



Acres International Limited
Vancouver, B.C., Canada

NOTES

Produced by: Acres International Limited
4th Floor, 845 Cambie St.
Vancouver, B.C. V6B 2P4 (Dec., 1990)

Survey: River survey done by Surveys Section, Water Management Branch, Projects 86FPP-4 (April, 1986) and 88FDC-4, (Sept.-Oct., 1988)
a) Horizontal control based on provincial network.
b) Elevations are in metres and are referred to Geodetic Survey of Canada datum. (⊗ indicates Survey Monument).

Mapping: Base mapping done by Map Production Division, Surveys and Resource Mapping Branch, Project 88-053. (Nov., 1989)
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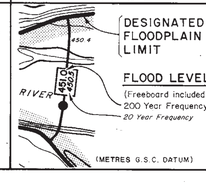
LEGEND

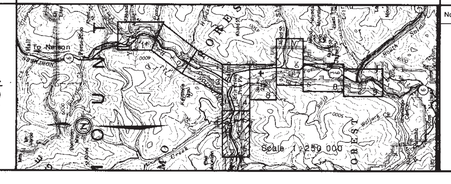


DESIGNATED FLOODPLAIN LIMIT

FLOOD LEVEL
(Freeboard included)
200 Year Frequency
20 Year Frequency

(METRES G.S.C. DATUM)

KEY MAP



REVISIONS

No.	DESCRIPTION	DATE

ISSUE OF MAPPING DATE SEPT. 30, 1991

DRAWN T. E.
CHECKED M.N.-P.
RIVER SURVEY T. M. D.
DESIGNED B. B.
ENGINEER
RECOMMENDED
APPROVED

ENVIRONMENT CANADA INLAND WATERS / ENVIRONNEMENT CANADA EAUX INTÉRIEURES
BRITISH COLUMBIA MINISTRY OF ENVIRONMENT / COLOMBIE-BRITANNIQUE MINISTÈRE DE L'ENVIRONNEMENT
CANADA (BRITISH COLUMBIA) FLOODPLAIN MAPPING AGREEMENT / L'ACCORD CANADA COLOMBIE-BRITANNIQUE SUR LA CARTOGRAPHIE DES PLAINES D'INONDATION

FLOODPLAIN MAPPING
SALMO RIVER
YMIR TO SOUTH SALMO RIVER
(Including Erie Creek)

100m 0 100 200 300 400 500m
Scale in metres

FILE No. 33-0200-S.2
N.T.S. MAP No. 82F/3,6
SCALE 1:5 000
NEGATIVE No.
DRAWING No. 90-32-5 REV.
SHEET 5 of 9

DDtlmg

SEE SHEET 4

SEE SHEET 7

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Vancouver, B.C., Canada

NOTES

Produced by: Acres International Limited
4th Floor, 845 Cambie St.
Vancouver, B.C. V6B 2P4 (Dec., 1990)

Survey: River survey done by Surveys Section, Water Management Branch, Projects 88KPP-4 (April, 1986) and 88FDC-4 (Sept.-Oct, 1988)
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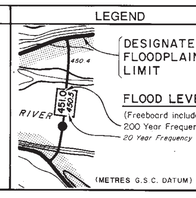
LEGEND

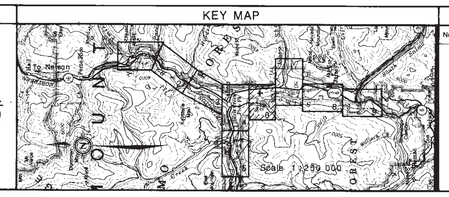


DESIGNATED FLOODPLAIN LIMIT

FLOOD LEVEL
(Freeboard included)
200 Year Frequency
20 Year Frequency

(METRES G.S.C. DATUM)

KEY MAP



REVISIONS

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ISSUE OF MAPPING DATE: SEPT. 30, 1991

DRAWN: T. E.
CHECKED: M.N.-P.
RIVER SURVEY: T. M. D.
DESIGNED: B. B.
ENGINEER:

ENVIRONMENT CANADA — INLAND WATERS
BRITISH COLUMBIA MINISTRY OF ENVIRONMENT
ENVIRONNEMENT CANADA — EAUX INTÉRIEURES
COLOMBIE-BRITANNIQUE MINISTÈRE DE L'ENVIRONNEMENT

CANADA-BRITISH COLUMBIA FLOODPLAIN MAPPING AGREEMENT
L'ACCORD CANADA COLOMBIE-BRITANNIQUE SUR LA CARTOGRAPHIE DES PLAINES D'INONDATION

FLOODPLAIN MAPPING
SALMO RIVER
YMIR TO SOUTH SALMO RIVER
(Including Erie Creek)

100m 0 100 200 300 400 500m
Scale in metres

RECOMMENDED:
APPROVED:

FILE No. 33-0200-S.2
N.T.S.MAP No. 82F/3,6
SCALE 1 : 5 000
NEGATIVE No.
DRAWING No. 90-32-6
REV.
SHEET 6 of 9

DDfimg

SEE SHEET 6

SEE SHEET 8

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Vancouver, B.C., Canada

NOTES

Produced by: Acres International Limited
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Vancouver, B.C. V6B 2P4 (Dec, 1990)

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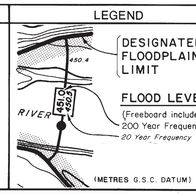
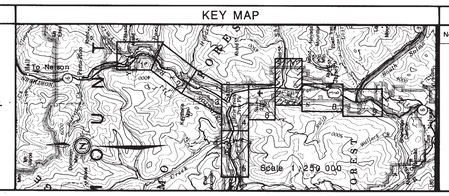
LEGEND



KEY MAP



REVISIONS

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ENVIRONMENT CANADA INLAND WATERS / ENVIRONNEMENT CANADA EAUX INTÉRIEURES
BRITISH COLUMBIA MINISTRY OF ENVIRONMENT / COLOMBIE-BRITANNIQUE MINISTÈRE DE L'ENVIRONNEMENT
CANADA BRITISH COLUMBIA FLOODPLAIN MAPPING AGREEMENT
L'ACCORD CANADA COLOMBIE-BRITANNIQUE SUR LA CARTOGRAPHIE DES PLAINES D'INONDATION

FLOODPLAIN MAPPING
SALMO RIVER
YMIR TO SOUTH SALMO RIVER
(Including Erie Creek)

100m 0 100 200 300 400 500m
Scale in metres

FILE No. 33-0200-S.2
N.T.S.MAP No. 82F/3,6
SCALE 1:5 000
NEGATIVE No.
DRAWING No. 90-32-7
REV.
SHEET 7 of 9

DDflmg

Acres International Limited
Vancouver, B.C., Canada

NOTES

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4th Floor, 845 Cambie St.
Vancouver, B.C. V6B 2P4 (Dec.,1990)

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LEGEND

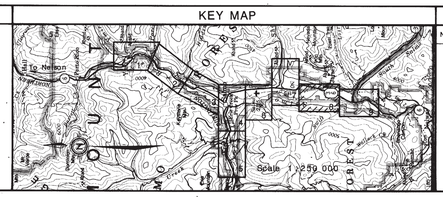
DESIGNATED FLOODPLAIN LIMIT

FLOOD LEVEL
(Freeboard included)
200 Year Frequency
20 Year Frequency

RIVER 451.0 200Yr

(METRES G.S.C. DATUM)

KEY MAP



REVISIONS

No.	DESCRIPTION	DATE

ISSUE OF MAPPING
DATE SEPT. 30, 1991

DRAWN T. E.
CHECKED M.N.-P
RIVER SURVEY T. M. D.
DESIGNED B. B.
ENGINEER
RECOMMENDED
APPROVED

ENVIRONMENT CANADA INLAND WATERS
ENVIRONNEMENT CANADA EAUX INTÉRIEURES

BRITISH COLUMBIA MINISTRY OF ENVIRONMENT
COLOMBIE-BRITANNIQUE MINISTÈRE DE L'ENVIRONNEMENT

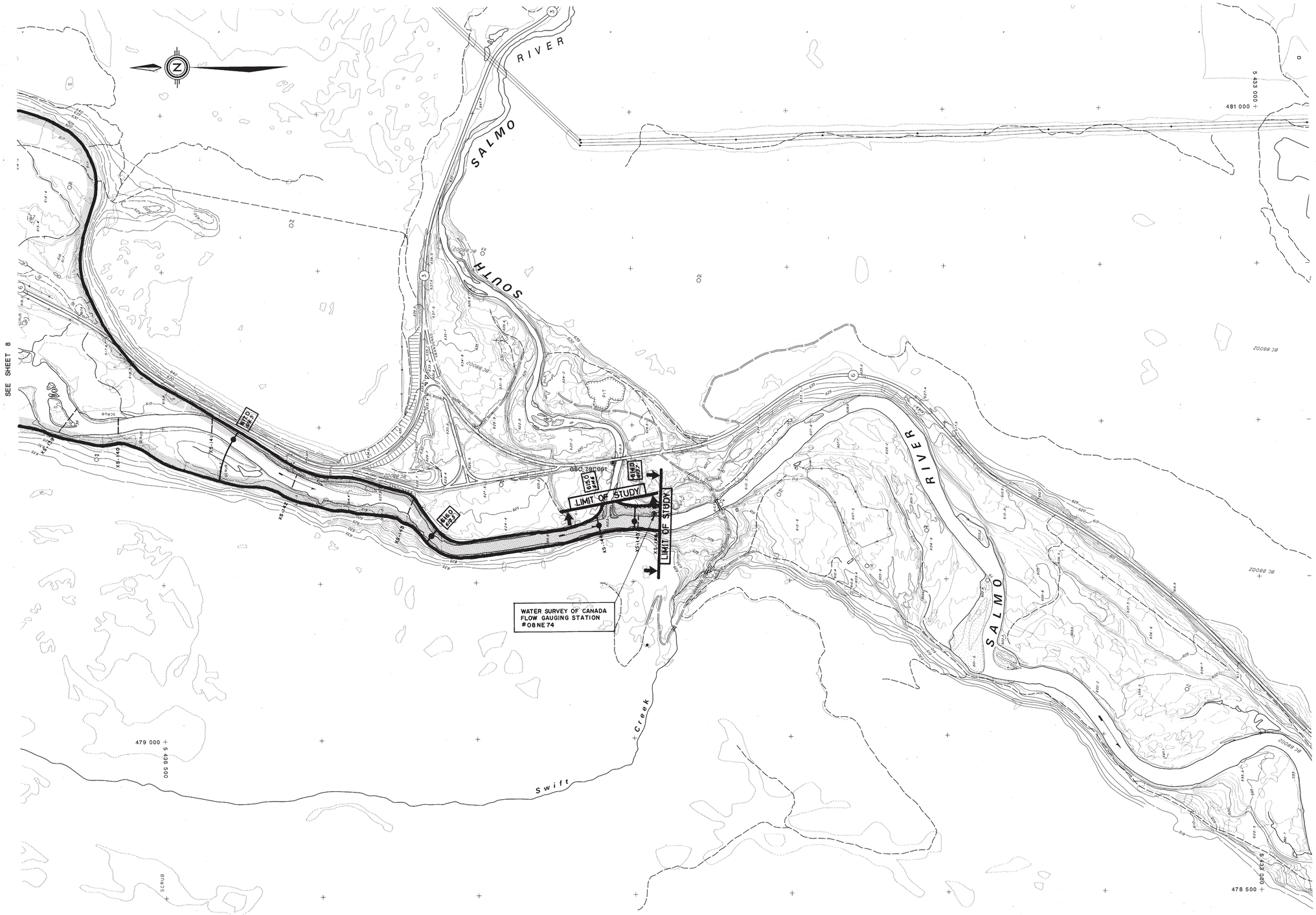
CANADA BRITISH COLUMBIA FLOODPLAIN MAPPING AGREEMENT
L'ACCORD CANADA COLOMBIE-BRITANNIQUE SUR LA CARTOGRAPHIE DES PLAINES D'INONDATION

FLOODPLAIN MAPPING
SALMO RIVER
YMIR TO SOUTH SALMO RIVER
(Including Erie Creek)

100m 0 100 200 300 400 500m
Scale in metres

FILE No. 33-0200-S.2
N.T.S.MAP No. 82F/3,6
SCALE 1 : 5 000
NEGATIVE No.
DRAWING No. 90-32-8 REV.
SHEET 8 of 9

DDflmg



WATER SURVEY OF CANADA
FLOW GAUGING STATION
#08NE74

Acres International Limited
Vancouver, B.C., Canada

NOTES

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4 th Floor, 845 Cambie St.
Vancouver, B.C. V6B 2P4 (Dec., 1990)

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7. The floodplain limits are not delineated for side streams and tributaries.
8. The required setback of buildings from the natural boundaries of lakes and watercourses to allow for the passage of floodwaters and possible bank erosion is not shown. This information is available either through local municipalities or the Ministry of Environment.
9. MAPS AVAILABLE FROM THE MINISTRY OF CROWN LANDS, SURVEYS AND RESOURCE MAPPING BRANCH, MAPS B.C. MAP AND AIR PHOTO SALES, VICTORIA, B.C.

LEGEND

DESIGNATED
FLOODPLAIN
LIMIT

FLOOD LEVEL
(Freeboard included)
200 Year Frequency
20 Year Frequency

(METRES G.S.C. DATUM)

KEY MAP

REVISIONS

No.	DESCRIPTION	DATE

ISSUE OF MAPPING
DATE SEPT. 30, 1991

DRAWN T. E.
CHECKED M.N.-P.
RIVER SURVEY T. M. D.
DESIGNED B. B.

ENVIRONMENT CANADA
INLAND WATERS
ENVIRONNEMENT CANADA
EAUX INTÉRIEURES

BRITISH COLUMBIA MINISTRY
OF ENVIRONMENT
COLOMBIE-BRITANNIQUE MINISTÈRE
DE L'ENVIRONNEMENT

CANADA BRITISH COLUMBIA
FLOODPLAIN MAPPING AGREEMENT
L'ACCORD CANADA COLOMBIE-BRITANNIQUE SUR
LA CARTOGRAPHIE DES PLAINES D'INONDATION

FLOODPLAIN MAPPING
SALMO RIVER
YMIR TO SOUTH SALMO RIVER
(Including Erie Creek)

100m 0 100 200 300 400 500m
Scale in metres

ENGINEER
RECOMMENDED
APPROVED

FILE No. 33-0200-S.2
N.T.S.MAP No. 82F/3,6
SCALE 1 : 5 000
NEGATIVE No.
DRAWING No. 90-32-9
REV.
SHEET 9 of 9

DDflmg