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APPENDIX D

CANADIAN OKANOGAN/SIMILKAMEEN SUBBASIN SUMMARY

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1.0 CANADIAN OKANOGAN/SIMILKAMEEN SUBBASIN SUMMARY

1.1 OKANOGAN MAINSTEM BASIN OVERVIEW

The Okanogan watershed in Canada extends north from the Columbia Plateau in Washington State to the height of land separating the drainage basins of the Columbia and Fraser Rivers. The majority of the Okanogan River mainstem lies in a valley that is a long north-south trench located in the Interior Plateau of British Columbia. The valley is 18 kilometers wide at the northern end, and only 5 to 10 kilometers wide at the southern end. From a few miles north of Armstrong, BC, the entire valley drains south to the Columbia River. Many of the tributaries to the Okanogan River are small systems that arise in the hills that surround this valley.

The Similkameen River, which measures approximately 197 kilometers in length, is a major tributary to the Okanogan River. The Similkameen River watershed is located to the west of the Okanogan River watershed. However, while the majority of the Similkameen River watershed lies in Canada, the confluence of the Similkameen and Okanogan Rivers actually lies in Washington State.

Other notable and fish bearing main tributaries to the Okanogan River include Mission Creek and Kelowna (Mill) Creek near the City of Kelowna, Vernon Creek south of the City of Winfield, Penticton Creek near the City of Penticton, Powers Creek, Trepanier Creek just north of Peachland, and Peachland Creek near the Town of Peachland. The combined stream length of these main tributaries (not including the Okanogan River mainstem itself and Kelowna Creek) is approximately 227 kilometers (Powers Creek 29 kilometers; Mission Creek 74 kilometers; Peachland Creek 31 kilometers; Penticton Creek 29 kilometers; Trepanier Creek 28 kilometers; Vernon Creek 36 kilometers). There are approximately 66 kilometers of total stream accessible to stream-spawning Kokanee of which 19 kilometers is located in Mission Creek. In the Okanogan basin, 95% of stream spawning occurs within Mission, Kelowna (Mill), Powers, Trepanier, Peachland, and Penticton Creeks.

The Okanogan watershed also contains several large lakes. The largest of these is Lake Okanogan, which extends approximately from the City of Vernon in the North to the City of Penticton in the South. Next in size and downstream in order is medium sized Skaha Lake, followed by the small-sized Vaseux Lake. Osoyoos Lake is a medium sized lake that straddles the Canada-US border.

1.2 LAND USE AND OWNERSHIP

The growth of the orchard industry in the semi-arid Okanogan Valley required an inexpensive supply of water available to all orchards. Between 1860 and 1920 agriculture moved from stock raising and grain growing to intensive orcharding thus increasing demand for irrigation. This increased demand for water resulting in long, high volume, elaborate and expensive irrigation systems requiring storage, conveyance and application of water. By 1920 such a system was in place and the Okanogan fruit industry flourished.

1.3 TOPOGRAPHY, GEOLOGY & SOILS

Within the Okanogan basin there are four major soil types and a group of groundwater soils where natural drainage is poor. Brown soils predominate to a maximum elevation of

approximately 610 m and occur as far north as Summerland. Dark brown soils occur further north within the elevation range from 344 m to 1067 m. These soils are found on the lower slopes and in well-drained parts of the valley bottom and are ideal for orcharding. Black soils occur largely in the north Okanogan on southern exposures throughout the entire region. They are found to an elevation of 1372 m and are associated with low soil moisture levels and grassland vegetation. The intermountain podsol soils that are predominant in the north Okanogan are of little agricultural importance.

1.4 VEGETATION AND RIPARIAN CONDITION

The Okanogan valley is located within the rain shadow of the Coast Mountains. Throughout the valley, the precipitation level reaches a peak in June and again between December and January. Within the valley, precipitation increases to the north and with elevation.

The valley bottom up to an elevation of approximately 750 m is described as an Interior Douglas - fir and Ponderosa Pine - Bunchgrass biogeoclimatic zone. The Ponderosa Pine zone occurs at elevations between 335 and 900 meters as a thin band on the bottoms and/or sidewalls of valleys such as the Similkameen and Okanogan watersheds. The zone in British Columbia represents the northern limits of the zone that is much more extensive in the US. Typically, Ponderosa Pine falls between that of Bunchgrass and Interior Douglas-fir zones. At higher elevations, within the Interior Douglas-fir biogeoclimatic zone, the forest is more closed and Western Larch, Western Red Cedar, and Lodgepole Pine are found more frequently.

Cottonwood trees are also found along many of the watercourses in the lower elevations of the Okanogan watershed. Cottonwood forests are sensitive to changes in the watershed. Where they are found on active floodplains, cottonwood forests rely on the natural cycle of flooding to replenish soil nutrients and moisture. Many streams in the interior have been dyked and channeled to prevent flooding. The Okanogan River between Penticton and the US border has been converted into a straight channel. Black cottonwood is very resistant to flooding and regenerates best on disturbed lands such as floodplains. The cottonwood ecosystem of the southern interior is among the rarest plant community in the province. In the south Okanogan and Similkameen valleys, fewer than 500 hectares remain. They are important as they provide crucial habitat, especially to species that are not well adapted to living in the arid grasslands and forests that dominate this part of the province. Cottonwoods grow quickly and die relatively young. They often provide snags (standing dead trees) which are important to a variety of wildlife species. These snags may eventually fall into the stream, where they help create cover and pool habitat for fish and other aquatic creatures. In this capacity fallen trees help to stabilize stream banks and prevent erosion and siltation of stream beds.

1.5 WATER QUANTITY/HYDROLOGY

The Okanogan Valley is located in the rain shadow of the Coast Mountains. Moisture is precipitated on the windward side of the mountain range resulting in a moisture deficit within the valley. Air masses descending on the leeward slopes of the Coast Mountain range are warmed and become more stable, favoring potentially higher rates of evaporation and exacerbating the moisture deficit in Okanogan Valley. Mean precipitation increases to the north and with elevation. Conversely, mean daily temperature decreases to the north and upslope. The Okanogan Valley typically experiences precipitation peaks in June and in December/January.

1.6 WATER QUALITY

Streams flowing into the mainstem show high nutrient element (nitrogen and phosphorous) loading, most of which is not immediately available for plant or algal growth. The rate of supply of nutrients that are available to plants and algae for growth appear to be the limiting factor for overall biological production in the Okanogan mainstem lakes. In larger, deeper lakes such as Okanogan Lake, oxygen tends to remain plentiful and is therefore thought to not be a limiting factor.

1.7 FISHERIES RESOURCES IN THE OKANOGAN BASIN

Kokanee is the key species of concern within the Okanogan basin. Currently the number of Kokanee present in Okanogan Lake represent 10% of historical numbers supported by this system. The decline in stocks culminated in the 1995 closure of the Kokanee sport fishery. This decline also led to the formation of the Okanogan Lake Action Plan, the focus of which was to define limiting factors to Kokanee production and to identify and implement remedial measures.

To ensure that streams and riparian corridors within urbanized areas are functioning properly in order to provide habitat for wild fish species, a review of Water Act Compliance can be conducted. The Urban Referral Compliance Evaluation is a Fisheries Renewal BC initiative. Fisheries Renewal BC is a provincial Crown corporation created to revitalize the province's fish resource and the communities that depend on it. The proponents will record the level of compliance for approved and non-approved works in and about urban streams. This evaluation will enable resource users to determine the need for further compliance evaluations and help develop restoration objectives within the urban environment. Several tributaries to the Okanogan basin located within urban areas have undergone such a review; these include Kelowna (Mill), McDougall, and Vernon creeks; however, the results of these assessments are unclear at this time.

Reconnaissance Fish and Fish Habitat Inventories at the 1:20 000 level, have been conducted for several sub-watersheds throughout the Okanogan and Similkameen watersheds. These inventories are intended to determine fish presence or absence, species type, potential barriers to fish, and the overall state of the watershed. Participants of this type of inventory range from forestry companies to First Nations groups to government agencies. These studies have been mainly conducted through the provincial "Forest Renewal BC Program", and are predominantly for sub-watersheds that are slated for forest harvest activities.

Several watershed assessments and sediment source surveys have also been conducted throughout the Okanogan watershed, and to a lesser extent in some areas of the Similkameen watershed. These studies have been mainly conducted through the provincial "Watershed Restoration Program", and are predominantly for sub-watersheds that have previously experienced forest harvest activities. Several significant tributaries to the Okanogan basin have been assessed. In the Similkameen basin, there have been some watershed assessments done, some road condition assessments conducted, and similarly some sediment source and habitat assessments performed; however, its generally been cursory in nature and only a few of the subwatersheds have been assessed. For example, the Ashnola River subwatershed has had a sediment source and channel assessment conducted. Several subwatersheds downstream of Princeton have had work done, while upstream of Princeton little has been done in the way of watershed assessments.

In addition, fish population estimates can be estimated using a Creel Census. The Ocoela Fish and Game Club conducted such a census on Wood Lake, with the purpose of estimating the angler

pressure and effort on the lake and to educate anglers regarding Kokanee conservation strategies and benefits.

The Okanogan Valley is an extended finger of the semi-arid Sonoran Desert ecotype, which has been made much more attractive to fish and humans by a chain of main valley lakes that unfortunately are fed by relatively few tributaries. Many of these streams are ephemeral in nature, connecting to the main system only during spring freshet flows. Of the 46 named tributaries in the Okanogan region, only 20 are known to support either Kokanee salmon or rainbow trout spawning runs.

Kokanee are known to exist in Okanogan and Skaha lakes. Anadromous sockeye are known to spawn just above Lake Osoyoos. No Bull Trout are known to be in the Okanogan watershed on the Canadian side of the border. The tributaries of this watershed are addressed separately (Matthews and Cannings, pers comm).

1.7.1 Artificial Production

Extensive fish stocking has occurred throughout both Okanogan and Similkameen watersheds for several years. Among the species of fish stocked into these areas include Rainbow trout, Kokanee, and Brook trout from a variety of stocks and at different life cycle stages. Not only has fish stocking occurred in the Okanogan and Similkameen mainstems, but in other major tributaries to these rivers including Kelowna (Mill), Mission, Peachland, Penticton, Trepanier, and Vernon Creeks. Records do not indicate any stocking activities in Powers Creek. Other major tributaries in these watersheds have also been stocked.

Artificial production facilities within the Okanogan watershed that have stocked these tributaries in the past include Skaha and Summerland hatcheries. Fraser Valley Hatchery (in the Vancouver lower main land region) has stocked Rainbow trout in the Similkameen watershed.

1.8 RANKINGS OF HABITAT LIMITING FACTORS IN THE OKANOGAN BASIN

Reach break description	Reach 1	Reach 2	Reach 3
	“channelized” from Penticton to US border		
<u>Attribute Considered</u>			
<u>Water Quality</u>			
Dissolved Oxygen	G2		
Stream Temperature	P2		
Turbidity/Suspended Sediment	F2		
Nutrient Loading	F2		
<u>In Channel Habitat</u>			
Fine Sediment (substrate)	DG		
Large Woody Debris	P2		
Percent Pool	P-F2		
<u>Habitat Access</u>			
Fish Passage	F2		
<u>Stream Flow</u>			
Resembles Natural Hydrograph	P2		
Impervious Surface	DG		
<u>Stream Corridor</u>			

Reach break description	Reach 1	Reach 2	Reach 3
Attribute Considered	“channelized” from Pentiction to US border		
Riparian Vegetation	P2		
Stream Bank Stability	G2		
Floodplain Connectivity	P2		

1.8.1 Support for Limiting Habitat Factor Rankings in the Okanogan Basin

Constraints to fish, wildlife, and habitat result from many of the direct and indirect impacts within the basin; many of these impacts and their resolution have cross-border implications. Such impacts include hydroelectric facilities and their operations, water consumption, water management, urban development, infrastructure, agriculture, forestry, water quality, ground disturbances, out right habitat loss, and introduced species.

Dealing with these constraints will require both institutional and technical approaches. The complexity of the jurisdictional arrangements and differences in management objectives within the basin necessitates an extensive and comprehensive process of trans-boundary coordination between federal, state/provincial, and local governments, public utility districts, tribal entities, and other stakeholders. Many good efforts are already underway to facilitate such coordination; but such coordination is still in its infancy, and much remains to be done. The technical component will require an ecosystem-based approach; the issues are often regional and ecologically interconnected. Moreover, the requirements of each life stage must be identified and addressed. Unfortunately, at times we have incomplete data and understanding, which greatly adds to the difficulty of managing the Okanogan basin.

Stream Corridor

The increase in urbanization and agricultural land use in the Okanogan Valley has lead to the development of lands adjacent to lakes and streams within the watershed. To protect valuable land, dyking and channelization of streams has occurred on many stream within the watershed. Most of the meandering length of the Okanogan River between Pentiction and the US border has been converted into a straight channel.

Decline in black cottonwood stands adjacent to streams and lakes within the valley has decreased the amount of large woody debris recruitment potential. In addition, recruitment is poor particularly due to the presence of dykes which remain bare (no planting has occurred on the dykes). Any recruitment of large woody debris at this point is primarily due to beaver activity in the area.

In-channel habitat

Pools are limited to the natural section of the Okanogan River mainstem. Within the channelized section, drop structures and weirs create some artificial pools that may serve as fish habitat.

Spawning habitat is currently not a limiting factor to salmonid production in the Okanogan system. However, unstable hydraulic profiles may limit the amount of accessible spawning habitat or may strand emerging fry. Regulating hydraulic profiles to benefit sockeye has a

negative effect on Kokanee. Off channel rearing habitat in Osoyoos Lake in particular is a problem due to temperature ranges and other external influences.

Water Quality

Dissolved oxygen is not likely to be a limiting factor to salmonid use in the mainstem. There appears to be good mixing by the presence of riffles that allows for oxygen absorption. In larger, deeper lakes such as Okanogan Lake, oxygen tends to remain plentiful and is therefore thought to not be a limiting factor.

Temperature is considered to be an issue. Ranges can be in excess of 26 degrees Celsius which can be lethal to salmonids. Regulatory control of water levels greatly influences the water temperature as water quantity influences temperature. In addition, the limited amount of riparian vegetation does little to provide shade which would also enable a stable water temperature regime to develop. Furthermore, temperature and the amount of dissolved oxygen present in a waterbody are related, and combined can result in negative incubation and migration impacts.

Periodic presence of inorganic debris resulting in water turbidity is not considered to be an issue. Vaseux Creek however does add suspended sediments to the system when flash floods occur. This tributary is the main contributor to fine sediments to the Okanogan mainstem between Osoyoos and Vaseux lakes.

Streams flowing into the mainstem show high nutrient element (nitrogen and phosphorous) loading. However, most of this loading is not immediately available for plant or algal growth. The rate of supply of nutrients that are available to plants and algae for growth appear to be the limiting factor for overall biological production in the Okanogan mainstem lakes. Some management consideration is apparently being given to adding nutrients into the Okanogan system so as to improve production.

No specific data is available for the determination of contaminants within the system, however, inferences from adjacent land use such as agricultural, urbanization, golf courses, and forestry suggest that inputs into the system are quite likely.

2.0 EDUCATION/PUBLIC AWARENESS

Public awareness and involvement in all aspects of restoration and rehabilitation programs is key to the initiation and continued success of these projects. Several attempts have been made within the Okanogan and Similkameen watersheds to inform the public of upcoming and ongoing projects to enhance these areas. Typically in the form of open houses and public forums, other effective methods for passing information to the public include interpretive signage, the Okanogan storm drain marking program, education programs for local schools, volunteer and interest groups, and guided tours of successful enhancement projects.

Installation of interpretive signage has occurred on Kelowna (Mill) and Penticton creeks for example. These signs pertain to issues to do with Okanogan Lake Kokanee and habitat issues within this watershed. A Mission Creek awareness program assembled by the Ministry of Environment, Lands, and Parks included a 12 panel information kiosk and an accompanying brochure to promote fisheries awareness. Another effort to increase public awareness of the importance of Okanogan lake fisheries was produced by the Habitat Conservation Trust Fund in the form of a video, information pamphlet and slide show presentation.

Coordination of school classroom incubation and bank stabilization programs as well as interpretive field trips to the Mission Creek spawning channel educate students on the importance of environmental stewardship and rehabilitation.

Guided educational tours of Peachland Creek explained Kokanee spawning ecology to school groups and the general public.

2.1 PRESENT SUBBASIN MANAGEMENT

2.1.1 Existing goals, objectives and strategies

Management intentions or objectives for fish and wildlife populations including explanation of currently existing management objectives and specific management plans, court orders, permits, etc. from which they are derived; and habitat quality objectives including any federal, tribal, state or county instituted land or water management guidelines, requirements, or restrictions with the objective of protecting fish, wildlife or their habitat; and general methods, approaches, or strategies to achieve these objectives.

Federal, provincial, local municipalities, tribal groups, and public interest groups all manage, regulate, or otherwise are involved in land and water usage within their respective jurisdictions. For the most part, these governing bodies and stakeholders have policies and guidelines to control the demands placed upon the watershed and their mandates include the management of natural resources for society while maintaining a level of protection of water, land, fish, and wildlife resources. Several of these organizations and their mandates are described below.

2.1.2 BC Fisheries (MoFs)

BC Fisheries is a provincial government agency and are directly responsible for the management of the freshwater recreational fisheries, aquaculture activities, marine plant harvesting and for the regulation of the sale, inspection and processing of fish. The province also exercises delegated

authority under the federal Fisheries Act, for the management of the non-salmon freshwater fisheries and wild oyster harvest.

2.1.3 BC Hydro

BC Hydro is the main hydropower generator in BC, and is a crown corporation (owned by government, but operated as a semi-autonomous corporation). BC Hydro's stated goal is "*to provide energy solutions to our customers in an environmentally and socially responsible way*".

2.1.4 BC Ministry of the Environment, Lands and Parks (MELP)

BC MELP is a provincial government agency whose stated mandate is to protect and conserve natural resources, maintain and restore the quality of land, water and air, and manage water resources for the optimum health of humans and all living things, now and for future generations. The ministry supports human social, recreation and settlement needs, environmentally-sensitive economic development and the sustainable use of resources, and seeks to ensure the government receives a fair return for the use of public resources.

2.1.5 BC Ministry of Forests (MoF)

BC MoF is a provincial government agency that strives to encourage maximum timber resource productivity; manage timber resources responsibly to achieve the greatest short- and long-term social benefits; practice integrated resource management; encourage a globally competitive forest industry; and to assert the financial interests of the Crown.

Canada – BC Agreement on the Management of Pacific Salmon Fishery Issues

The Pacific Fisheries Resource Council advises the council of Fisheries Ministers regarding matters of conservation and long term sustainable use of salmon resources and habitat. Both Governments agree to establish a joint Fisheries Renewal Advisory Board, including stakeholder and community representation, to coordinate each government's respective development and delivery of programs in the areas of habitat restoration and salmonid enhancement. The Board would have a mandate to directly involve stakeholders and communities in restoration and enhancement priority setting and in program delivery.

2.1.6 Coho Recovery Plan

Protecting and rebuilding Coho stocks is the key focus of this plan. The major components of the plan are habitat protection and restoration, strategic stock enhancement, stock assessment, enforcement and catch monitoring, and public education. It is unclear whether or not Coho may potentially reach the Canadian portion of the Okanogan watershed, and thus it is unclear if this recovery plan may potentially apply to the Okanogan watershed.

2.1.7 Columbia Basin Trust

The Columbia Basin Trust manages assets, including money allocated by the Province for power projects and other investments, for the ongoing economic, environmental and social benefit of the region, without relieving governments of their obligations. This money comes from a transfer of funds that are provided to the provincial government as part of the "downstream benefits" aspect of the Canada-US Columbia Basin agreement. By investing money in local businesses (including hydroelectric operations) and occasionally in other cultural, educational or ecological activities the Trust promotes development of power projects while maintaining environmental integrity.

2.1.8 Columbia Basin Fish and Wildlife Compensation Program (Canada)

This program that is jointly managed by BC Hydro and BC Ministry of Environment, Lands and Parks and its purpose is to conserve and enhance fish and wildlife populations affected by BC Hydro dams in the Columbia Basin. The Program's primary mandate is to protect and rehabilitate fish, wildlife and their habitats many of which projects they conduct themselves and fund many other projects by other organizations (which they refer to as "partners"). First Nations groups are distinctly one of their target partners. This program does not include the Okanogan basin, but may have some technical expertise of benefit to the current Okanogan watershed program objectives.

2.1.9 Environment Canada

Environment Canada's mandate is to preserve and enhance the quality of the natural environment, including water, air and soil quality. In addition, this government agency strives to conserve Canada's renewable resources, including migratory birds and other non-domestic flora and fauna, and to protect Canada's water resources. As well, Environment Canada enforces the rules made by the Canada – United States International Joint Commission relating to boundary waters, coordinates environmental policies and programs for the federal government. Environment Canada holds authority under the federal Fisheries Act for the management of deleterious substances in aquatic systems.

2.1.10 Fisheries and Oceans Canada (FOC)

Fisheries and Oceans Canada is responsible for policies and programs in support of Canada's economic, ecological and scientific interests in oceans and inland waters. The mandate of the department includes the conservation and sustainable utilization of Canada's fisheries resources in marine and inland waters; for leading and facilitating federal policies and program on oceans; and for safe, effective and environmentally sound marine services responsive to the needs of Canadians in a global economy. FOC is the main agency holding authority under the federal Fisheries Act for the management of fish and fish habitat.

2.1.11 Fisheries Renewal BC

Fisheries Renewal BC is responsible for a wide range of initiatives including promoting the protection, conservation and enhancement of fish stocks and habitat. As well, this program was designed to create jobs in the fisheries sector and to facilitate planning and fisheries-related investments in partnerships with different sectors of the BC fisheries and with BC communities. Developing local infrastructure that will encourage fisheries-related employment and investment in communities and building a multi-skilled workforce in fishing communities is another of this agency's mandates. These goals are achieved by supporting employment, training and technological development and by providing assistance and advice to government on how best to coordinate and deliver fisheries-related programs. Top priorities will be programs for fisheries restoration and enhancement, commercial and recreational fisheries diversification and development, skills training for fisheries workers, community-based fisheries job creation strategies, and development of long-term provincial fisheries renewal strategy.

2.1.12 Forest Renewal BC

Forest Renewal BC develops and implements plans including investments to renew the forest economy of British Columbia by enhancing the productive capacity and environmental values of forest lands, and by creating jobs, providing training for forest workers, and strengthening local

communities that depend on the forest industry. Operational inventories including fish and fish habitat assessments, Watershed Restoration Program (WRP) including identification of impacts and opportunities for improvement, as well as actual restoration projects are among the tools this agency uses to identify areas requiring enhancement.

2.1.13 Habitat Conservation Trust Fund

The Habitat Conservation Trust Fund was set up to pursue habitat preservation, restoration, and enhancement, species conservation, land stewardship, environmental education, or land acquisition. The Fund has an approximate budget of \$5 million Canadian per year that is generated from hunting and fishes license surcharges.

2.1.14 Habitat Restoration and Salmon Enhancement Fund (HRSEP)

The purpose of this fund is to pursue habitat restoration, salmon stock rebuilding, and resource and watershed stewardship.

2.1.15 Kokanee Salmon Heritage Project (Okanogan)

The Kokanee Salmon Heritage Project was developed as a result of the myriad of questions about Kokanee which arose during school and public interpretative talks at the Mission Creek Spawning Channel in Kelowna, BC. The scientific authority for the project is Dr. Peter Dill, a researcher on trout and salmon in Canada for some thirty years and on Kokanee in the Okanogan for the past ten years. Dr. Dill is a biology professor at Okanogan University College.

2.1.16 Okanogan Basin Technical Working Group

A cooperative endeavor between ONA, FOC, and MoFs/MELP to identify and design mitigation measures for impacted sites within the Okanogan Basin. Current activities include restoration works in the Skaha Lake system that is funded by the Douglas County Public Utilities Department.

2.1.17 Okanogan Nations Alliance (ONA)

The Okanogan Nation Alliance has an inherent right and responsibility to enjoy, manage and protect it's peoples, lands, resources and forms of government as stated in the "[Okanogan Nation Declaration](#)" of August 22, 1987. Their mandate is to strive for the advancement, assertion, support and preservation of the Aboriginal Rights of the Okanogan Nation. The ONA promotes protection, enhancement and preservation of the peoples, lands and resources, including fish and wildlife, of the Member Bands.

2.1.18 Provincial Okanogan Lake Action Plan

The Okanogan Lake Action Plan took shape in 1996 after the closure of the Kokanee sport fishery the previous year. The goal of the plan is to identify biological relationships within Okanogan Lake to determine limiting factors to Kokanee production. In addition, the Plan will determine remedial measures that will result in the recovery of the lake's Kokanee population.

2.1.19 Provincial Water Use Planning (WUP)

All water management groups (including BC Hydro) are assessing how to better balance the social, economic, environmental, recreational and power generation uses of water. WUPs will define the operating parameters to be applied in the day to day operations of the facilities in order to meet these goals.

2.1.20 Restructuring Canada's Pacific Fishery

A predominantly federal initiative to protect and restore Pacific fisheries. Includes fisheries and license restructuring, community economic development and adjustment in an attempt to rebuild the fishery resource within the province.

2.1.21 Rebuilding the Resource

A predominantly federal initiative to assist in the protection and restoration of Pacific fisheries. Includes HRSEP and community stewardship groups to develop strategic enhancement of specific stocks of concern.

2.1.22 Salmonid Enhancement Program

A predominantly federal initiative to protect and restore salmonid populations and habitat. The Salmonid Enhancement Program is mainly involved in incubation and rearing programs (including the operation of fish hatcheries). Some habitat improvement activities are conducted by the group as well.

2.1.23 South Okanogan Similkameen Conservation Program (SOSCP)

Run by the Federal Ministry of the Environment, the South Okanogan-Similkameen Conservation Program consists of a large fund that is mainly used for the purchase of land.

2.1.24 Transborder Pacific Salmon Southern Boundary Restoration and Enhancement Endowment Fund

The fund was established under "Pacific Salmon Agreement" between Canada and the USA to enable habitat rehabilitation and fishery enhancement projects to proceed, which will improve opportunities in both countries. As well the fund will allow for improvement in the scientific understanding of factors affecting salmon production in freshwater and marine environments.

2.1.25 Wild Salmon Policy

A predominantly federal initiative to assist in the protection and restoration of Pacific fisheries. The goal of the Wild Salmon Policy is to conserve the long-term viability of Pacific salmon populations and their natural habitats by focussing on the genetic diversity of populations and habitats.

2.2 RESEARCH, MONITORING AND EVALUATION ACTIVITIES

Comprehensive RM&E activities are needed for ongoing projects.

2.2.1 Statement of fish and wildlife needs

Statement of near term fish and wildlife project needs taking into account assessment information and management goals, objectives and strategies

2.2.2 Subbasin recommendations – subbasin teams project review

- Projects and budgets – projects funded by Bonneville proposed for continuation for the next 3 years including an explanation of their relationship to the assessment information, other existing activities, and management goals, objectives and strategies
- Identify new and existing research, monitoring and evaluation activities
- Needed for future actions – additional future efforts needed to achieve objectives to be funded by Bonneville
- Actions by others – additional efforts needed to achieve objectives to be funded by others

2.3 PROJECTS UNDERTAKEN FOR THE OKANOGAN BASIN

2.3.1 Okanogan Basin Projects

Project Name	Description	Lead Proponent	Activity	Description	Term	Location
Okanogan Lake - Mysis Beam Trawl Harvesting Feasibility	In-lake population estimate for mysis shrimp, development of more efficient harvesting techniques, harvest product acceptability, and harvest technique cost benefits.	BC Ministry of Environment Lands and Parks	Inventory – Mapping Stock Assessment	Graphed and mapped seven stations and 75+ trawls 15 kg per 1/2 hour trawl of stock assessed	9-1-99 to 3-1-00	Okanogan Lake
Nicola/Similkameen /Okanogan River Reconnaissance (1:20 000) Fish and Fish Habitat Inventory	1:20K Reconnaissance Fish and Fish Habitat Inventory, performed according to Resource Inventory Committee (RIC) standards	Gorman Brothers Lumber Limited	Inventory - 1:20000 Reconnaissance	1:20K Reconnaissance Fish and Fish Habitat Inventory	4-1-99 to 4-1-00	Okanogan River Watershed
Okanogan Basin- Fish Species Presence and Distribution	Review of existing materials/reports within the Ministry of the Environment, Lands and Parks regional office compiled into one report	Okanogan Nation Fisheries Commission	Other - General	Compilation of data	7-26-99 to 1-31-00	Okanogan lake tributary to the Columbia River near WestBank/ Kelowna
Okanogan Lake Spawning Habitat Construction	Beach gravel moved to below high water mark from above to create Kokanee spawning habitat. Identification of spawning sites during the first year	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement Inventory - Other	Shore spawning habitat created for Kokanee by moving beach gravel to below the high water mark from above the high water mark Spawning sites identified in the first year of the new spawning habitat	4-1-83 to 4-1-84	Okanogan Lake
Okanogan River Habitat Enhancement (86)	Creation of spawning habitat for Kokanee in the Okanogan River channel by scarifying 160 m and excavating and replacing gravel throughout 400 m of the channel	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	160 m of scarification and 400 m of gravel excavation and replacement	4-1-86 to 4-1-87	Okanogan River, near Penticton

Project Name	Description	Lead Proponent	Activity	Description	Term	Location
Okanogan Storm Drain Marking (88)	Implementation of a Storm Drain Marking program in the Okanogan: Coordination of school groups and volunteers, marking of storm drains, and distribution of pamphlets	BC Ministry of Environment Lands and Parks	Other - General	Implementation of a Storm Drain Marking program in the Okanogan: coordination of school groups and volunteers, marking of storm drains, and distribution of pamphlets	4-1-88 to 4-1-89	City of Kelowna, Okanogan region
Okanogan Storm Drain Marking Program (89)	Implementation of a Storm Drain Marking program in the Okanogan: coordination of school groups and volunteers, marking of storm drains, and distribution of pamphlets	BC Ministry of Environment Lands and Parks	Other - General	Coordination of school groups and volunteers, marking of storm drains, and distribution of pamphlets.	4-1-89 to 4-1-90	City of Kelowna

2.3.2 Chute Creek Sub-Basin Projects

Project Name	Description	Lead Proponent	Activity	Description	Term	Location
Nicola/Similkameen /Okanogan River Reconnaissance (1:20 000) Fish and Fish Habitat Inventory	1:20K Reconnaissance Fish and Fish Habitat Inventory, performed according to RIC standards	Gorman Brothers Lumber Limited	A sample based survey covering whole watersheds, providing information regarding fish species distributions, characteristics and relative abundance, and stream reach and lake biophysical characteristics	1:20K Reconnaissance Fish and Fish Habitat Inventory	4-1-99 to 4-1-00	Main Stem + Tributaries

2.3.3 Eneas Creek Sub-Basin

Project Name	Description	Lead Proponent	Activity	Description	Term	Location
Trout & Eneas Creek Watershed Restoration	The Trout Creek watershed drains the Thompson Plateau on the west side of Okanogan Lake near Summerland. The watershed is 744 sq. km in size and ranges from 342 m to 1920 m.	District of Summerland	Restoration - Overview Assessment	An Integrated Watershed Restoration Plan was conducted. The objectives were defined and a summary of findings and recommendations were issued. It contains a Fish Habitat Assessment Procedure, Sediment Source Survey and Access Management Map.	3-1-98 to 3-1-99	Upslope Eneas Creek Watershed

2.3.4 Equisis Creek Sub-basin

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Equesis/Naswhito/Whiteman Creek Fish Habitat and Passage Assessments	Habitat assessment for approx. 8km	Okanogan Nation Fisheries Commission	Habitat Assessment	Assessment of the quality of fish habitat and the diversion structures for ease of fish passage, according to Level 1 fish and fish habitat assessment methods	11-22-99 to 3-31-00	Main Stem + Tributaries
Naswhito Creek Watershed Restoration	The Naswhito Creek watershed is a tributary to Okanogan Lake situated approximately 20km west of Vernon. The watershed area is approximately 80 sq. km.	Riverside Forest Products Limited	Restoration - Overview Assessment	Overview fish habitat assessment procedure conducted for the Equesis, Naswhito, Whiteman and Shorts watersheds. The objective of this report was to assess the present condition of watersheds by reviewing historical fish studies, forest harvesting, water quality and discharge, maps and airphotos.	4-25-97 to 4-25-98	Main Stem + Tributaries

2.3.5 Kelowna Creek Sub-basin

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Kelowna Creek Watershed Restoration	Forest Renewal BC (FRBC) has funded the restoration of the Kelowna Creek Watershed which is located approximately 20 km NE of the City of Kelowna. The area is approx. 7900 ha and has been used historically for irrigation, recreation and timber harvesting. This was a joint project and the Vernon District office has the same report with a different number. In Vernon it is FRBC project #KA34-96-006. Also includes FRBC project #TOM98242.	Glenmore-Ellison Improvement District	Restoration - Overview Assessment	Includes 7 different sub activities. They are a Level I Interior Watershed Assessment Procedure (IWAP), Summary report for Level I Road Assessment in Kelowna Creek, Postill Lake Road- Preliminary Level II Rehabilitation Plan, Results of Gully Assessment Procedure, Results of Channel Assessment Procedure and Results of Riparian Vegetation Assessment.	3-1-96 to 3-1-97	Upslope, Watershed; Kelowna Creek
Kelowna (Mill) Creek Watershed Restoration	Part of Forest Renewal British Columbia's Watershed Restoration Program, the Kelowna (Mill) Creek watershed is located approximately 20 km northeast of the city of Kelowna, BC The watershed area is approximately 7,900 ha. The watershed has been used historically for irrigation, recreation, and timber harvesting. The Kelowna Creek watershed has been divided into 5 sub-units: Bulman, Conroy, Postill, South, and Residual. Mill Creek is now the official name for Kelowna Creek.	Glenmore-Ellison Improvement District	Restoration - Overview Assessment	Update Equivalent Clearcut Area (ECA) calculations; - update the watershed report card; - provide a risk assessment of the potential hydrologic impacts associated with the proposed forest development for the period of 1998 to 2003 and; - initial and final Watershed Assessment Committee (WAC) meetings to discuss and make recommendations for the proposed forest development plans.	12-1-98 to 12-1-99	Riparian, Stream, Upslope
			Restoration - Overview Assessment	Access Management Strategy (AMS). Options to be considered: - ongoing maintenance for continued use and; - deactivation measures ranging from temporary to permanent with full rehabilitation to leaving the road as is, if stable.	10-28-96 to 10-28-97	Upslope
			Restoration - Overview Assessment	Stream channel assessment work. The purpose of the channel assessment procedure was to identify significant	6-1-97 to 6-1-98	Riparian, Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
				changes to stream channels that appear to be the result of past logging activities. A total of 10 sites were assessed in the 1995/96 field seasons. Five sites were found to be requiring remedial work.		
			Restoration - Detailed Assessments and Prescriptions	Level II Road Assessments carried out for selected roads and hillslopes identified as having high priority hazards within the Kelowna Creek Watershed. A total of 10 roads were assessed in October, 1996, nine of which require remedial work which could be completed in November, 1996, if conditions are appropriate. The prescriptions for the nine roads in this report should be considered temporary due to the presence of snow at the time of inspection.	11-1-96 to 11-1-97	Upslope
			Restoration – Other	Reconnaissance survey undertaken by Tolko Industries Ltd. to relocate sections of the Postill Lake / Kelowna Creek Road to minimize adverse road sections and debris deposition from road maintenance into Kelowna Creek. An additional report under separate cover is also available which provides field notes as well as site and aerial photos.	8-1-97 to 8-1-98	Upslope
			Restoration - Effectiveness Monitoring & Evaluation	Collection of water quality data in 1995 from the Kelowna Creek watershed. The water quality monitoring portion of this Watershed Restoration Project was conducted between April 5, 1995 and August 30, 1995. Samples were taken at 11 sites and each sample was tested for ten	2-8-96 to 2-8-97	Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
				parameters. The monitoring program will provide data to assist with determining the impacts of timber harvesting on water quality and to evaluate the effectiveness of any remedial work undertaken		
			Restoration - Upslope Restoration / Rehabilitation	The components of the Kelowna Creek watershed assessment are: - Level I Watershed Assessment; - Level I Road Condition Assessment; - Level II Road Assessment and; - Gully Assessment.	3-1-96 to 3-1-97	Riparian, Stream, Upslope
Kelowna Creek Watershed Restoration Plan (WRP)	Kelowna Creek watershed is located approximately 20 km NE of the City of Kelowna. The area is approx. 7900 ha and has been used historically for irrigation, recreation and timber harvesting.	Riverside Forest Products Limited	Restoration - Overview Assessment	This report contains an introduction, methods, current watershed conditions, risks of future development, conclusions and recommendations. There is a map of the area.	12-1-98 to 12-1-99	Upslope
Lower Mill Creek Watershed Restoration Project	Habitat Restoration; 450 m of streambank stabilized, 450 m of instream complexing and 1400 m of riparian planting. Education; project open houses for public and senior staff and two newspaper articles published.	City of Kelowna	Restoration - Instream Restoration / Rehabilitation		8-1-99 to 10-15-99	Stream
Snehumpton Creek- Fish Absence/Presence Inventory and Preliminary Habitat Assessment	Completion of a fish absence/presence site reconnaissance inventory in the lower reaches of Snehumpton Creek for purposes of gathering baseline data	Lower Similkameen Indian Band	Assessment - Habitat Assessment	Approx. 4 km of stream treated. Report completed of fish inventory and preliminary habitat assessment.	8-1-99 to 1-31-00	Stream
Mill Creek Interpretive Signage	Education/public awareness; installation of four interpretive signs	City of Kelowna	Other - General	Installation of four interpretive signs.	10-1-99 to 3-31-00	Stream
Kelowna/McDougall/Vernon Creeks Urban Referral Compliance	Review of Water Act compliance and applications for 4 urban creeks	Penticton Indian Band/Columbia Environmental Consulting	Inventory – Urban	4 urban creeks reviewed for the level of compliance to the Water Act for all approved and non-approved works in and about the streams.	2-1-99 to 3-31-00	Riparian, Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Evaluation						
Okanogan Storm Drain Marking (88)	Implementation of a Storm Drain Marking program in the Okanogan: Coordination of school groups and volunteers, marking of storm drains, and distribution of pamphlets	BC Ministry of Environment Lands and Parks	Other - General	Same as project description.	4-1-88 to 4-1-89	City of Kelowna
Kelowna (Mill) Creek Enhancement	Planning and identification of potential enhancement projects for spawning habitat with public involvement, following the construction of a flood control project	BC Ministry of Environment Lands and Parks	Restoration - Assessment & Planning	Planning and identification of potential enhancement projects for spawning habitat of Kokanee	4-1-88 to 4-1-89	Stream

2.3.6 Lambly Creek Sub-basin

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Lambly Creek Watershed Restoration	The Lambly Creek watershed is a community watershed located on the west shore of Okanogan Lake northwest of Kelowna. Elevation ranges from 324 m to 1800 m. Dams regulate flow into Lambly Creek. Its area is approx. 24410 ha. Access into the watershed is excellent.	Riverside Forest Products Limited	Restoration - Overview Assessment	An Integrated Watershed Restoration Plan (IWRP). An activity report was written.	12-1-97 to 12-1-98	Upslope
			Restoration - Overview Assessment	An Interior Watershed Assessment Procedure (IWAP). An activity report was written.	12-1-97 to 12-1-98	Upslope
			Restoration - Overview Assessment	This is an Access Management Strategy. An activity report was written.	12-1-97 to 12-1-98	Upslope
			Restoration - Overview Assessment	A Fish Habitat Assessment Procedure was conducted. An activity report was written.	10-1-96 to 10-1-97	Stream
			Restoration - Overview Assessment	A Sediment Source Survey was conducted. An activity report was written.	12-1-97 to 12-1-98	Upslope
			Restoration - Overview Assessment	These are the final Watershed Assessment Committee (WAC) recommendations. The objective of this report is to provide information regarding both the current watershed condition and the risks associated with proposed forest development.	11-1-98 to 11-1-99	Upslope
Tadpole Lake Water Storage	Collection of information and development of a plan for sharing water storage in Tadpole Lake with Westbank Irrigation District.	BC Ministry of Environment Lands and Parks	Other - General	Collection of information and development of a plan for sharing water storage in Tadpole Lake with Westbank Irrigation District to secure minimum flow for Powers Creek to increase Kokanee numbers	4-1-88 to 4-1-89	Lake, Stream

2.3.7 Mission Creek Sub-basin

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Mission Creek Watershed Restoration	Mission Creek watershed is 858 sq. km in area with elevations ranging from 342 m at its confluence with Okanogan Lake to a max of 2,171 m at the summit of Little White Mountain. Mission Creek is the largest tributary of Okanogan.	BC Ministry of Environment Lands and Parks	Restoration - Overview Assessment	This activity includes three sections 1) Integrated Watershed Restoration Plan (IWRP), 2) Access Management Strategy (AMS), and 3) Interior Watershed Assessment (IWAP). The result of the assessment work that has been carried out in the watershed provides recommendations for the subsequent phases involving prescription work and restoration. Watershed-level planning objectives and an access management strategy was produced.	3-1-97 to 3-1-98	Upslope
Kelowna Education, Streamkeeper, and Habitat Project Coordination	Coordination of school classroom incubation, Streamkeepers, bank stabilization, interpretive fieldtrips. Project involves numerous community organizations.	City of Kelowna	Other – General	Project coordination to enhance Kokanee.	1-1-96 to 1-1-97	Stream
			Enhancement - Fish Culture Activities	Enhance kokanee	1-1-96 to 1-1-97	Stream
			Restoration - Riparian Restoration / Rehabilitation	Enhance kokanee	1-1-96 to 1-1-97	Riparian, Stream
			Restoration - Riparian Restoration / Rehabilitation	Enhance kokanee	1-1-96 to 1-1-97	Riparian, Stream
Okanogan Timber Supply Area (TSA) Small Lakes Inventory	1:20K reconnaissance lake inventory	BC Ministry of Environment Lands and Parks	Inventory - 1:20000 Reconnaissance	1:20K Lake Reconnaissance F+FH Inventory	4-1-98 to 4-1-99	Lake+ tributaries
Mission Creek Kokanee Habitat Enhancement	Planning phase for water management and fish enhancement goals for the lower 8km of Mission Creek	Okanogan University College	Other - General	Planning to increase spawning habitat capacity for Kokanee	2-1-99 to 3-31-00	Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Mission Creek Spawning Channel Improvements	The existing 1000 m long diversion channel improved for spawning Kokanee: existing intake structures realigned, gravel placed, and channel regraded.	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	Improvements to the existing 1000 m long diversion channel for spawning Kokanee: existing intake structures realigned, gravel placed, and channel regraded	4-1-99 to 4-1-00	Stream
Kelowna/Nelson Spawning Gravel Cleaning Equipment Tests	UBC testing and evaluations of gravel cleaning equipment which remove fine sediments from spawning substrates through hydraulic agitation and suction discharge.	BC Ministry of Environment Lands and Parks	Assessment - Other	UBC testing and evaluations of gravel cleaning equipment which remove fine sediments from spawning substrates through hydraulic agitation and suction discharge	4-1-88 to 4-1-89	Kelowna region
Okanogan Storm Drain Marking Program (89)	Implementation of a Storm Drain Marking program in the Okanogan: coordination of school groups and volunteers, marking of storm drains, and distribution of pamphlets	BC Ministry of Environment Lands and Parks	Other - General	Coordination of school groups and volunteers, marking of storm drains, and distribution of pamphlets	4-1-98 to 4-1-99	City of Kelowna
Mission Creek Spawning Channel Evaluation (90)	Evaluation of spawning channel enhancements with estimates of Kokanee egg to fry survival rates.	BC Ministry of Environment Lands and Parks	Assessment - Habitat Assessment	Evaluation of spawning channel enhancements with estimates of Kokanee egg to fry survival rates.	4-1-90 to 4-1-91	Stream
Mission Creek Spawning Channel Evaluation (91)	Enumeration of fry and adult Kokanee to assess effectiveness of the spawning channel.	BC Ministry of Environment Lands and Parks	Assessment - Habitat Assessment	Enumeration of fry and adult Kokanee to assess effectiveness of the spawning channel	4-1-91 to 4-1-92	Stream
Mission Creek Spawning Channel Evaluation (92)	Enumeration of fry and adult Kokanee to assess effectiveness of the spawning channel	BC Ministry of Environment Lands and Parks	Assessment - Habitat Assessment	Enumeration of fry and adult Kokanee to assess effectiveness of the spawning channel	4-1-92 to 4-1-93	Stream
Mission Creek Spawning Channel Evaluation (93)	Final year of fry output studies. Required to firm up egg-fry survival estimator for Okanogan spawning	BC Ministry of Environment Lands and Parks	Assessment - Stock Assessment	Final year of fry output studies	4-1-93 to 4-1-94	Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
	channels					
Mission Creek Awareness	Construct a 12-panel information kiosk, and prepare a brochure to promote fisheries awareness.	BC Ministry of Environment Lands and Parks	Other - General	Construct a 12-panel information kiosk, and prepare a brochure to promote fisheries awareness.	4-1-89 to 4-1-90	Main Stem + Tributaries

2.3.8 Naramata Creek Sub-basin

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Naramata Creek Watershed Restoration	The project area is located 15 km northeast of the City of Penticton and consists of three watersheds: Naramata Creek, Robinson Creek, and Upper Chute Creek. Naramata watershed has an area of 2931 ha and is used for both domestic and irrigation purposes.	Gorman Brothers Lumber Limited	Restoration - Detailed Assessments and Prescriptions	Summarizes the results of a surface and ground water hydrology assessments carried out in the Naramata watersheds. Primary concern is the impact of forest development on water quality and quantity due to ongoing infestations of mountain pine beetle and spruce bark beetle.	11-1-96 to 11-1-97	Stream
			Restoration - Overview Assessment	An Integrated Watershed Restoration Plan including a Sediment Source Survey (SSS) and Access Management Plan for the Naramata-Robinson-Chute Creek was conducted. The SSS has identified 3 high, 3 moderate and 13 low priority sites for rehabilitation. Access management maps have recommended 15 km of roads to be permanently deactivated.	12-1-97 to 12-1-98	Upslope
			Restoration - Detailed Assessments	This activity produced the prescriptions for the priority sites notes in Contract #DPE-WRP-98-GORMANS-1 in the Naramata Creek Watershed.	9-1-98 to 9-1-99	Upslope
			Restoration - Detailed Assessments	A geological engineering assessment of possible landslide was conducted in the Naramata Creek Watershed.	7-1-97 to 7-1-98	Upslope
			Restoration - Detailed Assessments	Naramata Creek and Robinson Creek are tributaries of Okanogan Lake.	12-1-95 to 12-1-96	Stream
			Restoration - Overview Assessment	Report type - Channel Assessment: The objectives of this report are to: Videotape and provide audio commentary of the streams, review video and identify sites as being potentially degraded, conduct ground truthing, review existing literature, compile an inventory of sediment sources to each stream, collect anecdotal info on the streams, prioritize degraded	12-1-95 to 12-1-96	Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
				streams, and to identify and recommend further assessment procedures.		
Nicola/Similkameen/ Okanogan River Reconnaissance (1:20 000) Fish and Fish Habitat Inventory	1:20K Reconnaissance Fish and Fish Habitat Inventory, performed according to the Resource Inventory Committee (RIC) standards	Gorman Brothers Lumber Limited	Inventory - 1:20000 Reconnaissance	1:20K Reconnaissance Fish and Fish Habitat Inventory	4-1-99 to 4-1-00	Main Stem + Tributaries

2.3.9 Naswhito Creek Sub-basin

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Equesis/Naswhito/Whiteman Creek Fish Habitat and Passage Assessments	Habitat assessment for approx. 8km	Okanogan Nation Fisheries Commission	Assessment - Habitat Assessment	Assessment of the quality of fish habitat and the diversion structures for ease of fish passage, according to Level 1 fish and fish habitat assessment methods.	11-22-99 to 3-31-00	Stream
Naswhito Creek Watershed Restoration	The Naswhito Creek watershed is a tributary to Okanogan Lake situated approximately 20 km west of Vernon. The watershed area is approximately 80 sq. km.	Riverside Forest Products Limited	Restoration - Upslope Restoration / Rehabilitation	Summary of implemented work at a failure on Browns Creek Forest Service Road. A summary report of road deactivation prescriptions in the watershed and road relocation and road upgrade for the Browns Creek Forest Service Road.	3-1-98 to 3-1-99	Upslope
			Restoration - Overview Assessment	Overview of the fish habitat assessment procedure conducted for the Equesis, Naswhito, Whiteman and Shorts watersheds. Assess the present condition of watersheds by reviewing historical fish studies, forest harvesting, water quality and discharge, maps and airphotos. The watersheds are located on the west side of Okanogan Lake, west of Vernon, BC	4-25-97 to 4-25-98	Stream
			Restoration - Overview Assessment	The results of the interior watershed assessment procedure conducted on the Naswhito Creek Watershed. Document watershed characteristics and conditions, and to determine the potential for cumulative hydrologic impacts that may be associated with past forest development in the watersheds.	12-1-98 to 12-1-99	Upslope

2.3.10 Peachland Creek Sub-basin Projects

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Peachland Creek and Trepanier Creek Watershed Restoration	The Peachland and Trepanier Creeks lie within two adjacent watersheds and are located on the west side of Okanogan Lake by Peachland, BC. Both watersheds are currently under forest licenses to Riverside Forest Products Limited, Gorman Brothers Lumber Ltd. and the Small Business Forest Enterprise Program.	District of Peachland	Restoration - Overview Assessment	The purpose of the Interior Watershed Restoration Plan (IWRP) activity is to integrate the results of the Sediment Source Survey, Access Management Strategy, Fish Habitat Assessment Procedure and Interior Watershed Assessment Procedure to recommend an action plan for the prescription phase.	2-1-98 to 2-1-99	Upslope
			Restoration - Overview Assessment	This activity outlines the results of the overview Sediment Source Survey work carried out as part of phase two of the Integrated Watershed Restoration Plan on the Peachland/ Trepanier watersheds.	2-1-98 to 2-1-99	Riparian, Stream, Upslope
			Restoration - Overview Assessment	Access Management Plan: identify the current and proposed future uses of all roads on the watershed based on the needs of stakeholders and other users. Deactivation strategies were proposed for roads where use is suspended for up to three years or more.	2-1-98 to 2-1-99	Upslope
			Restoration - Overview Assessment	Fish Habitat Assessment: This report contains an introduction to the study area with description, methodology section, extensive results and discussion section including fish habitat assessment and fish distribution assessment for both watersheds and a final recommendations section detailing each watershed.	5-29-97 to 5-29-98	Stream
			Restoration - Overview Assessment	Level 1 Coastal or Interior Watershed Assessment Procedure (CWAP or IWAP).	9-1-97 to 9-1-98	Stream
			Restoration - Overview Assessment	Terrain Stability.	1-22-99 to 1-22-00	Upslope

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Peachland Creek Kokanee Spawning Enhancement (86)	Enhancement of Kokanee spawning habitat by constructing 300 sq. m of gravel platforms upstream from previous enhancement activities.	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	Construction of 300 sq. m of gravel platforms upstream from previous enhancement activities for kokanee.	4-1-86 to 4-1-87	Stream
Peachland Creek Kokanee Spawning Enhancement (87)	Enhancement of Kokanee spawning habitat by constructing more gravel platforms, cleaning sediment basins, and removing excess debris. Also, eggs collected and Kokanee spawners enumerated.	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	More gravel platforms constructed, sediment basins cleaned, and excess debris removed	4-1-87 to 4-1-88	Stream
			Enhancement - Fish Culture Activities	Kokanee eggs collected	4-1-87 to 4-1-88	Stream
			Assessment - Stock Assessment	Enumeration of Kokanee spawners	4-1-87 to 4-1-88:	Stream
Peachland Creek Tours (88)	Educational tours of Kokanee spawning ecology prepared and conducted for school groups and the public.	BC Ministry of Environment Lands and Parks	Other - General	To appropriately conserve and, where necessary, enhance wild fish populations and their habitats.	4-1-88 to 4-1-89	Lake, Stream
Peachland Creek Kokanee Spawning Enhancement (88)	Maintenance and evaluation of previous projects: gravel platforms, siltation control measures, incubation boxes. Construction of an enumeration fence and collection of Kokanee eggs.	BC Ministry of Environment Lands and Parks	Restoration - Effectiveness Monitoring & Evaluation	To appropriately conserve and, where necessary, enhance wild fish populations and their habitats.	4-1-88 to 4-1-89	Stream
			Inventory – Escapement	Collection of Kokanee eggs	4-1-88 to 4-1-89	Stream
			Enhancement - Fish Culture Activities	Kokanee eggs collected	4-1-88 to 4-1-89	Stream
Peachland Creek Kokanee Spawning Enhancement (89)	Maintenance of gravel platforms, siltation control measures, and	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	Maintenance of gravel platforms, siltation control measures, and incubation boxes.	4-1-89 to 4-1-90	Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
	incubation boxes. Evaluations of previous projects by assessing Kokanee fry.		Assessment - Stock Assessment	Evaluation of previous projects by assessing Kokanee fry.	4-1-89 to 4-1-90	Stream
			Assessment - Stock Assessment	Evaluation of previous projects by assessing Kokanee fry	4-1-89 to 4-1-90	Stream
Peachland Creek Kokanee Spawning Enhancement (90)	Maintenance of gravel platforms, and incubation boxes, and control of siltation. Previous projects evaluated by assessing Kokanee fry.	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	Maintenance of gravel platforms and incubation boxes, and control of siltation	4-1-90 to 4-1-91	Stream
			Assessment - Stock Assessment	Evaluation of previous projects by assessing Kokanee fry	4-1-90 to 4-1-91	Stream
			Assessment - Stock Assessment	Evaluation of previous projects by assessing Kokanee fry	4-1-90 to 4-1-91	Stream
Peachland Creek Kokanee Spawning Enhancement (91)	Gravel platforms maintained, siltation controlled, and rock weirs repaired. Previous projects evaluated by assessing Kokanee fry.	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	Gravel platforms maintained, siltation controlled, and rock weirs repaired.	4-1-91 to 4-1-92	Stream
			Assessment - Stock Assessment	Assessment of Kokanee fry to evaluate previous projects	4-1-91 to 4-1-92	Stream
Peachland Creek Tours (89)	Preparation and follow through of educational tours of Kokanee spawning ecology for school groups and the public.	BC Ministry of Environment Lands and Parks	Other - General	Educational tours of Kokanee spawning ecology prepared and conducted for school groups and the public.	4-1-89 to 4-1-90	Stream
Peachland Creek Erosion Control	Construct a series of check dams to minimize siltation in the creek and to stabilize the entire	BC Ministry of Environment Lands and Parks	Restoration - Instream Restoration / Rehabilitation	Construct a series of check dams to minimize siltation in the creek and to stabilize the entire gully, which is used by Kokanee.	4-1-89 to 4-1-90	Main Stem of Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
	gully that is used by Kokanee.					
Peachland Creek Erosion Control	Construct a series of check dams to minimize siltation in the creek and to stabilize the entire gully, which is used by Kokanee	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	Construct a series of check dams to minimize siltation in the creek and to stabilize the entire gully, which is used by Kokanee	4-1-90to 4-1-91	Stream

2.3.11 Pentincton Creek Sub-basin Projects

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Hedley / McNulty / Cahill / Winters Creek Watershed Restoration	Part of Forest Renewal British Columbia's Watershed Restoration Program, the study area contains the Hedley / McNulty Creek Watershed, the Cahill Creek Watershed and Winters Creek Watershed that together have an area of about 600 sq. km. The study area is located on the Thompson Plateau northeast of the town of Hedley, and north of the Similkameen River valley and Highway 3 between Princeton and Keremeos in southern BC	Weyerhaeuser Canada Limited	Restoration - Overview Assessment	The purpose of the Access Management Strategies (AMS) is to identify the current and proposed future uses of all roads in the watershed based on the needs of stakeholders and other watershed users.	2-1-98 to 2-1-99	Upslope
			Restoration - Overview Assessment	The objective of the Fish Habitat Assessment Procedure (FHAP) was to assess, restore, protect and maintain aquatic and fish habitats that have been impacted by forestry practices.	5-1-97 to 5-1-98	Stream
			Restoration - Overview Assessment	Integrate results from the Sediment Source Survey (SSS), Access Management Strategy (AMS), Fish Habitat Assessment Procedure (FHAP), and Interior Watershed Assessment Procedure (IWAP).	2-1-98 to 2-1-99	Stream, Upslope
			Restoration - Overview Assessment	Resource Report with: Watershed Assessment Procedure Details, IWAP Report Cards, IWAP Forms and round table minutes.	2-1-98 to 2-1-99	Upslope
			Restoration - Overview Assessment	Outlines the Sediment Source Survey (SSS) work carried out as part of Phase 2 of the Integrated Watershed Restoration Plan.	2-1-98 to 2-1-99	Upslope
			Restoration - Overview Assessment	The terrain stability mapping was conducted at Terrain Survey Intensity Level C. It incorporated detailed terrain stability information and interpretations to be used by forest planners to identify areas that require on-site assessments of terrain stability prior to the approval of road construction, cutblock boundaries, timber harvesting methods and silvicultural systems.	11-1-98 to 11-1-99	Upslope
			Restoration - Detailed Assessments	Prescriptions for the priority sites noted in Contract #98-WRP-Prescriptions for the Penticton, Shuttleworth, and Vaseux Watersheds.	9-1-98 to 9-1-99	Upslope

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Penticton Creek Interpretive Signage Project	4 interpretive signs designed and developed. Signs pertain to issues to do with Okanogan Lake Kokanee and habitat issues on Penticton Creek.	Penticton Flyfishers	Other - General	Education: design and development of 4 signs to do with issues of Okanogan Lake Kokanee and habitat issues on Penticton Creek.	11-22-99 to 3-15-00	Lake, Stream
Penticton Creek Resting and Leaping Pool	Improvement of fish ladder to provide access to an additional 0.6 km of stream	Penticton Flyfishers	Restoration - Restore Fish Passage	Improvement of fish ladder to provide access to an additional 0.6 km of stream	11-22-99 to 3-15-00	Stream

2.3.12 Powers Creek Sub-basin Projects

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Powers Creek Screening	Replacement of an existing unscreened diversion with a screened irrigation diversion to prevent migrating Rainbow trout fry from becoming trapped in an irrigation canal.	BC Ministry of Environment Lands and Parks	Enhancement - Barrier Modification / Obstruction Removal	Replacement of an existing unscreened diversion with a screened irrigation diversion.	4-1-86 to 4-1-87	Stream
Powers Creek Fishway Construction	Construction of a fishway to assist Kokanee in bypassing a rock obstruction and reaching their spawning habitat	BC Ministry of Environment Lands and Parks	Enhancement - Barrier Modification / Obstruction Removal	Construction of a fishway to assist Kokanee in bypassing a rock obstruction and reaching their spawning habitat	4-1-86 to 4-1-87	Stream
Tadpole Lake Water Storage	Collection of information and development of a plan for sharing water storage in Tadpole Lake with Westbank Irrigation District to secure minimum flow for Powers Creek	BC Ministry of Environment Lands and Parks	Other - General	Collection of information and development of a plan for sharing water storage in Tadpole Lake with Westbank Irrigation District to secure minimum flow for Powers Creek	4-1-88 to 4-1-89	Lake, Stream

2.3.13 Robinson Creek Sub-basin Projects

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Robinson Creek Riparian Fencing	Fencing construction was completed for 2 km	Naramata Citizens Association	Restoration - Other	Habitat restoration for 2 km; fencing construction completed.	4-1-99 to 4-1-00t	Riparian
Naramata Creek Watershed Restoration	The project area is located 15 km northeast of the City of Penticton and consists of three watersheds: Naramata Creek, Robinson Creek, and Upper Chute Creek. Naramata watershed has an area of 2931 ha and is used for both domestic and irrigation purposes.	Gorman Brothers Lumber Limited	Restoration - Detailed Assessments & Prescriptions	Naramata Creek and Robinson Creek are tributaries of Okanogan Lake. A resource report was written for these areas.	12-1-95 to 12-1-96	Stream
			Restoration - Overview Assessment	Report type - Channel Assessment: The objectives of this report are to: Videotape and provide audio commentary of the streams, review video and identify sites as being potentially degraded, conduct ground truthing, review existing literature, compile an inventory of sediment sources to each stream, collect anecdotal info on the streams, prioritize degraded streams, and to identify and recommend further assessment procedures.	12-1-95 to 12-1-96	Stream

2.3.14 Similkameen River Sub-basin Projects

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Tulameen Main Line Watershed Restoration	This watershed is 1,780 sq. km in size and is located in southwestern BC, 299 km east of Vancouver. The western portion of the watershed is located in the Cascade Mountains, while the eastern portion is situated within the Thompson Plateau. Elevation in the watershed range between 600 and 2300 m.	Tolko Industries Limited	Restoration - Overview Assessment	Report type - Channel Assessment: This report contains an introduction and background information, objectives, methods of assessment results and summary. The appendices include filed notes, photo plates, photo documentation forms 1 and 2, water survey of Canada stream flow data, water licenses and watershed maps. (Please note that this is a draft copy and none of the appendices are present).	2-1-99 to 2-1-00	Stream
Nicola/Similkameen/Okanogan River Reconnaissance (1:20 000) Fish and Fish Habitat Inventory	1:20K Reconnaissance Fish and Fish Habitat Inventory, according to Resource Inventory Committee (RIC) standards	Gorman Brothers Lumber Limited	Inventory - 1:20000 Reconnaissance	1:20K Reconnaissance Fish and Fish Habitat Inventory	4-1-99 to 4-1-00	Main Stem + Tributaries
Merritt Timber Supply Area (TSA) Enhanced Forestry	1:20K Reconnaissance Fish and Fish Habitat Inventory, according to Resource Inventory Committee (RIC) standards	Weyerhaeuser Canada Limited	Inventory - Other	1:20K Reconnaissance Fish and Fish Habitat Inventory; Planning only	4-1-96 to 4-1-97	Stream
Tolko Multi Activity Land-Based 1996	1:20K Reconnaissance Fish and Fish Habitat Inventory, according to Resource Inventory Committee (RIC) standards	Tolko Industries Limited	Inventory - 1:20000 Reconnaissance	1:20K Reconnaissance Fish and Fish Habitat Inventory	4-1-96 to 4-1-97	Stream
Tulameen River Watershed	The Tulameen Watershed is located approximately	BC Ministry of Environment	Restoration - Overview	Channel Assessment.	4-1-99 to 4-1-00	Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Restoration	200 km east of Vancouver, BC in the Merritt Forest District, between Hope and Princeton, north of Manning Park and south of Merritt. The watershed is about 1780 sq. km in size. The western portion of the Tulameen watershed is located within the Cascade Mountains, while the eastern portion is situated within the Tulameen plateau.	Lands and Parks	Assessment			
			Restoration - Overview Assessment	Overview channel assessment for the Tulameen watershed. The objectives of this report were to determine how historic land use practices have affected stream channel processes in the watershed. The Tulameen Watershed is located approximately 200 km east of Vancouver, BC The watershed is about 1780 sq. km in size. The western portion of the Tulameen watershed is located within the Cascade Mountains, while the eastern portion is situated within the Tulameen plateau	4-1-97 to 4-1-98	Stream
			Restoration - Detailed Assessments & Prescriptions	Stream assessment conducted for the Tulameen River. The objective of this report was to compile existing historical information to identify factors that limit fish production and water quality in the watershed, and to determine trends in habitat quality in the watershed.	7-1-97 to 7-1-98	Stream
			Restoration - Effectiveness Monitoring & Evaluation	Stream restoration works, surveys, assessments and prescriptions which have taken place in the past year (1997). The objective of this work is to restore the streams to pre development conditions.	3-2-98 to 3-2-99	Stream
			Restoration - Detailed Assessments and Prescriptions	Fish habitat rehabilitation prescriptions for the Granite Creek sub basin of the Tulameen River watershed. The objectives of these prescriptions are to stabilize stream banks and channels, create enhanced fish habitat in streambeds and reduce sediment delivery into the water system.	9-1-98 to 9-1-99	Riparian, Stream, Upslope
Ashnola River Watershed Restoration	The Ashnola River watershed lies on the Thompson Plateau and is bordered to the south by the Canada USA border. The objectives of this	Lower Similkameen Indian Band	Restoration - Overview Assessment	Level 1 Coastal or Interior Watershed Assessment Procedure (CWAP or IWAP): This report outlines the interior watershed assessment procedure for the Ashnola River Watershed. The objectives of this report were to determine the potential for any cumulative hydrologic impacts resulting from past forest	4-1-98 to 4-1-99	Riparian, Stream, Upslope

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
	<p>project were to restore the watershed to some level of pre harvest activity, including: reestablishing natural hydrology and drainage patterns, revegetation plans and rehabilitating gullies and landslides for reclamation and visual quality purposes. Activities to accomplish work includes: road deactivation, road rehabilitation or bioengineering.</p>		<p>Restoration - Overview Assessment</p>	<p>development. The Ashnola River watershed lies on the Thompson Plateau and is bordered to the south by the Canada USA border. It flows northwest into the Similkameen River, and drains an area of 879.3 ha.</p> <p>Sediment Source Survey. An overview Channel Assessment Procedure was conducted on the channel morphology of selected streams within the Ashnola River watershed and a sediment source survey evaluated potential sediment sources from roads, cutblocks and natural sources including landslides.</p>	<p>1-1-98 to 1-1-99</p>	<p>Stream</p>
<p>Arrastra Creek Watershed Restoration</p>	<p>The watershed is located 40 km SW of Princeton, BC and encompasses 150 sq. km which drains the east side of the Cascade Mountains into Granite Creek, Tulameen and eventually Similkameen Rivers. The watershed had been modified through timber harvesting and livestock free ranging. This area is also heavily used for recreation.</p>	<p>First Nations of Okanogan-Similkameen Environmental Protection Society</p>	<p>Restoration - Instream Restoration / Rehabilitation</p>	<p>Report type - In Stream & Off Channel Rehabilitation: This report contains executive summary, background, watershed characteristics, project design, implementation summary and recommendation for future work. There are some tables and figures as well as photos and diagrams</p>	<p>11-1-98 to 11-1-99</p>	<p>Stream</p>
<p>Granite Creek Watershed Restoration</p>	<p>The watershed is located in the Penticton Forest District west of Princeton, BC and drains into the Tulameen River.</p>	<p>Ardeu Wood Products Ltd.</p>	<p>Restoration - Instream Restoration / Rehabilitation</p>	<p>Resource Report.</p>	<p>2-1-99to 2-1-00t</p>	<p>Stream</p>

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Wolfe Creek Watershed Restoration	Part of Forest Renewal British Columbia's Watershed Restoration Program. It originates in the Cascade Mountains and Wilbert Hills in southern BC. It flows in a general northeast direction, discharging into the Similkameen River east of Princeton at the Wolf Indian Reserve No. 3. The watershed is 238 sq. km in area and has one major tributary named Willis Creek.	First Nations of Okanogan-Similkameen Environmental Protection Society	Restoration - Overview Assessment	Integrated Watershed Restoration Plan: develop a strategy to adequately protect natural resources (fisheries, water, timber) while maintaining access to, and use of these resources by stakeholders in the watershed.	3-1-98 to 3-1-99	Riparian, Stream, Upslope
			Restoration - Overview Assessment	The general objective of the Integrated Watershed Restoration Plan is to develop a strategy to adequately protect natural resources (fisheries, water, timber) while maintaining access to, and use of these resources by stakeholders in the watershed.	3-1-98 to 3-1-99	Riparian, Stream, Upslope
			Restoration - Overview Assessment	Identify potential watershed impacts in the Wolfe Creek drainage due to forest harvest practice. Further objectives include but are not limited to: - updating existing forest road and cutblock information; - evaluating forestry impacts relative to other land use impacts within the watershed; - investigating water quality conditions at two locations along Wolfe Creek.	9-6-96 to 9-6-97	Riparian, Stream, Upslope
Hedley / McNulty / Cahill / Winters Creek Watershed Restoration	Part of Forest Renewal British Columbia's Watershed Restoration Program, the study area contains the Hedley / McNulty Creek Watershed, the Cahill Creek Watershed and Winters Creek Watershed that together have an area of about 600 sq. km. The study area is located on the Thompson Plateau northeast of the town of Hedley, and north of the Similkameen River valley and Highway.		Restoration - Overview Assessment	This Integrated Watershed Restoration Plan (IWRP). An Interior Watershed Assessment Procedure for the Hedley Watershed was prepared in 1996 by Dobson Engineering	3-1-98 to 3-1-99	Riparian, Stream, Upslope
			Restoration - Overview Assessment	Stability conditions of the roads, hillslopes and gullies in the study area. The goal of the Sediment Source Survey is to identify erosion problems with existing roads, hillslopes and gullies, and to determine sites that require rehabilitation.	2-16-98 to 2-16-99	Upslope
			Restoration - Overview Assessment	Level I Interior Watershed Restoration Plan (IWAP): assess the pot. for cumulative hydrologic impacts in the Winters and Cahill Creeks Watersheds associated with previous forest develop. and road construction. The four primary impact categories: - peak flows; surface erosion; riparian buffers and; mass wasting.	11-1-97 to 11-1-98	Riparian, Stream, Upslope

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
			Restoration - Overview Assessment	Level I Interior Watershed Assessment Procedure (IWAP): assess the potential for cumulative hydrologic impacts in the Hedley / McNulty Creek Watershed associated with previous forest development and road construction.	3-1-96 to 3-1-97	Riparian, Stream, Upslope
Willis Creek Watershed Restoration	The Willis Creek watershed is located approximately 20 km south of Princeton, BC. The study area consists of a 4 km section of the Willis Creek valley and valley sides		Restoration - Overview Assessment	Summary of the results of two site visits conducted to view new slides in the spring of 1997, detailed prescriptions and a cost estimate for remediation of the new slide areas, and prioritization of works to be completed.	9-19-97 to 9-19-98	Upslope
			Restoration - Overview Assessment	A field review of the remedial treatment measures carried out along a segment of the Old Commander road, just south of its junction with the Willis Creek Mainline. The purpose of the review was to assess the efficacy of site rehabilitation measures carried out to date.	9-25-98 to 9-25-99	Upslope
			Restoration - Overview Assessment	The results of a study of an approximately 100 ha area of the Willis Creek Basin. The purpose of the study was to develop detailed prescriptions for restoration and rehabilitation of road, landslide and gully elements potentially having a detrimental impact on water quality and habitat in Willis Creek.	10-3-96 to 10-3-97	Upslope
Northwest Tulameen River Watershed Restoration	Part of Forest Renewal British Columbia's Watershed Restoration Program, the Northwest Tulameen Watershed is located south of Merritt, BC and includes an area of approximately 42,500 ha. The study area is generally bounded by the Tulameen River and the	Tolko Industries Limited	Restoration - Overview Assessment	The Integrated Watershed Restoration Plan (IWRP) includes descriptions of the project's Sediment Source Survey, Stream Channel and Fish Habitat Assessment, and Access Management Plan, as well as a determination of Watershed Level Objectives	3-31-98 to 3-31-99	Riparian, Stream, Upslope

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
	Illal Creek to the south, Otter Creek to the east, Spearing Creek to the north, and the Coldwater River basin to the west.					
Old Arrastra Creek Watershed Restoration	The Arrastra Creek Forest Service Road is located approximately 25 km west of Princeton, BC The area assessed consisted of approximately 1.3 km of the old Arrastra Creek Forestry Service Road	BC Ministry of Forests	Restoration - Upslope Restoration / Rehabilitation	Road deactivation prescriptions conducted for the Old Arrastra Creek FSR area. Road deactivation prescriptions were developed for this area because of the need to reduce the potential delivery of sediment into Granite Creek and to stabilize existing sediment sources in order to protect fish and fish habitat in Granite Creek.	3-1-97 to 3-1-98	Upslope
			Restoration - Upslope Restoration / Rehabilitation	Equipment supervision carried out on Oct 10-12 for the slope failure on the Arrastra Creek forest service road near Princeton.	10-30-96 10-30-97	Upslope
			Restoration - Upslope Restoration / Rehabilitation	Field reconnaissance carried out on September 30, 1996, of the slope failure on the Arrastra Creek Forest service road near Princeton. The failure is located on Arrastra Creek FSR at the east approach to the east approach of the bridge on Blakeburn Creek.	10-9-96 to 10-9-97	Upslope
Tolko Multi-Year Plan 1998	1:20K Reconnaissance Fish and Fish Habitat Inventory, performed according to Resource Inventory Committee (RIC) standards	Tolko Industries Limited	Inventory - 1:20000 Reconnaissance	1:20K Reconnaissance Fish and Fish Habitat Inventory	4-1-98 to 4-1-99	Stream
Whipsaw, Smith and Willis Creek Watersheds 1:20K Reconnaissance Fish and Fish Habitat Inventory	1:20K Reconnaissance Fish and Fish Habitat Inventory, performed according to Resource Inventory Committee (RIC) standards	Weyerhaeuser Canada Limited	Inventory - 1:20000 Reconnaissance	1:20K Reconnaissance Fish and Fish Habitat Inventory	4-1-99 to 4-1-00	Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Okanogan/Boundary/Similkameen Rivers-Barriers to Fish Passage (Phase 1)	Identification of 186 potential obstructions to fish passage	Okanogan Region Wildlife Heritage Fund Society	Assessment - Habitat Assessment	Identification of 186 non-natural potential barriers to fish passage	10-1-99 to 3-3-00	Stream
Okanogan Region Inventory of Non-natural Barriers to Fish Passage	186 potential fish passage obstructions identified to date	Okanogan Region Wildlife Heritage Fund Society	Other - General	186 potential fish passage obstructions identified to date	10-1-99 to 3-3-00	Stream
Chain Lake Chemical Rehabilitation	Chemical rehabilitation of Chain Lake to eradicate Finescale suckers and Peamouth Chub, which will enhance the Rainbow trout fishery.	BC Ministry of Environment Lands and Parks	Enhancement - Other	Chemical rehabilitation of Chain Lake to eradicate Finescale suckers and Peamouth Chub, which will enhance the Rainbow trout fishery.	4-1-81 to 4-1-82	Lake
Allison Creek Fish Barrier Construction	Construction of a coarse fish barrier to prevent the invasion of Bridgelip suckers, Longnose dace, and Torrent Sculpin in order to protect the productive Rainbow trout population	BC Ministry of Environment Lands and Parks	Enhancement - Other	Construction of a coarse fish barrier to prevent the invasion of Bridgelip suckers, Longnose dace, and Torrent Sculpin	4-1-84 to 4-1-85	Stream
Rampart Dam Construction	Construct an earth-fill dam with overflow spillway to increase Rainbow trout production. Also, provide access into the lake to adult trout	BC Ministry of Environment Lands and Parks	Enhancement - Barrier Modification / Obstruction Removal	Construct an earth-fill dam with overflow spillway to increase Rainbow trout production. Also, provide access into the lake to adult trout.	4-1-98 to 4-1-99	Lake

2.3.15 Trepanier Creek Sub-basin Projects

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Trepanier Creek Watershed Restoration Project	Trepanier Creek watershed has an area of 255 sq. km. The watershed is located on the eastern edge of the Thompson Highland physiographic division.	Gorman Brothers Lumber Limited	Restoration - Assessment & Planning	This activity provides final watershed assessment committee recommendations. It also describes current watershed conditions, a risk assessment of proposed forest development, and conclusions regarding future watershed activity. Activity # 105256	12-3-98 to 12-3-99	Upslope
Peachland Creek and Trepanier Creek Watershed Restoration	The Peachland and Trepanier Creeks lie within two adjacent watersheds and are located on the west side of Okanogan Lake by Peachland, BC.	District of Peachland	Restoration - Overview Assessment	The purpose of the Integrated Watershed Restoration Plan (IWRP) activity is to integrate the results of the Sediment Source Survey, Access Management Strategy, Fish Habitat Assessment Procedure and Interior Watershed Assessment Procedure (IWAP) to recommend an action plan for the prescription phase.	2-1-98 to 2-1-99	Upslope
			Restoration - Overview Assessment	Overview Sediment Source Survey work carried out as part of phase two of the Integrated Watershed Restoration Plan on the Peachland/ Trepanier watersheds.	2-1-98 to 2-1-99	Riparian, Stream, Upslope
			Restoration - Overview Assessment	Fish Habitat Assessment.	5-29-97 to 5-29-98	Stream
			Restoration - Overview Assessment	Level 1 Coastal or Interior Watershed Assessment Procedure (CWAP or IWAP).	9-1-97 to 9-1-98	Stream
			Restoration - Overview Assessment	Terrain Stability..	1-22-99 to 1-22-99	Upslope
Trout Creek Watershed Restoration Project	Trout Creek watershed drains the Thompson Plateau on the west side of Okanogan Lake near	Gorman Brothers Lumber Limited	Restoration - Overview Assessment	Level 1 Coastal or Interior Watershed Assessment Procedure (CWAP or IWAP): This report contains the final watershed assessment committee recommendations. It also contains a section on current	12-3-98 to 12-3-99	Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
	Summerland.			watershed conditions, risk assessment of proposed forest development and conclusions and recommendations.		
Nicola/Similkameen/Okanogan River Reconnaissance (1:20 000) Fish and Fish Habitat Inventory	1:20K Reconnaissance Fish and Fish Habitat Inventory, performed according to Resource Inventory Committee (RIC) standards	Gorman Brothers Lumber Limited	Inventory - 1:20000 Reconnaissance	1:20K Reconnaissance Fish and Fish Habitat Inventory	4-1-99 to 4-1-00	Main Stem + Tributaries
Trepanier Creek Watershed Stewardship Action Plan	Stewardship/community planning; partnerships built with 11 groups/organizations	Trepanier Creek Linear Park Society	Other - General	Stewardship/community planning; partnerships built with 11 groups/organizations	2-1-99 to 3-31-00	Stream
Trepanier Creek Spawning Channel: Watershed Concerns	Preliminary evaluation of a proposed spawning channel. Developed recommendations for four issues (low flows; sedimentation from the Macdonald Creek landslide; municipal issues and public/input stewardship) that may have an impact on the proposed spawning channel and fish habitat	Trepanier Creek Linear Park Society	Restoration - Assessment & Planning	A preliminary engineering evaluation of proposed spawning channel was completed. This evaluation will lead to stewardship and community planning regarding the following issues: low flows, sedimentation from the MacDonald landslide and municipal issues, all which would impact the proposed channel.	9-1-99 to 12-15-99	Main Stem of Stream
Trepanier Ditch Upgrade	The Trepanier ditch water system upgraded to a pressurized system to contribute to upgrading the multi-user ditch system	BC Ministry of Environment Lands and Parks	Enhancement - Water Quality	Upgrade the Trepanier ditch water system to a pressurized system to contribute to upgrading the multi-user ditch system	4-1-88 to 4-1-89	Stream

2.3.16 Vaseux Creek Sub-basin Projects

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Hedley / McNulty / Cahill / Winters Creek Watershed Restoration	Part of Forest Renewal British Columbia's Watershed Restoration Program, the study area contains the Hedley / McNulty Creek Watershed, the Cahill Creek Watershed and Winters Creek Watershed that together have an area of about 600 sq. km. The study area is located on the Thompson Plateau northeast of the town of Hedley, and north of the Similkameen River valley and Highway 3 between Princeton and Keremeos in southern BC	Weyerhaeuser Canada Limited	Restoration - Overview Assessment	The objective of the Access Management Strategies (AMS) is to propose changes to the road system that will reduce the risk of environmental damage, particularly sediment delivery to streams while still maintaining the access into the watershed for the various stakeholders and watershed users.	2-1-98 to 2-1-99	Upslope
			Restoration - Overview Assessment	The Interior Watershed Restoration Plan (IWRP), problems requiring prescription work, priority list, time and cost estimates, and recommendations.	2-1-98 to 2-1-99	Stream, Upslope
			Restoration - Overview Assessment	Both watersheds located in the Okanogan highlands region southeast of Okanogan and Vaseux Lakes cover 379 sq. km. Resource report about them.	2-1-98 to 2-1-99	Upslope
			Restoration - Overview Assessment	Identify all unstable or potentially unstable land areas at a mapping scale of 1:20,000 for the total watershed area of 37,767 ha. The report discusses methods and results of the terrain stability mapping which involved a Terrain Survey Intensity Level D Analysis and an assessment of the potential effects of conventional forest harvesting on terrain stability.	3-1-99 to 3-1-00	Upslope
			Restoration - Overview Assessment	Sediment Source Survey (SSS): To review all roads corridors, hillslopes and gullies within both watersheds, to determine eligibility for restoration funding, to identify and inventory sites of road related mass wasting/surface erosion/stream sedimentation hazards and to confirm priority areas for future prescription work.	2-1-98 to 2-1-99	Upslope
			Restoration - Detailed Assessments &	Prescriptions for the priority sites noted in Contract #98-WRP-Prescriptions for the Penticton, Shuttleworth, and Vaseux Watersheds.	9-1-98 to 9-1-99	Upslope

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
			Prescriptions Restoration - Overview Assessment	The study area is located approx. 10 km south of Penticton where it drains into the Okanogan River. Resource report about.	5-1-97 to 5-1-98	Stream
Weyerhaeuser- OK Falls Div.- Multi-Year Plan (1998) 1:20K Reconnaissance Fish and Fish Habitat Inventory	1:20K Reconnaissance Fish and Fish Habitat Inventory, performed according to Resource Inventory Committee (RIC) standards	Weyerhaeuser Canada Limited	Inventory - 1:20000 Reconnaissance	1:20K Reconnaissance Fish and Fish Habitat Inventory	4-1-98 to 4-1-99	Stream
Okanogan Falls Reconnaissance (1:20,000) Stream Inventory	1:20K Reconnaissance Fish and Fish Habitat Inventory, performed according to Resource Inventory Committee (RIC) standards	Weyerhaeuser Canada Limited	Inventory - 1:20000 Reconnaissance	1:20K Reconnaissance Fish and Fish Habitat Inventory	4-1-97 to 4-1-98	Main Stem + Tributaries

2.3.17 Vernon Creek Sub-basin Projects

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Vernon/Winfield Creeks Stewardship Action Plan	Habitat assessment, inventory and mapping for 6km	Oceola Fish and Game Club	Inventory - Mapping	Inventory and mapping for 6km	2-1-99 to 3-31-00	Stream
Oyama Creek Watershed Restoration	The Oyama Creek watershed is located on the south east side of Kalamalka Lake, near Oyama on the eastern corner of the Thompson Plateau. The watershed has an area of 4 400ha. This watershed supplies both domestic and irrigation water to the Wood Lake Improvement District.	Wood Lake Improvement District	Restoration - Overview Assessment	Access management strategy for the Oyama Creek Watershed. The objective of this report was to identify the long term access requirements for the current roads in the watersheds and determine an appropriate level of deactivation, based on road use that will reduce environmental impacts, particularly sediment delivery to streams.	3-1-98 to 3-1-99	Upslope
			Restoration - Overview Assessment	Integrated watershed restoration plan for the Oyama Creek watershed. The purpose of this report is to integrate the results of the sediment source survey, access management strategy, fish habitat assessment procedure, channel assessment procedure and interior watershed assessment procedure completed in the watershed.	3-1-96 to 3-1-97	Stream, Upslope
			Restoration - Upslope Restoration / Rehabilitation	Road design for the Oyama Creek Watershed. The objective of this report was to present the road alignments, volume estimates and construction considerations for approximately 1.7 km of proposed road upgrade of the Oyama Lake Road.	11-7-97 to 11-7-98	Upslope
			Restoration - Overview Assessment	Results of the interior watershed assessment procedure conducted on the Oyama Creek Watershed. The objectives of this report were to document watershed characteristics and conditions, and to determine the potential for cumulative hydrologic impacts that may be associated with past forest development in the watersheds.	3-1-98 to 3-1-99	Upslope

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
			Restoration - Effectiveness Monitoring & Evaluation	The water quality monitoring which was conducted for the Oyama Creek watershed. The objectives of this report were to provide baseline water quality data and document any changes that may occur as a result of timber harvesting or other activities.	3-1-97 to 3-1-98	Stream
Vernon Creek Watershed Restoration	Vernon Creek is the community watershed for the town of Winfield. Vernon Creek originates in the Thompson Plateau about 22 km northeast of Winfield	Winfield and Okanogan Centre Irrigation District	Restoration - Upslope Restoration / Rehabilitation	The restoration work completed on landslide #16 in the Vernon Creek watershed during 1997. The landslide took place on May 16, 1997. The restoration program consisted of emergency erosion control, engineering, logistical planning and site works.	12-21-97 to 12-21-98	Upslope
			Restoration - Overview Assessment	The landslide rehabilitation assessment procedure conducted in the Vernon Creek watershed. The objectives of this report were to reduce erosion and improve site stability, minimize sediment delivery off site and allow for revegetation, as well as mitigate visual impacts and initiate and enhance natural rehabilitation processes.	9-30-97 to 9-30-98	Upslope
			Restoration - Overview Assessment	The sediment source survey conducted for the Vernon Creek Watershed. The objectives of this report were to review all road corridors, hillslopes and gullies within the watersheds and determine eligibility for restoration funding; and identify and inventory sites of road related mass wasting, surface erosion and stream sedimentation hazards, as well as confirm priority areas for future prescription work. This report summarizes the stream channel assessment work carried out in the Vernon Creek Watershed.	4-1-97 to 4-1-98	Upslope
			Restoration - Overview Assessment	The stream channel assessment, sediment source survey and water quality monitoring program carried out in the Vernon Creek Watershed. The objectives of the stream channel assessment were to: - review aerial photos of the Vernon Creek system to identify any changes in channel characteristics and evaluate channel	4-1-97 to 4-1-98	Upslope

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
			Restoration - Overview Assessment	<p>sensitivity; - complete field assessments to determine if past forestry activities have caused channel impacts, focusing on potential impacts identified by the Level I Interior Watershed Assessment Procedure (IWAP) analysis and the review of aerial photos; - identify any sites on the stream channel which have been impacted by forestry activities; - identify the need for detailed prescriptions for site restoration, as needed, and; - comment on possible effects of future harvest on the stream channel.</p> <p>The access management strategy for the Vernon Creek Watershed. The objective of this report was to identify the long term access requirements for the current roads in the watersheds and determine an appropriate level of deactivation, based on road use that will reduce environmental impacts, particularly sediment delivery to streams.</p>	3-1-99 to 3-1-00	Upslope
			Restoration - Effectiveness Monitoring & Evaluation	Interim reports were submitted in July, September and November 1996 and March 1997. This is the final report. The general objective of this study was to measure water quality at specific locations within the Vernon Creek watershed to serve as baseline data for monitoring the effects of future watershed restorative activities	7-11-97 to 7-11-98	Upslope
King Edward Lake Watershed Restoration	King Edward Creek (known locally as Deer Creek) originates on the Thompson Okanogan Plateau in the southern interior approximately 15 km southeast of the community of Vernon, and is a tributary of Coldstream Creek. The	Tolko Industries Limited	Restoration - Detailed Assessments and Prescriptions	The integrated watershed restoration plan for the King Edward Creek Watershed. The purpose of this report is to integrate the results of the sediment source survey, access management strategy, fish habitat assessment procedure, channel assessment procedure and interior watershed assessment procedure completed in the watersheds.	3-1-98 to 3-1-99	Upslope

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
	two creeks meet about 5 km upstream of the outlet to Kalamalka Lake.					
Coldstream Creek Watershed Restoration	Part of Forest Renewal British Columbia's Watershed Restoration Program, Coldstream Creek flows south from Silver Star Provincial Park onto a broad valley floor near Lavington, before discharging into Kalamalka Lake. The Coldstream Creek community watershed comprises that portion of the drainage area upstream of the Municipality of Coldstream water intake and treatment plant, and has a drainage area 6,643 ha.	BC Ministry of Forests	Restoration - Overview Assessment	1) define the potential negative cumulative or site-specific effects of past forest practices, and other land uses, on the watershed's hydrology, slope and channel geomorphology, and water quality and; 2) provide guidance on continued forest operations.	12-1-98 to 12-1-99	Riparian, Stream, Upslope
Okanogan Timber Supply Area (TSA) Small Lakes Inventory	1:20K reconnaissance lake inventory	BC Ministry of Environment Lands and Parks	Inventory - 1:20000 Reconnaissance	1:20K Lake Reconnaissance Fish and Fish Habitat Inventory	4-1-98 to 4-1-99	Lake
Wood Lake Angler Survey / Creel Census	Estimation of angler pressure/effort on the lake, estimation of number of Kokanee and other species harvested, education of anglers towards Kokanee conservation	Oceola Fish and Game Club	Assessment - Stock Assessment Other - General	Estimation of number of Kokanee and other species harvested, estimation of angler pressure/effort on fish stocks Education: interviews were conducted with 90% of the anglers on the lake. Anglers learned of the purpose of the project and its rewards	3-11-00 to 6-1-00 3-11-00 to 6-1-00	Lake Lake
Kelowna/McDoug	Review of Water Act	Penticton Indian	Inventory -	4 urban creeks reviewed for the level of compliance to	Start date:	Riparian,

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
all/Vernon Creeks Urban Referral Compliance Evaluation	compliance and applications for 4 urban creeks	Band/Columbia Environmental Consulting	Urban	the Water Act for all approved and non approved works in and about the streams.	2-1-99 to 3-31-00	Stream
Echo Lake Dam Restoration (86)	Reconstruction of an earth-fill dam with an outlet flow control device and an overflow spillway to increase storage capability and increase the quality and quantity of rainbow trout production.	BC Ministry of Environment Lands and Parks	Enhancement - Water Quality	Reconstruction of an earth-fill dam with an outlet flow control device and an overflow spillway	4-1-86 to 4-1-87	Lake
Vernon Creek Improvement Inventory	A stream inventory conducted. Identification of the methods (e.g. channelization, culvert reconstruction, rip-rap and gravel placement), locations, timing and costs for stream improvements which would benefit Kokanee	BC Ministry of Environment Lands and Parks	Inventory - Other	A stream inventory was conducted to identify the methods (e.g. channelization, culvert reconstruction, rip-rap and gravel placement), locations, timing and costs for stream improvements that would benefit Kokanee	4-1-86 to 4-1-87	Stream
Echo Lake Dam Restoration (87)	Reconstruction of an earth-fill dam with an overflow spillway at the outlet to improve the quality and quantity of Rainbow trout production	BC Ministry of Environment Lands and Parks	Enhancement - Water Quality	Reconstruction of an earth-fill dam with an overflow spillway at the outlet	4-1-87 to 4-1-88	Lake
Vernon Creek Passage Improvement	Improvement of passage for Kokanee through construction of baffles within a culvert and weir, removing a concrete weir, and placing another weir to decrease water velocity. Volunteers	BC Ministry of Environment Lands and Parks	Restoration - Restore Fish Passage	Construction of baffles within a culvert and weir, removal of a concrete weir, placement of another weir to decrease water velocity, and removal of man-made debris	4-1-87 to 4-1-88	Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
	coordinated to remove man-made debris.					
Vernon Creek Habitat Improvement (88)	Various stream enhancement activities for Kokanee performed: boulder weirs placed, gravel spawning platforms constructed, stream clearance conducted, and 100 m of streambank excavated and stabilized	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	Boulder weirs placed, gravel spawning platforms constructed, stream clearance conducted, and 100 m of streambank excavated and stabilized	4-1-88 to 4-1-89	Stream
Okanogan Drainage Warmwater Fish Enhancement (88)	Enhancement of a Smallmouth bass fishery by controlling weeds, establishing riparian vegetation, transplanting bass, constructing refuge holes, and placing brush piles in lakes for rearing habitats.	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	Enhancement of a Smallmouth bass fishery by controlling weeds, establishing riparian vegetation, constructing refuge holes, and placing brush piles in lakes for rearing habitats.	4-1-88 to 4-1-89	Lake
			Enhancement - Fish Culture Activities	Smallmouth bass transplanted into the lakes	4-1-88 to 4-1-89	Lake
Vernon Creek Habitat Improvement (89)	Various stream enhancement activities performed to enhance Kokanee spawning habitat: stream clearance, gravel placement, and installation of a fish barrier at the creek junction.	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	Stream clearance, gravel placement, and installation of a fish barrier at the creek junction.	4-1-89 to 4-1-90	Stream
Vernon Creek Habitat Improvement (90)	Various stream enhancement activities performed to enhance Kokanee spawning habitat: stream clearance, and gravel placement	BC Ministry of Environment Lands and Parks	Enhancement - Habitat Enhancement	Stream clearance and gravel placement	4-1-90 to 4-1-91	Stream

Project Name	Project Description	Lead Proponent	Activity	Activity Description	Term	Location
Winfield Creek Enhancement	Improve Kokanee spawning habitat by excavating and replacing spawning substrate, excavating settling ponds to control silt and sand deposition, and re-aligning the stream course.	Oceola Fish and Game Club	Enhancement - Habitat Enhancement	Improve Kokanee spawning habitat by excavating and replacing spawning substrate, excavating settling ponds to control silt and sand deposition, and realigning the stream course.	4-1-89 to 4-1-90	Main Stem + Tributaries
Coldstream Creek Renewal Project	Land use mapping, hydrology assessment, design of water quality and streambed mapping, and research into previous work on Coldstream Creek	North Okanogan Naturalist Club	Inventory - Mapping	Land use mapping within the watershed	2-7-99 to 3-31-00	Stream

3.0 FISHERIES RESOURCES AND HABITAT LIMITING FACTOR RATINGS BY SUB-BASIN

3.1 CHUTE CREEK

3.1.1 Sub-basin Overview

Flowing from the east, Chute Creek drains directly to Okanogan Lake.

This system is extremely precipitous in the lower reaches thus limiting fish access further upstream. The steep nature of Chute Creek reduces the potential for rearing pool formation in addition to increasing potential washout of spawning gravel and large woody debris.

In response to this high stream energy and erosion potential, the lower 200m of Chute Creek have been confined in a concrete flume as a flood control measure. The flume has effectively eliminated any possibility of restoring even a low level of salmonid production in lower Chute Creek.

A diversion dam located 17.3 m upstream of the confluence represents a potential barrier to further upstream migration by resident fish populations. There is also a cascade located approximately 430 m upstream of the confluence that would also restrict fish passage.

3.1.2 Fisheries Resources in Chute Creek Sub-basin

Known fish species in the system include Brook Trout, Kokanee, and Rainbow Trout. Summerland and Pennask Lake Hatcheries have also stocked Chute Creek with Rainbow Trout at the eyed egg life cycle stage.

3.1.3 Chute Creek Limiting Factors Matrix

Reach break description	Reach 1
Attribute Considered	Confluence to 200m u/s
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	DG
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	DG
Large Woody Debris	DG
Percent Pool	P1
<u>Habitat Access</u>	
Fish Passage	P1
<u>Stream Flow</u>	
Resembles Natural Hydrograph	P1
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	DG
Stream Bank Stability	DG
Floodplain Connectivity	P1

3.2 ENEAS CREEK

3.2.1 Sub-basin Overview

Eneas Creek is a third order stream that measures 19 km in length. The stream flows from the headwaters at Garnet Valley Dam and Reservoir, located about 14.5 km upstream. The confluence is located on Okanogan Lake just north of the town of Summerland, BC.

Water Quantity/Water Quality

A fish kill in 1989 was the combined result of low stream flows and streamside pesticide applications.

A small groundwater tributary enters Eneas Creek about 0.5 km upstream of the confluence with Okanogan Lake. According to a local resident this stream has supported spawning by up to “8 pairs of trout and 135 Kokanee” in years past. Water quality was apparently exceptionally good in this tributary.

3.2.2 Fisheries Resources in Eneas Creek Sub-basin

Brook Trout, Kokanee, Rainbow Trout and Redside Shiner are known to be present in Eneas Creek. The reach downstream of the Reservoir to the Highway 97 crossing, a distance of approximately 13 km, supports a substantial population of Eastern Brook Char, as does the Reservoir itself. In addition, fish stocking of Rainbow Trout as either eyed eggs or fry has occurred by Summerland and Pennask Lake Hatcheries.

Less than 0.6 km of the lower reach of the stream is likely accessible to adult Rainbow Trout and Kokanee from Okanogan lake, owing to a series of difficult culvert obstructions. Despite access restrictions and some deterioration in water quality below Summerland, trout and Kokanee production remains viable.

An incubation box was used for several years to enhance Kokanee escapement in Eneas Creek. Gravel placement and cleaning took place in an effort to enhance spawning and egg incubation habitat.

There is an opportunity to view spawning Kokanee on Eneas Creek that could be further developed for educational purposes. Very few areas for the enhancement of Kokanee remain and should be preserved.

3.2.3 Eneas Creek Limiting Factors Matrix

Reach break description	Reach 1	Reach 2
Attribute Considered	Confluence to 0.5km u/s	U/s of 0.5km
<u>Water Quality</u>		
Dissolved Oxygen	DG	DG
Stream Temperature	DG	G1
Turbidity/Suspended Sediment	P1	G1
Nutrient Loading	P1	G1
<u>In Channel Habitat</u>		
Fine Sediment (substrate)	DG	DG
Large Woody Debris	DG	DG
Percent Pool	DG	DG
<u>Habitat Access</u>		
Fish Passage	P1	DG
<u>Stream Flow</u>		
Resembles Natural Hydrograph	P1	DG
Impervious Surface	DG	DG
<u>Stream Corridor</u>		
Riparian Vegetation	DG	DG
Stream Bank Stability	DG	DG
Floodplain Connectivity	DG	DG

3.3 EQUESIS CREEK

3.3.1 Sub-basin Overview

Equesis Creek is a fourth order stream that measures 23.3 km in length. It flows from the headwaters of Pinaus Lake east into the northwest arm of Okanogan Lake. The confluence is located about 9.6 km west of Vernon, BC.

Water Quantity/Hydrology

Habitat quality varies considerably over the entire length of the system. However, it appears much of the stream is capable of producing and supporting trout in the presence of adequate flows during late summer and early fall. Stable winter discharge is also necessary to sustain overwintering trout juveniles and incubating Kokanee eggs. Additional reservoir storage would make a big difference in the ability of the system to meet total annual water use higher than this level.

Water Quality

The lower 13 km of Equesis Creek are thought to be productive. However, persistent organic debris in the system is blocking the creek and restricting fish migration into this reach. Several small dams located on Equesis Creek also limit fish passage to upper reaches.

3.3.2 Fisheries Resources in Equesis Creek Sub-basin

Fish species known to be present in this system include Kokanee, Rainbow Trout, and Yellow Perch.

An earth dam was constructed to stop Yellow Perch migration, and several other diversion irrigation dams further upstream also restrict other fish migration. An irrigation dam located 2.6 km upstream of the confluence with Okanogan Lake is likely passable to larger trout in the spring, but is impassable to Kokanee in the fall. Apparently this dam was originally designed to pass fish, but accommodation for fish passage during installation was not made. An irrigation dam situated approximately 3.7 km upstream of the confluence with Okanogan Lake likely limits further upstream trout migration except during certain conditions such as spring freshet. The dam appears to have been designed and installed with no special provision for fish passage. These obstructions in the lower reaches may have seriously reduced the level of trout and Kokanee recruitment to Okanogan Lake from the creek.

It is noteworthy that Pinaus Lake, located at the headwaters of Equesis Creek, does support an intensive trout fishery.

A fishway present on Equesis Creek was modified and reconstructed in 1990 to allow for Rainbow Trout access to upper reaches.

3.3.3 Equesis Creek Limiting Factors Matrix

Reach break description	Reach 1
Attribute Considered	
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	P2
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	P1
Large Woody Debris	DG
Percent Pool	DG
<u>Habitat Access</u>	
Fish Passage	P1
<u>Stream Flow</u>	
Resembles Natural Hydrograph	F1
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	DG
Stream Bank Stability	DG
Floodplain Connectivity	DG

3.4 KELOWNA (MILL) CREEK

3.4.1 Sub-basin Overview

The Kelowna (Mill) Creek watershed is located approximately 20 kilometers northeast of the City of Kelowna. The watershed is approximately 7900 hectares and has been used historically for irrigation, recreation, and timber harvesting activities. Stream channel assessment work carried out in the Kelowna Creek watershed identified significant changes to the stream channels within this watershed, all of which appear to be the result of past logging activities. Five sites were found to be requiring remedial work. Several surveys have been conducted on this watershed, and gravel placement has occurred to enhance spawning and egg incubation habitat. The protection of Kokanee, Rainbow trout, and Brook trout spawning and rearing habitat should be considered the foremost priority of management practices in this creek.

Land Use

The City of Kelowna has recently expressed interest in incorporating fisheries needs (spawning gravel additions, settling ponds, and/or children's fishing ponds) into their planning for parks and other developments.

Water Quantity/Hydrology

A dam located at the outlet of Postill Lake was constructed to provide water storage for the City of Kelowna. The presence of the dam quite possibly has lowered stream flows and thus reducing available spawning habitat for stream spawning Kokanee. In addition, eutrophication of spawning gravel substrate has limited the spawning and egg incubation habitat available in the creek. This creek is also under heavy pressure from urban and agricultural development.

One of the few production assets of Kelowna Creek is its relatively stable discharge regime. Specific amounts of water are being released from the dam located at the outlet of Postill Lake to promote rapid flushing of lower stream pollutants. This release may be having the inadvertent benefit of perpetuating the small populations of trout and Kokanee remaining in the system. Failing restoration of flushing flows, artificial cleaning of natural and artificial spawning gravel could be initiated on an annual basis.

Water Quality

By virtue of intensive streamside development, particularly in the lower 4 km, water quality and productive salmonid habitat have drastically deteriorated. For this reason it is suspected the stream is at best only marginally productive for trout and Kokanee. Eutrophication of gravel substrate has occurred, limiting spawning and egg incubation habitat. In the past, high suspended solid loads were observed during the Kokanee spawning period. Apparently these suspended solids emanated from a storm drain cleaning program.

3.4.2 Fisheries Resources in Kelowna Creek Sub-basin

Kelowna (Mill) Creek is a fourth order stream. It flows through the City of Kelowna, BC where it drains directly to Okanogan Lake. Urban development, particularly in the lower reaches of Kelowna Creek, has heavily influenced and placed a strain on the fish populations within this creek.

Fish presence in Kelowna Creek includes Brook Trout, Kokanee, Largescale Sucker, Prickly Sculpin, Rainbow Trout, and Redside Shiner. Brook Trout fry and fingerling have been stocked in Kelowna Creek by the Summerland Hatchery.

The dam located at the outlet of Postill Lake provides water storage for the City of Kelowna. Otherwise, no known single obstruction was considered impassable to trout and/or Kokanee. Rapidly increasing stream gradient northeast of the Kelowna Airport could, however, abruptly end all upstream migration.

Several surveys have been conducted on this watershed, and gravel placement has occurred to enhance spawning and egg incubation habitat. The protection of Kokanee, Rainbow, and Brook Trout spawning and rearing habitat should be considered the foremost priority to management of this creek.

3.4.3 Kelowna Creek Limiting Factors Matrix

Reach break description	Reach 1
Attribute Considered	Confluence to gradient increase
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	P2
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	P1
Large Woody Debris	DG
Percent Pool	DG
<u>Habitat Access</u>	
Fish Passage	G1
<u>Stream Flow</u>	
Resembles Natural Hydrograph	F1
Impervious Surface	P1
<u>Stream Corridor</u>	
Riparian Vegetation	P1
Stream Bank Stability	DG
Floodplain Connectivity	DG

3.5 LAMBLY CREEK

3.5.1 Sub-basin Overview

The Lambly Creek watershed is a community watershed located on the west shore of Okanogan Lake northwest of Kelowna. Elevation ranges from 324 m to 1800 m. Dams regulate flow into Lambly Creek. Its area is approx. 24410 ha. Lambly Creek flows from the west to the east, and discharges into Okanogan Lake. The confluence is located approximately 6.4 km north of Siwash Point. This fourth order stream is 23 km in length.

Water Quantity/Hydrology

This stream has apparently experienced severe stock size reductions. These reductions are attributed to minimal summer and fall flows that result from an almost complete water diversion at a point just over 4.8 km upstream of the confluence with Okanogan Lake. At this location a diversion dam redirects Lambly Creek flow south to the Rose Valley Reservoir. Apparently no requirement was stipulated in the original water license to provide minimum fish maintenance flows downstream. A study indicated that there should be adequate flows to meet both the Lakeview Irrigation District diversion requirements and fish flows. Establishment of upstream storage in Terrace Meadows would significantly improve flows for both Kokanee and trout.

It should be noted that Lambly Creek historically has experienced natural low flows, particularly during August. This condition is only exacerbated by the presence of the Rose Valley Reservoir dam. Habitat qualities downstream of the falls remain compatible with some trout production. However, given the lack of suitably sized gravel in the lower reaches of this stream, establishing some flood-protected spawning refuges may improve recruitment to Okanogan Lake.

3.5.2 Fisheries Resources in Lambly Creek Sub-basin

Fish species present in the system include Kokanee, Rainbow Trout, Longnose Sucker, and other suckers. Stocking of Lambly Creek with eyed egg Rainbow Trout was conducted by Beaver Lake and Summerland Hatcheries.

Historically this stream was reputed to be an important trout producer, although only approximately 1.5 km is accessible to migrating fish populations. A large impassable obstruction, namely a 30 m vertical falls, prevents further upstream passage.

A management plan exists for the Lambly Creek watershed to protect and manage wild fish stocks and habitat. The Kokanee spawning grounds in this creek are considered sensitive and it is important to protect these areas.

3.5.3 Lambly Creek Limiting Factors Matrix

Reach break description	Reach 1
Attribute Considered	Confluence to 1.2km u/s
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	DG
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	F1
Large Woody Debris	DG
Percent Pool	F1
<u>Habitat Access</u>	
Fish Passage	P1
<u>Stream Flow</u>	
Resembles Natural Hydrograph	P1
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	DG
Stream Bank Stability	DG
Floodplain Connectivity	DG

3.6 MISSION CREEK

3.6.1 Sub-basin Overview

Mission Creek is the largest tributary of Okanogan Lake, and ranges in elevation from 342 meters, at its confluence with the lake, to a maximum of 2171 meters at the summit of Little White Mountain with 60% of the watershed above 1300 meters in elevation. The watershed, which has a total of 1157 kilometers of forestry roads throughout its borders, is 858 square kilometers in size. Mission Creek watershed is 858 sq. km. The watershed is located on the Okanogan Highland physiographic division with the dominant bedrock in this area being Monashee Gneiss.

This fifth order stream measures 74.3 km in length and flows from the east to Okanogan Lake. The confluence is located approximately 5 km south of the City of Kelowna. The importance of Mission Creek to the fish populations of this watershed is considered to be very high.

Water Quantity/Hydrology

Dams have been located on Mission Creek to provide Kelowna City District with an ample water supply. Decreases in water discharge flows have reduced the amount of available gravel for spawning and egg incubation purposes. If low water flows continued into a warm September, the water temperature could become lethal for Kokanee eggs. It appears that fisheries flow objectives cannot be met without provision of additional storage at considerable cost. Annual cleaning of spawning gravel may have a high benefit:cost ratio.

3.6.2 Fisheries Resources in Mission Creek Sub-basin

Several enhancement projects have been conducted on Mission Creek. The most noteworthy of such projects is the construction of a spawning channel.

Fish species present in Mission Creek include Burbot, Kokanee, Longnose Dace, Peamouth Chub, Rainbow Trout, Redside Shiner, and suckers. Extensive stocking of Kokanee fry by the Skaha Hatchery has also occurred in Mission Creek.

Construction of flood control dykes has resulted in extensive stream channelization. These measures protect surrounding land from spring freshet and other flood events. This process has resulted in the redistribution of gravel beds, and thus decreased the amount of suitable spawning habitat. At least half of the accessible stream length (which is nearly 19 km) has been channelized, dredged, and straightened. Dyking of these lower reaches has, however, resulted in stable streambanks in this area.

Falls located approximately 19 km upstream of the confluence to Okanogan Lake are a migration barrier to all species of fish. A cascade located upstream of the falls represents an additional potential barrier to further upstream migration.

The closing of the Kokanee fishery in addition to rebuilding the spawning channel is expected to increase Kokanee escapement to Mission Creek. Protection and enhancement of fish habitat, water flows, and water quality should be considered top priorities for this watershed.

3.6.3 Mission Creek Limiting Factors Matrix

Reach break description	Reach 1
Attribute Considered	Confluence to 19km u/s
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	P2
Turbidity/Suspended Sediment	DG
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	DG
Large Woody Debris	P2
Percent Pool	DG
<u>Habitat Access</u>	
Fish Passage	F2
<u>Stream Flow</u>	
Resembles Natural Hydrograph	P2
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	P2
Stream Bank Stability	G2
Floodplain Connectivity	P2

3.7 NARAMATA CREEK

3.7.1 Sub-basin Overview

Naramata watershed has an area of 2931 ha and is used for both domestic and irrigation purposes. Flowing through the village of Naramata is Naramata Creek, a third order stream measuring 12.7 km in length.

3.7.2 Fisheries Resources in Naramata Creek Sub-basin

Fish species present in the system include Kokanee and Rainbow Trout.

Habitat complexity and trout rearing opportunities appear to improve with increasing distance from the confluence with Okanogan Lake. However, it is unlikely that more than 1.6 to 2.4 km of this system is accessible to migrating trout. A culvert and the rapidly increasing stream grade would restrict further fish passage. Most suitable substrate available for Kokanee spawning is located within the lower reaches of Naramata Creek.

Approximately 3.4 km upstream of the confluence with Okanogan Lake is a 3.5 m high dam that prevents fish access upstream. Further upstream, a 5 m high falls may possibly be an additional fish barrier.

Naramata citizens installed spawning platforms to increase potential habitat for spawning and egg incubation purposes. Fish and fish habitat inventories have also been conducted on Naramata Creek.

3.7.3 Naramata Creek Limiting Factors Matrix

Reach break description	Reach 1	Reach 2
Attribute Considered	Confluence to 1.6km u/s	1.6km to 2.4km u/s of confluence
<u>Water Quality</u>		
Dissolved Oxygen	DG	DG
Stream Temperature	DG	DG
Turbidity/Suspended Sediment	DG	DG
Nutrient Loading	DG	DG
<u>In Channel Habitat</u>		
Fine Sediment (substrate)	F1	DG
Large Woody Debris	DG	DG
Percent Pool	DG	DG
<u>Habitat Access</u>		
Fish Passage	DG	P1
<u>Stream Flow</u>		
Resembles Natural Hydrograph	DG	DG
Impervious Surface	DG	DG
<u>Stream Corridor</u>		
Riparian Vegetation	DG	DG
Stream Bank Stability	DG	DG
Floodplain Connectivity	DG	DG

3.8 NASWHITO CREEK

3.8.1 Sub-basin Overview

The Naswhito Creek watershed is a tributary to Okanogan Lake situated approximately 20km west of Vernon. The watershed area is approximately 80 sq. km. Naswhito Creek is a third order stream that measures 25.3 km in length. The stream flows to Okanogan Lake from the west. The confluence is located approximately 2.8 km south of that of Equisis Creek.

Water Quantity

Habitat qualities below this dam remain compatible with trout production. There is evidence that severe spring flows result in bank erosion. Freshet conditions combined with flood control measures have likely reduced stream productivity. Low flows in late summer and during the fall of most years has reduced the original Kokanee population in this stream to remnant numbers.

3.8.2 Fisheries Resources in Naswhito Creek Sub-basin

Kokanee and Rainbow Trout are known to exist in Naswhito Creek.

Several dams located in the lower reaches of Naswhito Creek restrict fish passage upstream. A crude irrigation diversion dam has been constructed approximately 0.8 km upstream of the confluence with the lake. This dam creates a site of difficult trout passage and limits further upstream migration by Kokanee in the fall.

Approximately 5 km upstream of the confluence the stream becomes too steep to accommodate game fish spawning.

3.8.3 Naswhito Creek Limiting Factors Matrix

Reach break description	Reach 1
Attribute Considered	Confluence to 5km u/s
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	DG
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	DG
Large Woody Debris	DG
Percent Pool	DG
<u>Habitat Access</u>	
Fish Passage	P1
<u>Stream Flow</u>	
Resembles Natural Hydrograph	P1
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	DG
Stream Bank Stability	DG
Floodplain Connectivity	P1

3.9 PEACHLAND CREEK

3.9.1 Sub-basin Overview

Peachland and Trepanier creeks lie within two adjacent watersheds and are located on the west side of Okanogan Lake near Peachland, BC. The Peachland Creek watershed is 14150 hectares and size while the Trepanier Creek watershed is 25990 hectares. Trepanier Creek watershed ranges in elevation from 342 meters at the confluence with Okanogan Lake to a maximum of 1900 meters at the Mount Gottfriedsen with 60% of the watershed above 1160 meters in elevation. There are approximately 543 kilometers of roads within the two watersheds. Both urban development and agricultural practices occur along the lower three kilometers of both watersheds. At the headwaters of Peachland and Trepanier Creeks is the Brenda Mine. Also, both watersheds are currently under forest licenses to several forestry companies.

Peachland Creek flows from the west, and drains directly to Okanogan Lake south of the Town of Peachland, BC. It is a third order waterway, and is 31.2 km long. This stream is headwatered by Peachland Lake, a dammed reservoir whose inflow and outflow are largely regulated by Brenda Mines, the primary water licensee.

Water Quantity/Hydrology

Although a reliable flow regime is reported to be the greatest fish production asset of this stream, it remains susceptible to periods of periodic flow interruptions as witnessed in late August, 1977. It would be desirable to have the release of this stored water be part of an overall plan for the cooperative release of stored volumes held by Brenda Mines and the District of Peachland. An agreement between these two agencies to address the collective needs of all water users on both Peachland and Trepanier creeks would assist in ensuring that fish flow requirements are sustained.

Water Quality

A Water Survey Canada station located on Peachland Creek collects water quality and quantity data.

3.9.2 Fisheries Resources in Peachland Creek Sub-basin

Fish species known to be present in Peachland Creek include Brook Trout, Kokanee, and Rainbow Trout. The Skaha Hatchery has also stocked Peachland Creek with Kokanee fry. Peachland Creek is an important Kokanee spawning channel and provides viewing of spawning grounds for school programs and other educational purposes.

Only the lower reaches of this system are accessible to spawning trout and Kokanee. Hardy Falls, located approximately 1.0 km upstream of the confluence with Okanogan Lake, are 10 m high and represent an impassable barrier to all migrating fish. A dam located at the outlet of Peachland Lake is a barrier to resident fish migration.

The lower reaches of the stream appear to be deficient in trout rearing habitat. The area is relatively homogeneous, and would be even more so without the presence of the rock wing deflectors installed by a local rod and gun club. Despite this provision, gravel abundance and quality appears to be inadequate, particularly in terms of trout spawning requirements.

Local rod and gun club members have participated in a modest habitat improvement project in the stream below Hardy Falls. This project entailed building alternate rock wing dams to enhance holding areas and to provide sites for gravel deposition. These measures are primarily intended to benefit Kokanee spawning.

3.9.3 Peachland Creek Limiting Factors Matrix

Reach break description	Reach 1
Attribute Considered	Confluence to 1.2km u/s
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	DG
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	P1
Large Woody Debris	DG
Percent Pool	F1
<u>Habitat Access</u>	
Fish Passage	F1
<u>Stream Flow</u>	
Resembles Natural Hydrograph	P1
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	DG
Stream Bank Stability	DG
Floodplain Connectivity	DG

3.10 PENTICTON CREEK

3.10.1 Sub-basin Overview

Penticton Creek flows from the east and drains to Okanogan Lake at the City of Penticton, BC. This third order stream measures 28.8 km in length.

Water Quantity/Hydrology

Urban development within this watershed resulted in the construction of a concrete stream channel in 1950 in an effort to stop flooding in the lower reaches of Penticton Creek. The City of Penticton has launched an initiative to improve the esthetic appearance of this stream by naturalizing the lower reaches and modifying and stepping the existing weirs. This process could include a formal agreement with the City of Penticton for maintenance of base fish flows in the downstream reaches of this stream.

Water quality and quantity are measured at the Water Survey of Canada station.

3.10.2 Fisheries Resources in Penticton Creek Sub-basin

Brook Trout, Kokanee, Longnose Dace, and Rainbow Trout are present in the system. Additional stocking of Kokanee fry by the Skaha Hatchery has also occurred.

A dam located approximately 4.5 km upstream of the confluence to Okanogan Lake is a barrier to upstream migration of all fish. Several other dams are located on Penticton Creek. Approximately 30 km upstream of the confluence to Okanogan Lake there is a 16 m high and 32 m long cascade that is probably a migration barrier to resident fish populations.

Fishway ladders were constructed from the confluence with Okanogan Lake to the spawning grounds of Penticton Creek.

Gravel placement has occurred to enhance potential habitat for spawning and egg incubation and a viewing area has been constructed for educational purposes.

3.10.3 Penticton Creek Limiting Factors Matrix

Reach break description	Reach 1
Attribute Considered	
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	DG
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	DG
Large Woody Debris	DG
Percent Pool	DG
<u>Habitat Access</u>	
Fish Passage	P1
<u>Stream Flow</u>	
Resembles Natural Hydrograph	P1
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	DG
Stream Bank Stability	G1
Floodplain Connectivity	P1

3.11 POWERS CREEK

3.11.1 Sub-basin Overview

Powers Creek flows from the west to Okanogan Lake. It is a fourth order stream, and 29.4 km long. It passes through the community of Westbank, BC.

Water Quantity/Hydrology

The greatest natural asset of Powers Creek appears to be its generally favorable flow regime. This condition, combined with relatively undisturbed habitat upstream of the first chute appears promising for future enhancement.

3.11.2 Fisheries Resources in Powers Creek Sub-basin

There are known Kokanee and Rainbow Trout populations in Powers Creek.

A chute located 0.8 km upstream of the confluence with Okanogan Lake has been modified in the past by the Fish and Wildlife Branch to more easily pass trout spawners in the spring. Downstream of this chute the creek is bordered by several private properties, including a large ranch. Past channelization measures to protect this private land have contributed to a reduction in pool numbers and a limited amount of suitable spawning gravel.

The section upstream of this chute is confined within a short, steep-sided canyon. Flat “benches” over the next 1.8 km appear to be highly productive for Rainbow Trout. The lower chute remains, however, a total barrier to stream spawning Kokanee in the fall.

Falls and a series of bedrock chutes, located approximately 2.6 km upstream of the confluence, represent an obstruction to further upstream migration.

A dam is located approximately 3.3 km upstream of the confluence with Okanogan Lake.

Gravel was added to the creek and cleaned to enhance Kokanee spawning and egg incubation habitat.

A rock chute was blasted in 1989 to remove this particular obstruction and allow for upstream fish migration. A fishway has been installed at this location to further facilitate fish passage.

3.11.3 Powers Creek Limiting Factors Matrix

Reach break description	Reach 1
Attribute Considered	Confluence to 2.6km u/s
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	DG
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	P1
Large Woody Debris	DG
Percent Pool	P1
<u>Habitat Access</u>	
Fish Passage	P2
<u>Stream Flow</u>	
Resembles Natural Hydrograph	F1
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	P1
Stream Bank Stability	DG
Floodplain Connectivity	DG

3.12 ROBINSON CREEK

3.12.1 Sub-basin Overview

Robinson Creek flows directly to Okanogan Lake from the east. The confluence with the lake is located just over 0.8 km north of the Village of Naramata. The stream itself is a second order stream that measures 8.7 km in length.

Near the confluence with Okanogan Lake, Robinson Creek is contained within extensive bank armoring. This armoring features a number of internal drop structures.

Water Quantity/Hydrology

Dams located at the outlets of Naramata and Elinor Lakes are also present. These two small headwater reservoirs appear to produce reasonably stable flow, resulting in a strong incentive for some level of trout production. Stream flows are considered to be a low to medium constraint to increasing the fisheries potential of Robinson Creek.

3.12.2 Fisheries Resources in Robinson Creek Sub-basin

Kokanee and Rainbow Trout populations are present in the system. Kokanee apparently only use the lower reaches. Local residents claim large Rainbow Trout can be observed in the stream during spring runoff.

A culvert located approximately 1.1 km upstream of the confluence with Okanogan Lake is a migration barrier for all species of fish. Upstream of the lowest road crossing the stream is bordered by orchards and more natural habitat qualities are apparent.

Gravel is not abundant in the stream, and where present the gravel beds have a high fraction of fine materials.

3.12.3 Robinson Creek Limiting Factors Matrix

Reach break description	Reach 1
<u>Attribute Considered</u>	
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	DG
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	P1
Large Woody Debris	DG
Percent Pool	DG
Habitat Access	
Fish Passage	P1
<u>Stream Flow</u>	
Resembles Natural Hydrograph	P1
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	P1
Stream Bank Stability	DG
Floodplain Connectivity	P1

3.13 SIMILKAMEEN MAINSTEM AND WATERSHED

3.13.1 Sub-basin Overview

This watershed is 1,780 sq. km in size and is located in southwestern BC, 299 km east of Vancouver. The western portion of the watershed is located in the Cascade Mountains, while the eastern portion is situated within the Thompson Plateau. Elevation in the watershed range between 600 and 2300 m.

The Similkameen River is a seventh order stream. In total it traverses 198 km from its source to its mouth. It generally flows from the west. The confluence with the Okanogan River is located in Washington State near Oroville. The basin drains approximately 9600 square km of the Pacific Northwest, 7600 square km of which are located within Canada.

Land Use

American placer gold prospectors just travelling through the basin resulted in the first major influx of people into the Similkameen. Cattle ranching in Princeton and mixed agriculture farming by the Hudson's Bay Company was also introduced into the area during this period.

Since WWII, ranching, agriculture, forestry and mining have increasingly developed. In addition, the opening of the Hope-Princeton Highway opened the area to recreation and tourism.

South of Hedley became an important tree fruit producing region. The introduction of intensified orcharding practices and other technological advances resulted in higher crop yields. Grape production became prominent in the valley during the 1970's at which time five commercial vineyards were in operation. Significant limitations to agricultural production in the basin include adverse topography, low rainfall, stony soil that has low moisture-holding capacity. Arable land is typically located in the valley bottom.

Forestry has been a major element of the economy in the basin. The largest employer in the region as of 1984 was Weyerhaeuser Canada Ltd. which operates a sawmill in Princeton. Several smaller mills operate in the basin as well. Dominant species in the Similkameen are spruce, Lodgepole pine, Douglas fir and balsam.

Mining opportunities significantly increased over the years as the basin is part of a highly mineralized area which contains several commercial deposits of copper, gold, silver, lead and zinc as well as reserves of low-sulphur thermal coal in the Tulameen area. Several mining companies operate in the basin.

Tourism in the valley was facilitated by the opening of the Hope-Princeton Highway in 1949. The basin offers a variety of activities for both summer and winter tourists. There are ten provincial parks in the basin.

Geology, Topography and Soils

Soils in the area are stony and have a low capacity to retain moisture limiting arable land to valley bottoms.

Vegetation and Riparian Condition

The Similkameen Valley is one of the hottest and driest areas of Canada. Dominant tree species within the basin include spruce, Lodgepole pine, Douglas fir and balsam.

Water Quantity/Hydrology

As of 1984 there were over 1000 water licenses within the Canadian portion of the basin in operation. The majority of these licenses were used for irrigation purposes, typically in the lower part of the river between Princeton and the border. Estimated diversions during irrigation season were equivalent to a continuous flow of 6.13 cubic m per second at that time. By the end of the summer streams are reduced to base flows and irrigation exacerbates the issue. There is very little lake/reservoir storage within the basin to supplement the late summer low flows.

The other water supply problem is periodic flooding. In the spring and early summer the river experiences its freshet. These freshets commonly results in flooding in the lower valley. Extensive dyking has been constructed to protect much of these lands.

3.13.2 Fisheries Resources in Similkameen Creek Sub-basin

Fish species known to be present in the Similkameen River include Black Bullhead, Bridgelip Sucker, Dolly Varden, Largescale Sucker, Longnose Dace, Mottled Sculpin, Mountain Whitefish, Northern Mountain Sucker, Northern Pikeminnow, Rainbow Trout, Redside Shiner, Sculpins, Slimy Sculpin, Suckers, Torrent Sculpin, Umatilla Dace, and Whitefish. Fish stocking of Rainbow Trout has also occurred in the Similkameen River by the Fraser Valley Hatchery.

Falls located at the mouth of the Similkameen River have been replaced by a dam. The falls were the historical natural barrier to the upstream migration of anadromous species. There is no passage for anadromous fish beyond the dam. Introducing these fish to the Similkameen may result in disease and habitat competition with resident non-anadromous fish.

The Enloe Dam located near the mouth of the Similkameen River is the barrier to upstream migration to anadromous fish. Historically anadromous fish have not migrated past this point due to the presence of impassable falls. Concessions made to enable anadromous fish into this system may increase disease and competition for habitat with resident fish populations.

3.13.3 Similkameen Creek Limiting Factors Matrix

Reach break description	Reach 1
Attribute Considered	
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	DG
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	DG
Large Woody Debris	DG
Percent Pool	DG
<u>Habitat Access</u>	
Fish Passage	DG
<u>Stream Flow</u>	
Resembles Natural Hydrograph	P1
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	DG
Stream Bank Stability	DG
Floodplain Connectivity	P1

3.14 TREPANIER CREEK

3.14.1 Sub-basin Overview

Trepanier Creek watershed has an area of 255 sq. km. The watershed ranges in elevation from 342 m at Okanogan Lake to a max of 1,900 m at Mt Gottfriedsen. 60% of the watershed is above the 1,160 m elevation. The watershed is located on the eastern edge of the Thompson Highland physiographic division. Trepanier Creek watershed is a designated community watershed.

Trepanier Creek is considered to be a fourth order stream. It measures 28.3 km in length, and flows from the west to Okanogan Lake. Its confluence with Okanogan Lake is located just north of Peachland, BC.

Water Quantity/Hydrology

Urban development has significantly impacted Trepanier Creek. The stream has a critical water shortage problem that impedes its ability to meet fish production needs. Flows are restricted by Peachland District water use. There have been extended periods of time when the lower reaches of this system have dried up completely. If the low flow situation can be resolved satisfactorily, there is a site in the lower reaches of this stream where a small freshet-protected side channel might be constructed to provide a spawning refuge for the remaining Kokanee attempting to persist in this stream.

Although Trepanier Creek appears to support comparatively high production of trout and Kokanee, additional licenses water withdrawal and periodic flood control measures resulting in channelization in its lower reaches threaten to reduce present level of recruitment to Okanogan Lake. An agreement with the District of Peachland and Brenda mines that would address the collective needs of all water users and fisheries requirements on both Trepanier and Peachland Creeks would be beneficial.

Water Quality

The most notable industrial development in Trepanier Creek's headwaters is Brenda Mine. The water treatment plant constructed by the Noranda/Brenda Mines group has worked well in removing molybdenum from water collecting in an open pit. Release of treated water at low-flow periods in both the summer and winter could be highly beneficial to downstream fish stocks.

3.14.2 Fisheries Resources in Trepanier Creek Sub-basin

Burbot, Kokanee, Prickly Sculpin, Rainbow Trout, and suckers are fish species known to be present in Trepanier Creek. Rainbow Trout at the eyed egg and fingerling life stage cycles have been stocked in Trepanier Creek by the Summerland Hatchery.

Only 1.3 km of this stream is accessible to migratory trout and Kokanee due to the presence of a series of bedrock and boulder chutes which culminate in a 12 m vertical irrigation dam. Approximately 75% of the total stream length downstream of the irrigation dam has been channelized. This channelization has reduced availability of holding pools for adult trout, and reduced the diversity of rearing niches for juveniles. Due to channelization of the lower reaches of this stream, spawning gravel for trout and Kokanee have almost totally disappeared due to washout during spring freshets. The best rearing habitat is presently located in the first 100 m downstream of a series of cascades and chutes. Falls located approximately 3.2 km upstream of

the confluence with Okanogan Lake are considered a barrier to the upstream migration of resident fish.

Placement of spawning gravel for Kokanee was conducted in the lower 1.1 km of Trepanier Creek. Kokanee habitat in Trepanier Creek is considered sensitive and must be protected.

3.14.3 Trepanier Creek Limiting Factors Matrix

Reach break description	Reach 1
<u>Attribute Considered</u>	
<u>Water Quality</u>	
Dissolved Oxygen	DG
Stream Temperature	DG
Turbidity/Suspended Sediment	DG
Nutrient Loading	DG
<u>In Channel Habitat</u>	
Fine Sediment (substrate)	P1
Large Woody Debris	DG
Percent Pool	P1
<u>Habitat Access</u>	
Fish Passage	P1
<u>Stream Flow</u>	
Resembles Natural Hydrograph	P1
Impervious Surface	DG
<u>Stream Corridor</u>	
Riparian Vegetation	DG
Stream Bank Stability	DG
Floodplain Connectivity	P1

3.15 VASEUX CREEK

3.15.1 Sub-basin Overview

Vaseux Creek flows directly to Okanogan Lake from the east.. It is a fourth order stream that measures 34.8 km in length.

Vegetation and Riparian Condition

The riparian condition is poor in the lower reaches of the stream. During sudden flash flood events debris is washed into the stream and transported downstream to lower accessible reaches, limiting fish use. A flume dam has been constructed on this creek, exacerbating conditions during flash flood events. Riparian condition upstream of this point is unknown at this time.

Water Quantity/Water Quality

Gravel beds present are considered to be suitable for trout spawning. However, water quality as well as quantity are issues in Vaseux Creek. The ephemeral nature of the stream would limit fish access and may strand emerging fry.

3.15.2 Fisheries Resources in Vaseux Creek Sub-basin

Fish species known to be present in Vaseux Creek include Bridgelip Sucker, Longnose Dace, Mountain Whitefish, Prickly Sculpin, Rainbow Trout, and Sockeye Salmon.

A series of falls and pools are located approximately 5.8 km upstream of the confluence to Okanogan Lake. One fall is 2 m and the other is 2.6 m in height. Fish would have difficulty mounting these falls, thus limiting upstream migration.

Extensive electrofishing has been conducted in Vaseux Creek for fish population assessment purposes.

3.15.3 Vaseux Creek Limiting Factors Matrix

Reach break description	Reach 1	Reach 2	Reach 3
Attribute Considered	Alluvial fan	Canyon at 3km u/s of confluence	Falls at 5.5km u/s of confluence
<u>Water Quality</u>			
Dissolved Oxygen	DG	DG	DG
Stream Temperature	P2	DG	DG
Turbidity/Suspended Sediment	P1	DG	DG
Nutrient Loading	DG	DG	DG
<u>In Channel Habitat</u>			
Fine Sediment (substrate)	DG	DG	DG
Large Woody Debris	P2	DG	DG
Percent Pool	DG	DG	DG
<u>Habitat Access</u>			
Fish Passage	P2	DG	DG
<u>Stream Flow</u>			
Resembles Natural Hydrograph	P2	DG	DG
Impervious Surface	DG	DG	DG
<u>Stream Corridor</u>			
Riparian Vegetation	P2	F2	G2
Stream Bank Stability	F2	DG	DG
Floodplain Connectivity	P2	DG	DG

3.16 VERNON CREEK

3.16.1 Sub-basin Overview

Vernon Creek is designated as a community watershed for the Town of Winfield, BC. Several enhancement projects have occurred in the Vernon Creek watershed including the placement of gravel for the enhancement of spawning and egg incubation potential. Riprap was added at the bottom of Wood Lake Road to stabilize stream banks in this section to prevent downstream siltation and sedimentation. As well, a Water Survey of Canada station was located on Vernon Creek in 1973 to collect data on water quality and quantity in the creek.

Vernon Creek enters Okanogan Lake west and slightly south of Vernon City limits. It is a fifth order stream that measures 36.1 km in length. The stream drains through a series of lakes, and is the principal outlet of Kalamalka Lake. The system can be readily divided into two distinct reaches or zones with the separating boundary located at Polson Park in downtown Vernon.

Land Use

Agricultural and rangeland activities occur throughout the watershed, and include ranches located in the Winfield area.

Fluvial Geomorphology and In-Channel Habitat

A large, flat-bottomed culvert located at the Okanogan Landing Road crossing of Vernon Creek approximately 1.5 km upstream of the lake is thought to be impassable to Kokanee in the fall. It is difficult for trout to migrate upstream in the spring as well. The culvert is also a complete barrier to spawning coarse fish species from Okanogan Lake.

Incidental Kokanee ascent further upstream from this point would be hampered by a series of culverted residential road crossings. Also, a beaver dam blocks the outlet of Minn Lake. This dam is considered to be a barrier to fish migration.

Several suggestions have been made to further enhance the fish habitat quality in Vernon Creek. Annual gravel placement by hand would benefit both Kokanee and Rainbow Trout spawning. The placement of boulder clusters in association with large woody debris would provide fish refuge sites. Stream bank stabilization and replanting of disturbed stream side areas with native plants to limit silt deposition. The removal of man-made debris and removal of beavers to prevent additional dam construction would also facilitate improved recruitment to Okanogan Lake.

Several enhancement projects have occurred in the Vernon Creek watershed. Gravel was placed to enhance spawning and egg incubation potential. Riprap was added at the bottom of Wood Lake Road to stabilize stream banks in this section. A debris jam was removed on upper Vernon Creek. Bank stabilization and creek bed widening was undertaken to increase habitat potential. Also the placement of weirs and gravel was conducted within Polson Park to create spawning platforms for Kokanee.

Water Quantity/Hydrology

Vernon Creek is subject to seasonal low flows, predominantly in the fall. A distillery had previously released water into the creek. However, this distillery no longer releases outfall into

this section, and thus flows are lower than historical regimes. Water withdrawal from area ranches for irrigation purposes has exacerbated low flow conditions.

Water Quality

Salmonid production is limited in Vernon Creek by poor water quality, disturbance to rearing habitat, and seasonal low flows. Downstream of Polson Park the water quality and productive habitat for salmonids rapidly deteriorates. Storm water discharge is also impacting water quality and is especially evident in the lower reaches of Vernon Creek as substrate embeddedness. Upstream of Polson Park the water quality is better, although habitat is generally unfavorable for good salmonid production. Pools are very scarce at discharge of less than 2.0 – 2.8 cubic m per second. The reach between Kalamalka Lake and Polson Park appears as a series of fast moving runs and riffles at this flow.

Water quality has also been degraded by a variety of waste products, including at one time treated sewage from the city's treatment plant. The impact of spray irrigation on groundwater quality and Lower Vernon Creek water quality should be investigated. While elevated levels of phosphorous have historically been found in well samples, it is not known if the nutrients are passing through to surface waters.

A Water Survey of Canada station was located on Vernon Creek in 1973 to collect data on water quality and quantity in the creek.

3.16.2 Fisheries Resources in Vernon Creek Sub-basin

Known fish present in Vernon Creek includes Burbot, Carp, Kokanee, Northern Pikeminnow (formerly N. Squawfish), Prickly Sculpin, Rainbow Trout, Redside Shiner, sculpins, and suckers. Fish stocking of Kokanee fry has occurred in Vernon Creek by the Skaha Hatchery.

The most productive habitat appears to be a section extending approximately 0.5 km downstream of Kalamalka Lake proper. Kokanee were observed spawning here in October, 1976 (most likely outlet spawners from Kalamalka Lake); it is unclear if they have spawned at this location since then. Cover, water velocity, and substrate characteristics appear compatible with trout spawning as well.

3.16.3 Vernon Creek Limiting Factors Matrix

Reach break description	Reach 1	Reach 2
Attribute Considered	Confluence to Polson Park, Vernon	U/s of Polson Park, Vernon
<u>Water Quality</u>		
Dissolved Oxygen	DG	F2
Stream Temperature	DG	DG
Turbidity/Suspended Sediment	P1	F1
Nutrient Loading	P1	F1
<u>In Channel Habitat</u>		
Fine Sediment (substrate)	DG	P1
Large Woody Debris	DG	DG
Percent Pool	DG	P1
<u>Habitat Access</u>		
Fish Passage	P1	DG
<u>Stream Flow</u>		
Resembles Natural Hydrograph	P1	DG
Impervious Surface	DG	DG
<u>Stream Corridor</u>		
Riparian Vegetation	DG	DG
Stream Bank Stability	DG	DG
Floodplain Connectivity	DG	DG