

Salmon Watershed Planning Profiles for the Bridge/Seton Habitat Management Area

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SALMON WATERSHED PLANNING PROFILES
FOR THE
BRIDGE/SETON HABITAT MANAGEMENT AREA

Prepared for:

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1.0 INTRODUCTION

The Bridge/Seton Habitat Management Area (HMA) is located on the west side of the Fraser River at Lillooet and encompasses 6500 square kilometers (Fig 1). Major salmon bearing watersheds include the lower Bridge River, Seton River, Yalakom River, Gates River, Portage River, and Cayoosh Creek.

The following watershed profiles summarize physiographic information, streamflow characteristics, salmon escapement information, development activity, biophysical conditions, sensitive watershed and habitat features, special considerations and recent planning initiatives for each watershed. This information has been compiled from published and unpublished documents as well as the personal experience and professional judgment of Department of Fisheries and Oceans (DFO) staff. Based on the assessment of this information, management objectives and strategies have been developed to protect the salmon resource.

It is intended that the management objectives and strategies specified in this document be implemented within the HMA. The document is a valuable tool for DFO strategic planning and habitat management initiatives including the Lillooet Land and Resource Management Planning process that was initiated in 1996. In addition, it will benefit provincial Ministries of Environment, Lands and Parks (MELP), and Forests (MOF) by providing guidance for resource development activities as well as provide direction to municipalities, resource development companies, other stakeholders, and First Nations with interests in the HMA.

The information within this document is also maintained in an ACCESS database that includes input, searching and reprinting features. The information can be updated, and the objectives and strategies re-evaluated, as circumstances dictate. Related information for the Bridge/Seton HMA can be found in an accompanying document titled the strategic overview of fisheries values for the Bridge/Seton HMA (Komori 1997).

1.1 The Department of Fisheries and Oceans Vision Statement

DFO's Policy for the Management of Fish Habitat sets a long-term policy objective, namely the achievement of an overall net gain of the productive capacity of Canada's fish habitats (DFO 1986). Specifically, the intent of the policy is to "increase the natural productive capacity of habitats for the nation's fisheries resources, to benefit present and future generations of Canadians". It sets out three specific goals: fish habitat conservation, restoration, and development. The Guiding Principle of the fish habitat conservation goal is to achieve no net loss of productive capacity in relation to development activities. No net loss applies to habitat which:

- currently produces fish harvested in a subsistence, commercial or recreational fishery; or
- although not directly supporting fish, provides nutrients and/or supplies food to adjacent or
- downstream habitats or contributes to water quality for fish; or
- has been identified by DFO as a candidate for enhancement activities.

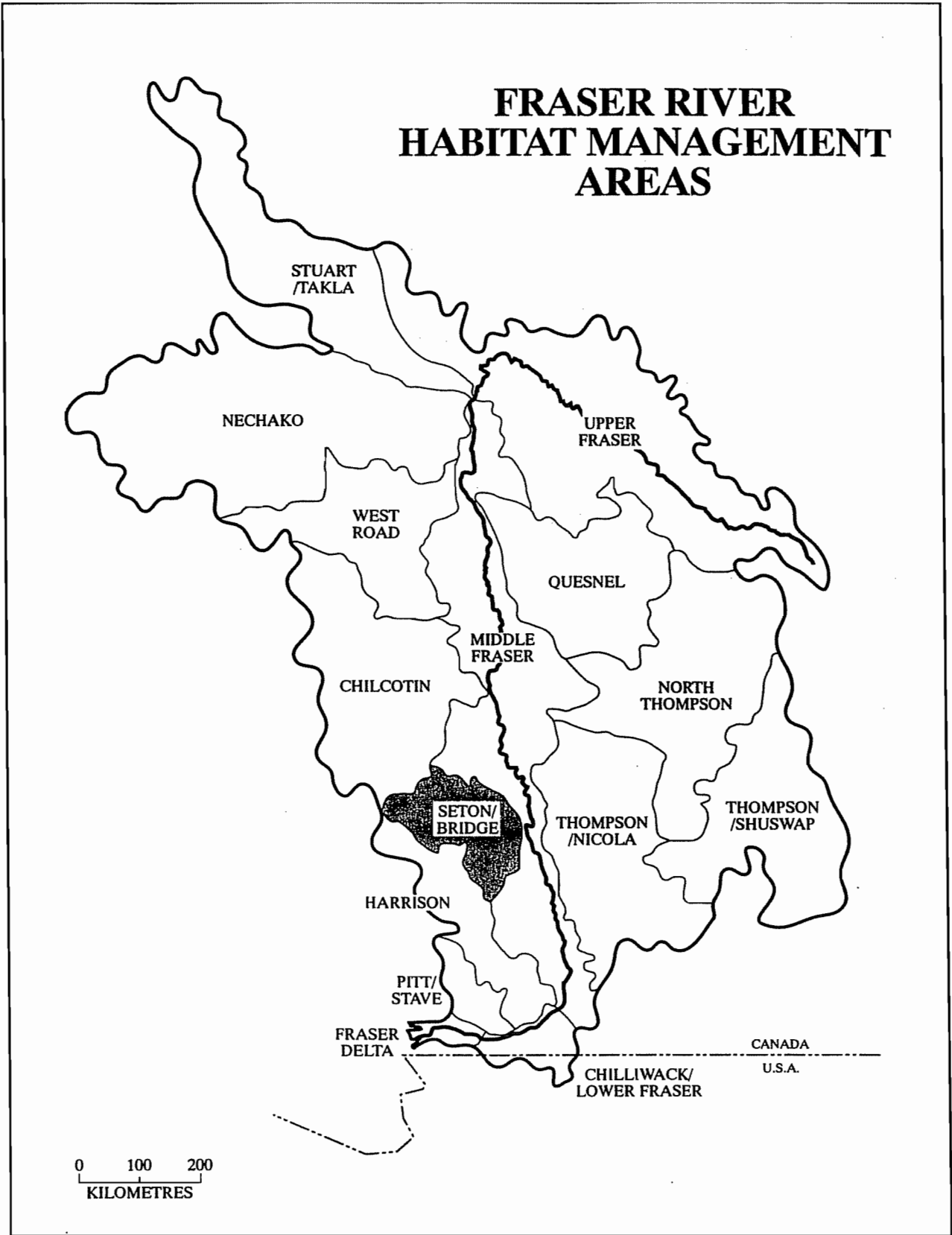


FIGURE 1. Location of the Bridge/Seton Habitat Management Area.

The second goal, fish habitat restoration, deals with the rehabilitation of the productive capacity of fish habitats in selected areas where economic or social benefits can be achieved through the fisheries resource. The third goal, fish habitat development, deals with the improvement and creation of fish habitats in selected areas where, again, fisheries resources production can be increased for the social or economic benefit of Canadians. These latter goals, restoration and development, will complement conservation efforts and contribute to a net gain of habitat.

In addition, DFO has identified seven measurable and achievable goals for sustainable fisheries development (O. Langer 1994 in Webb et al. 1994). These goals are:

1. **Avoid irreversible human induced alterations to fish habitats.** Alterations to fish habitat that reduce its capacity to produce fish populations which cannot be reversed within a human generation are to be avoided.
2. **Maintain the genetic diversity of fish stocks.** No fish stock, regardless of its size, will be arbitrarily eliminated and, where possible, efforts to conserve and rebuild small and remnant stocks are to be made.
3. **Maintain the physical and biological diversity of fish habitats.** Physical and biological diversity of habitat provides fish with an opportunity to adopt alternative life history strategies, thereby providing protection from natural habitat variation.
4. **Provide a net gain in productive capacity through proper habitat management.** Ecological limits control productive capacity of a stream system. Natural and self-sustaining production systems are preferred over semi-natural, artificial or non-self-sustaining systems.
5. **Maximize the value of commercial, sport, and aboriginal fisheries.** All market and extra-market values are to be considered, and measured in a way that permits comparison of competing users of the fisheries resources.
6. **Maximize the non-consumptive values of the fisheries resources.** Intangible and cultural values associated with fishery resources are to be given due consideration in decision making.
7. **Distribute fishery net benefits in a fair and equitable manner.** Local communities are to be involved in the decision-making process pertaining to habitat conservation, enhancement, and restoration, and particularly who is to benefit and who is to pay.

2.0 OVERVIEW OF SALMON RESOURCES

The Bridge/Seton HMA supports sockeye (*Oncorhynchus nerka*), pink (*Oncorhynchus gorbuscha*), chinook (*Oncorhynchus tshawytscha*) and coho (*Oncorhynchus kisutch*) salmon (Fig 2). The following chapter provides a summary of salmon escapement, escapement trends, life history characteristics, spawning and rearing habitat, and enhancement opportunities by species. For more detailed information, refer to Komori (1997).

2.1 Sockeye

Within the Bridge/Seton HMA, the majority of sockeye spawners return to the Gates River and Portage River. During 1981-1992, average Portage returns equaled 8,792 with a maximum of 31,844 and Gates sockeye averaged 16,054 with a maximum of 50,357 (DFO 1994). Relatively small runs averaging less than 500 sockeye return to the Seton River, Bridge River and Yalakom River. Historical maximum escapements are greater than 1,000 for the Bridge River, Seton River and Yalakom River. Sockeye stocks in the Bridge/Seton HMA generally show an increasing trend in escapement. In general, Portage River and Gates River sockeye stocks have been increasing since the construction of the Gates Creek spawning channel by the International Pacific Salmon Fisheries Commission (IPSFC) in 1968.

Most Fraser River sockeye stocks exhibit a four-year pattern of production characterized by one dominant year, followed by a sub-dominant year and then two years of relatively low returns (DFO 1995a). The dominant cycle year of the Gates River sockeye is the 1992 cycle whereas the dominant cycle line is not well defined in the Portage stocks. The Gates Creek stock is an early summer run, migrating through the lower Fraser River from mid-July to mid-August and into Gates Creek from July 20 to Sept 5 (Fretwell 1979). Portage River sockeye are a late run stock and migrate through the lower Fraser in October, migrate into Portage River from September 2 to November 21 and peak spawning occurs during mid-November (Fretwell 1979, DFO 1995a, FHIIP 1992).

The main spawning area for sockeye in the Gates River is the spawning channel located 5 kilometers upstream of Anderson Lake. Seton Lake provides primary rearing habitat for sockeye juveniles while Anderson Lake provides rearing habitat primarily for the Gates Creek stock (Geen and Andrew 1961). Sockeye spawning habitat in the Bridge/Seton HMA is currently underutilized.

DFO has limited management action directed at Bridge/Seton sockeye stocks. The only stock within the Bridge/Seton HMA with transferable knowledge from a well studied index stock is the Gates sockeye run (DFO 1994). The interim spawning escapement goals for the Gates and Portage Creek sockeye runs are 21,000 spawners and 8,000 spawners for all cycle years respectively (DFO 1995a). These goals represent an increase of 5,000 spawners in the Gates River and no further increase in Portage Creek sockeye, over average escapement values recorded between 1981-1992.

2.2 Chinook

Within the Bridge/Seton HMA, the majority of chinook are produced in the Bridge River and Portage River. Between 1981-1992, average chinook escapements to the Bridge River equaled 529 spawners and Portage chinook averaged 137 spawners (DFO 1994). Smaller chinook stocks are produced in the Seton River and the Yalakom River. Historical maximum chinook escapement is greater than 500 in the Bridge River and Portage River and greater than 100 in the Yalakom and Seton Rivers. Annual chinook escapements to the Bridge/Seton HMA have shown an increasing trend to 1994 except for the Yalakom chinook stock.

Chinook stocks in the Bridge/Seton HMA belong to summer run timing stocks and migrate through the lower Fraser after July 15 (DFO 1995c). Prior to the installation of the Mission Dam at the outlet of Carpenter Lake, chinook spawners migrated to the upper Bridge River watershed and known spawning areas included lower Tyaughton Creek and Ferguson Creek (Nielsen and Shepherd 1983). Chinook spawning is now limited to areas downstream of the Terzaghi Dam and includes the Bridge River mainstem from Camoo Creek to approximately 10 kilometers upstream of the Yalakom confluence (Stewart and Matthew 1984). The heaviest spawning occurs between the Horseshoe Bend upstream to the Yalakom confluence and light spawning occurs between Camoo Creek and Antoine Creek and from 1 to 7 kilometers upstream of the Yalakom confluence (Jarvis and Stewart 1985b). In the Yalakom River, coho and chinook spawning is scattered throughout but mainly occurs at Beaverdam Flats (FHIIP 1992). In the Bridge River, the upper wetted 12 kilometers provides rearing habitat for chinook, coho and rainbow trout (Lister and Beniston 1995).

Under the 1985 Pacific Salmon Treaty, Canada and the United States committed to halt declining chinook spawning escapements and attain by 1998, escapement goals established by each nation (DFO 1995c). In the Fraser River, interim rebuilding targets are based on doubling the average escapement numbers from 1979-1982. In general, chinook stocks have been rebuilt by reducing exploitation rates by 15% through management actions in ocean fisheries, particularly terminal sockeye and pink salmon fisheries (DFO 1995c). In the Bridge/Seton HMA, chinook escapements have reached their escapement target as returns have doubled from 366 during 1979-1982 to 789 between 1983-1994.

Enhancement activities in the Bridge/Seton HMA include brood stock collection and subsequent fry release programs for chinook, coho and steelhead by the local Rod and Gun Club. Since 1991, B.C. Hydro has operated a chinook fry release program in the Bridge River to mitigate for the 1991 and 1992 spills over the Terzaghi Dam. Historical habitat improvements for chinook, coho and steelhead in the Bridge River included the construction of 8 spawning platforms upstream of the Yalakom confluence in the early 1980s. This project was a joint effort by DFO, MELP and the Department of Highways during a road widening project. However, in 1982, flood release flows from Terzaghi dam transported a large proportion of the gravel downstream (Nielsen and Shepard 1983). Potential habitat improvement projects in the Bridge River include the development of a spawning and rearing channel at Horseshoe Bend and

increasing rearing habitat by re-watering of the upper Bridge River through flow releases through Terzaghi Dam (Kosakoski and Stalberg 1996, Maricle 1996, Lawrence and Cody 1996, Triton 1992).

2.3 Coho

The two main coho producing systems are the Gates River and the Bridge River within the Bridge/Seton HMA. Between 1981-1992, average Gates River and Bridge River coho escapement equaled approximately 500 spawners (DFO 1994). Smaller coho stocks averaging less than 140 fish are produced in the Yalakom River, Seton River, Portage River and Cayoosh Creek (DFO 1994). Historical maximum coho escapements exceed 500 for the Bridge River, Portage River and Gates River. Coho stocks in Gates River and Yalakom River show a declining escapement trend whereas the Bridge River and Seton River coho stocks appear to be increasing. The reliability of escapement data is highly variable, depending on the species, enumeration method used and variations in stream conditions. Coho salmon are inherently difficult to enumerate and coho escapement estimates are probably the most unreliable of all estimates for salmon species (DFO 1996). The apparent decline in the abundance of wild Fraser coho is attributed to excessive exploitation rates, habitat loss and decreased marine survival of smolts (DFO 1996).

Within the Bridge/Seton HMA coho generally spawn from October to early January with peak spawning during late November/early December (Jarvis and Stewart 1985a, FHIIP 1992, Matthew and Stewart 1987). The majority of coho in the Bridge/Seton HMA spend 2 years in freshwater and one year in the ocean (Matthew and Stewart 1987, Jarvis and Stewart 1985a). A small proportion (7-8%) of Bridge and Gates coho spend 2 years at sea and return as four year olds (Matthew and Stewart 1987).

In the Gates River, the heaviest spawning occurs within the 2 kilometer reach upstream of Spruce Creek. Light spawning occurs in the mainstem for 2 kilometers downstream of Spruce Creek and very scattered spawning occurs for within a 3 kilometer reach at seven 7 mile creek (Jarvis and Stewart 1985a). Some coho spawning also takes place in low gradient areas of Anderson Lake tributaries such as D'Arcy Creek (Matthew and Stewart 1987, FHIIP 1988). In the Bridge River, coho spawn from Camoo Creek to 10 kilometers upstream of the Yalakom River confluence (FHIIP 1992, Jarvis and Stewart 1985a).

2.4 Pink

Pink are the most abundant salmon species found in the Bridge/Seton HMA. The majority of pink are produced in the Seton River where the average escapement between 1981-1992 equaled 380,000 spawners. Smaller pink runs of 10,000-50,000 fish escape to the Bridge River, Portage River and Cayoosh Creek annually. The Yalakom River and Gates River support less than 100 spawners. Historical maximum pink escapements are greater than 500,000 in the Seton River and exceeded 50,000 in Portage River, Bridge River and Cayoosh Creek. Pink escapements to

Gates River and the Yalakom River have historically exceeded 1000 adults. Escapement estimates for the Seton, Gates, Portage and Bridge River have averaged approximately 0.8 million for the 1983-1991 cycle years with a peak of over 1.5 million in 1991 (DFO 1995b). Overall, pink escapement to the Bridge/Seton HMA exhibits an increasing trend.

Fraser River pink spawn primarily in odd years and are categorized as either early or late runs based on migration timing (DFO 1995b). Approximately 85% of the total return to the Fraser River belong to the early run pink and consists of stocks from the lower Fraser River, Thompson River and Seton Creek (DFO 1995b, IPSFC 1959). Seton pink adults migrate through the lower Fraser in mid-September and spawn from mid September to early November (Rosenberger 1996, FHIIP 1992, Triton 1992). Pink rear in the Strait of Georgia until mid-summer, then migrate as far as the Gulf of Alaska and rear for one year in the marine environment before returning to spawn as two year olds (DFO 1995b).

In the Seton River, the majority of pink salmon spawn in the artificial channels constructed during the mid-1960's by the IPSFC (Groves and Higgins 1995). Some pink spawning also occurs upstream of the Seton dam in the Portage River and Gates River. In the Bridge River, pink spawn from the mouth to approximately 10 kilometers upstream of the Yalakom confluence, with highest densities reported downstream of Camoo Creek. Pink salmon also spawn in the lowermost 0.5 kilometer of the Yalakom River (FHIIP 1992).

During the early 1900's, 28 million pink salmon spawned in Seton Creek, Thompson River and Nicola River drainages. However in 1913, the Hell's gate rockslide completely blocked access upriver and significantly reduced the Fraser pink run. In 1946, the construction of the Hell's Gate fishway restored passage through the Fraser Canyon. Pink stocks were further rebuilt in Seton Creek during the 1960's through the construction of two spawning channels to compensate for loss of historical spawning habitat by the construction of the Seton Dam and Cayoosh Creek diversion (Fretwell 1989). In combination with enhancement and mitigation measures, exploitation rates were reduced and pink escapement to the Bridge/Seton HMA has been steadily increasing (DFO 1995b).

Fraser River pink are managed as a single stock, based on in-season estimates of total run size with different exploitation rates applied to early and late run stock groups (DFO 1995b). The Seton and Thompson River pinks are the 2 major stocks making up the early Fraser River pink run (Rosenberger 1996).

3.0 METHODOLOGY

The Bridge/Seton HMA Salmon Watershed Planning Profiles consist of background information on watershed characteristics followed by assessment categories. These categories represent watershed features that can be altered by human activities and result in negative impacts to the fisheries resource. The watershed based characteristics include physiographic and biogeoclimatic information, streamflow characteristics and salmon escapement estimates. The assessment categories include resource development activity, biophysical conditions, sensitive watershed features and special considerations. A more detailed description of category and the assessment methodology used is described below.

From the background information and assessment of watershed features, specific management objectives and strategies consistent with sustainable land, water and other resource use have been developed for each watershed within the Bridge/Seton HMA.

3.1 General watershed information and hydrology

The primary source of general watershed and hydrologic information for this report is Rood and Hamilton (1995). All flow data relate to the stream mouth and mean 7 day low flows for winter (November 1 to April 30) and summer (May 1 to October 31) are presented if available.

3.2 Salmon Escapement

Salmon escapement information is presented by species with an assessment of the population trend. Escapement information includes the historic maximum escapement and year, the 1981 to 1992 average and maximum escapement and the 1969 to 1980 average escapement. The escapement trend is determined by comparing the 1981 to 1992 average escapement to the 1969 to 1980 average and is expressed as either static, increasing, decreasing or unknown. A difference of at least 20% is required to identify an increasing or decreasing trend.

The building potential for the stock is presented as low, medium or high. The measure of rebuilding potential has been determined by DFO (1994) and is based on changes in escapement over time. A "low" rating indicates that the historic maximum is greater than the recent (1981-1992) maximum by 50% and suggests there is significant potential to increase production.

3.3 Development Activity

Development types are further broken down into characteristics associated with the particular development (Table 1). For example, characteristics related to forestry development include percent total and recent logging, equivalent clearcut area (ECA) status and riparian condition. Percent logging is defined as the total area of the watershed that has been logged including those blocks with some hydrologic recovery. This information has been compiled to assist DFO staff in "flagging" watershed that have a level of forest harvesting (e.g. >20%) that warrants particular attention. In some cases, watersheds may have a low overall percent logging but a high percentage of logging when examined at the sub-basin level. Site specific impacts can warrant

the development of fisheries objectives and strategies to address forestry impacts on fisheries values. Equivalent clearcut area is a forest management term used to describe the total area within a watershed which functions in a similar fashion hydrologically to a clearcut opening, accounting for a recovery factor based on the stage(s) of forest regeneration (MacDonald et al 1997).

TABLE 1. Type of resource development activity and associated characteristics.

Type of Development	Associated Characteristics
Forestry	% total logging, % recent logging, ECA status, riparian condition
Agriculture	Extent, riparian condition, water withdrawal, water quality
Urbanization	Population level, extent, riparian condition, water withdrawal, water quality
Recreation	Extent, riparian condition, water quality
Placer mining	Extent, water quality, riparian condition
Other mining	Extent, water quality
Industrial development	Extent, water quality, riparian condition
Linear development	Extent, riparian condition
Hydro development	Extent, riparian condition
Other development	Extent, riparian condition
Cumulative development	Consideration of the impact of all development activities.

For each resource development category, a "level of concern" rating and comments are provided. The level of concern rating expresses the "sensitivity" of watershed features that can be altered by resource development activities and subsequently have a negative impact on fish and fish habitat. The level of concern is rated either "low" or "high". A low level of concern indicates that, based on the available information, and assuming that standard management practices are applied, minimal impact to salmon populations or their habitat would be expected to occur. Standard management practice assumes that an acceptable level of protection for stream habitat and water quality will be provided. This includes standard practices such as the Forest Practices Code, the Land Development Guidelines, placer mining regulations and guidelines, and Guidelines for Mineral Exploration and Reclamation. It is also assumed that routine auditing of development activities will be performed to ensure compliance with the prescribed standards. A high level of concern would indicate that the particular watershed has a high probability for significant impacts on fish or fish habitat from present or proposed development activities or biophysical features.

It should be noted that the level of concern assigned was based on the best available information. Reclassification may be necessary as new information becomes available, or changes in either the physical habitat, rate of development, or status of the salmon populations occur.

3.4 Biophysical Conditions

Biophysical conditions within the watershed were assessed and rated as having a “high” or “low” level of concern. The level of concern ratings were determined as described in the Development Activity section above. The following biophysical features are included in the watershed summary profiles for the Bridge/Seton HMA.

- Soils
- Terrain
- Hydrology
- Channel stability

3.5 Sensitive Watershed and Habitat Features

This category is used to identify the presence of sensitive watershed features or specific habitat features that would require site specific management strategies and includes the following;

- Sensitive physical features; ie beaver dams, obstructions
- Sensitive biological features; ie critical spawning or rearing habitat, near extinction of stocks
- Significant environmental variables; biophysical conditions resulting from impoundment, nutrient enrichment. ie geological considerations, high water temperatures, water quality problems
- Unique features; ie highly productive groundwater seepage

3.6 Special Considerations

The occurrence of, or the potential for, special considerations which may have present or future impacts on development activities including:

- Stock Management Initiatives
- Commercial Fishery
- Recreational Fishery
- Native Fishery
- Restoration Activity
- Restoration Opportunity
- Enhancement Activity
- Enhancement Opportunity

3.7 Summary of Habitat Concerns

The number of “high” ratings for the level of concern in the Development Activity and Biophysical Conditions categories are summarized in this section. The presence of Sensitive Watershed Features and Special Considerations are counted and included in the summary.

3.8 Recent Watershed Planning/Project Initiatives

The undertaking of recent watershed planning/project initiatives by government agencies and/or other stakeholders.

3.9 Specific Objectives and Strategies

Objectives and associated strategies are developed to address fisheries related concerns that have been previously identified in the resource development, biophysical conditions, sensitive features and special considerations sections. Seven primary objective categories appear within the ACCESS program;

- Identify and protect salmon habitat
- Restore and enhance habitat
- Maintain and enhance water quantity for instream uses
- Maintain/enhance watershed and stream channel integrity and stability
- Maintain/enhance fish and habitat diversity
- Rebuild and enhance salmon stocks
- Other

After selection of the appropriate objective category, the strategy is developed to address the fisheries related concern. There are often several strategies developed to address a single management objective.

4.0 RESULTS AND DISCUSSION

A total of 6 salmon bearing watersheds are delineated for the Bridge/Seton Habitat Management Area. A summary of land use development and habitat concerns within these watersheds are discussed in the following sections. A brief overview of management objectives and strategies associated with each watershed is also provided.

4.1 Summary of Land Use Development in the Bridge/Seton HMA

Hydroelectric development has had the single largest long-term impact on the fisheries values within the Bridge/Seton HMA. Hydroelectric power development on the Bridge and Seton Rivers and Cayoosh Creek has degraded salmon habitat through elimination of access to historical spawning and rearing areas, dewatering and alteration of flow regimes and reduction in natural rates of gravel recruitment. Periodic releases of high flows have increased suspended sediment loads, eroded spawning gravels and degraded riparian vegetation. Furthermore, hydroelectric development facilities are responsible for increasing natural mortality rates of returning adults and outmigrating juveniles.

The Bridge River hydro development is the third largest of BC Hydro's generating facilities and began in 1934 with an initial diversion of 30 cubic feet per second (cfs) overland through a tunnel to a power generating facility at Shalath located on the north shore of Seton Lake. Between 1946-1948, the Mission Dam was constructed at the outlet of Carpenter Lake, eliminating all access for anadromous fish species to the upper Bridge River watershed. In 1948, a second dam and power facility was constructed by BC Electric further upstream in the Bridge system at the outlet of Downton Lake and by 1954 diverted flows from the Bridge River to Seton Lake were increased to 2200 cfs. The water licenses carried no provision for the release of water for fisheries or any other purpose. In 1955, hydroelectric development in the Seton watershed included the construction of a diversion dam, powerhouse and tunnel in Cayoosh Creek and the completion of the Seton Dam by 1956. In 1960, the Mission Dam was replaced by the Terzaghi Dam and by 1967, diverted flows from the Bridge River to Seton Lake were increased to a final maximum of 5360 cfs. From Seton Lake, the majority of water is bypassed through a canal to the Seton generating station on the west bank of the Fraser River.

Placer mining and hard rock mining development is also responsible for the destruction of productive creek beds and riparian areas but mining activity has been significantly reduced since the 1970's within the Bridge River and Seton River watersheds. However, the potential for increased mining activity still exists and Alvino Mines and Resources Limited is currently in the process of re-opening the Bralorne/Pioneer gold mine.

Although percent logging of major watersheds is relatively low, known impacts of forest harvesting on fisheries values have occurred on a site specific manner rather than altering watershed based processes such as natural hydrologic regime. However, several drainages require further assessment to determine the extent of forestry related impacts on fisheries values. Linear development and agriculture have also had some impacts on fisheries values in the Bridge/Seton Habitat Management area.

4.2 Summary of Habitat Concerns

A summary of habitat concerns is provided for each watershed and are based on ratings provided in the watershed summary profiles. More specifically, the level of concern for development activity and biophysical conditions are rated as being either "high" or "low". A high level of concern is given a value of 1 whereas a low level of concern has a value of 0. Similarly, the presence of sensitive watershed features and special considerations are assigned a value of 1. A total value for these four categories provides a total number of habitat concerns by watershed within the Bridge/Seton HMA (Table 2). This information provides the reader with a sense of the extent of development activity, biophysical conditions, sensitive watershed features and special considerations associated with each watershed. However, there is a large variability in the extent and type of habitat related concerns within the study area. ***Therefore, the total number of ranking points does not identify the priority of one watershed over another as each watershed regardless of it's ranking contains habitat issues that require site specific attention.***

TABLE 2. Summary of habitat concerns by watershed for the Bridge/Seton HMA.

Watershed	Development Activity	Biophysical Concerns	Sensitive Habitat Features	Special Considerations	Total
Bridge River	7	2	3	8	20
Yalakom River	4	2	2	4	12
Seton River	8	1	1	6	16
Cayoosh Creek	4	0	2	4	10
Portage River	6	1	1	4	12
Gates River	7	0	0	4	11

The Bridge River has a total number of 20 points and the Seton River a total of 16 points for habitat concerns within each watershed. Hydroelectric power development has degraded salmon habitat through the loss of adequate instream flows, loss of access to historical spawning and rearing areas, degradation of riparian habitat, reduction in natural rates of gravel recruitment and increased suspended sediment loads. Furthermore, hydroelectric development structures continue to increase natural mortality rates of returning adults and outmigrating juveniles. Details on biophysical conditions, sensitive watershed features and special considerations are provided in the attached watershed summary profiles.

Portage River, Cayoosh Creek, Gates River and the Yalakom River has similar totals ranging between 10-12. Habitat issues in Cayoosh Creek result from hydroelectric development and forestry related development whereas habitat issues in the Gates River are related to urban, agricultural and forestry development.

4.3 Management Objectives and Strategies

To minimize further impacts to fisheries values from resource development activities, management objectives and strategies are provided on a watershed basis for Seton Creek, Portage River, Gates River, Cayoosh creek, Bridge River and Yalakom River. Management strategies have been developed by DFO and MELP habitat biologist, fish management biologist and habitat technicians.

Management strategies for the hydroelectric development in the Bridge/Seton HMA include the establishment of minimum flow releases through the Terzaghi Dam into the lower Bridge River. DFO has recommended a mean monthly flow release schedule for the Bridge River and suggests the construction of a suitable multi-level intake structure to release water of suitable quality and quantity. Another management strategy in the Bridge River is to reduce the frequency and magnitude of spills from the Terzaghi Dam by increasing the buffer in the reservoir to account for the imprecision of hydrologic forecasting of run-off events.

Primary management strategies in the Seton River watershed are to restore a more natural hydrograph and to reduce the mortality of adults and juveniles during passage through the powerhouse and by impingement on the trashracks at the power plant. Other management strategies for the Seton River are to minimize delays of adult sockeye and pink at the Seton powerhouse tailrace and to minimize stranding of juvenile salmonids during downramping flows. Salmonid management and production can also be improved by facilitating access for large chinook through the fishway and replacing the fish counter at the Seton Dam.

In the Bridge/Seton HMA, there is concern that the increasing rate of forestry development may have negative impacts on the fisheries resource. Management strategies include the assessment of road failures, slope failures, channel instability, increase sedimentation and degraded riparian areas through the application of the Watershed Assessment Procedure. Several sub-basins within the Gates River, Portage River, Cayoosh Creek , Yalakom River and the lower Bridge River have been prioritized for immediate assessment.

One of the management strategies for the Gates River watershed is the assessment of encroachment by urban, agriculture and mining development on salmon spawning and rearing habitat in the mainstem.

5.0 ACKNOWLEDGMENTS

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Preliminary resource planning efforts by DFO in the Fraser River Basin included an Analysis Criteria Workshop which provided general direction in setting objectives and strategies and identifying indicators. Participants in the workshop included Lidia Jaremovic, Violet Komori, Mike Romaine, John Patterson, Tony Cheong, Stuart Nimmo and Tom Pinkerton of FRAP as well as Dr. Steve MacDonald of the Science Branch, West Vancouver and Mr. Glenn Smith of the Fisheries Management Sector, New Westminster.

The ACCESS database for the stream profiles was designed and built by Alex Judkowicz.

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