PACIFIC FISHERIES RESOURCE CONSERVATION COUNCIL
Conseil pour la conservation des ressources halieutiques du pacifique

NORTH AMERICAN SALMON STRONGHOLD PARTNERSHIP

Harrison Basin Certification Application

JANUARY 2010

PREPARED FOR
Pacific Fisheries Resource Conservation Council
Suite 290, 858 Beatty Street, Vancouver, BC V6B 1C1

PREPARED BY
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I. GENERAL INFORMATION

Name of Project: Harrison River Stronghold

PREFACE

In 2009, the Pacific Fisheries Resource Conservation Council published a report which recommended that Canada participate in the Salmon Stronghold Partnership in order to test the Salmon Strongholds approach in Canada, including the scientific evaluation and ranking of a potential stronghold (Beeson, 2009). Recognizing the Harrison Basin's fisheries values, the Council decided, after first meeting with the Sts'ailes (Chehalis) First Nation, to pursue and apply the North American Salmon Stronghold Partnership's criteria in the Harrison Basin, and determine its scoring in terms of productivity and uniqueness.

PROJECT LOCATION

The proposed Harrison River Stronghold will be situated within the Fraser River Watershed in Southern British Columbia (three maps of the basin and watershed are attached). This is the key downstream portion of the Lillooet-Birkenhead and Harrison River basins (Map 1). The Harrison system is located within British Columbia's Coastal Western Hemlock biogeoclimatic zone (Krajina, 1965), and is a key component of the Fraser River Salmon Ecoregion (North American Salmon Stronghold Partnership, unpublished).

The main features of the proposed Harrison River Stronghold are Harrison Lake, the Chehalis River, Weaver Creek and the Harrison River (Map 2). Important upstream tributaries draining into Harrison Lake include Big Silver Creek and Cogburn Creek.

The Harrison River is a short but large tributary flowing southwest from Harrison Lake for 16.5 km, entering the Fraser River 116 km upstream from Georgia Strait (Map 3). The Harrison River is navigable, but has small rapids and difficult water downstream of the lake. Further downstream, near the confluence with the Fraser, the Harrison River expands into a wide backwater called Harrison Bay. In the days of the Fraser Canyon Goldrush (1858 era), sandbars at the confluence with the Fraser River were dredged; otherwise, the Harrison River is relatively untouched. There is little habitation around it, it is forested through most of its course and, although crossed by a highway and railroad bridge, there is no road next to the river itself and little disturbance of its riparian zone.

Harrison Lake is about 60 km long and almost 9 km across, at its widest point. The resort community of Harrison Hot Springs is situated at the south end of the lake, about 95 km east of Vancouver. A highway connects Harrison Hot Springs with the nearby town of Agassiz and points south, but it does not proceed north up the lake for any appreciable distance. Like the river, there are few roads surrounding the lake.with the exception of some forestry roads on the eastern upslopes which are not situated directly next to the lake.

The Chehalis River is a key tributary flowing into the Harrison River, and an important salmon producer. Originating in the mountains west of Statlu Lake, this canyoned river empties first into Statlu Lake, then Chehalis Lake and finally the Harrison River.

Big Silver Creek is the largest stream flowing into Harrison Lake (other than the Lillooet River). Also known as Big Silver River (or simply Silver River), it has been the site of numerous fisheries and habitat-enhancement projects over the years.

The proposed Harrison Stronghold area is home to several strong and unique runs of Pacific salmon. In fact, it may be the only area in BC to host all five species of salmon and steelhead trout. Specifically, this area provides

spawning grounds for three distinct Conservation Units of sockeye: one spawning in the Harrison Rapids area of the Harrison River; a second in the tributary portions of the basin, including the Chehalis River and Weaver Creek (Fisheries and Oceans, 2009); and a third in the Big Silver tributary flowing into Harrison Lake.

For reference purposes, it is important to note that the term "Conservation Unit" refers to the geographic areas identified by Fisheries and Oceans Canada that encompass salmon stocks sharing genetic similarities related to their evolution. Across BC they constitute hundreds of distinct stocks within each of the of the broad species categories, such as coho and chum.

The life history of the sockeye in the Harrison Rapids Conservation Unit is unusual, with the fish swimming downstream to the Fraser River estuary upon emergence rather than rearing in freshwater first. Although this run is not enhanced, it has remained strong, actually increasing in number while other late-run Fraser River sockeye populations have dwindled. Monitoring in the Fraser from the 1990s to the present has indicated that many late-run Fraser sockeye are dying in-river before spawning (Labelle, 2009); however, this mortality pattern has not affected the Harrison Rapids stock. In fact, in each of the last five years, close to 400,000 of these fish have reached a very short stretch of the Harrison River to spawn.

The life history of Weaver Creek sockeye is also unique, in that they swim downstream to the Harrison River and then upstream to Harrison Lake to rear. This local adaptation is particularly amazing given that other upstream and uplake populations of the same sockeye Conservation Unit have a more standard life history (including a fourth CU that inhabits the Lillooet portion of this drainage system).

In addition, two Conservation Units of chinook are recognized in the Harrison Basin. Like the sockeye, these chinook have a unique life history; they swim downstream after emergence to rear in the ocean rather than rearing in freshwater first. This rapid-growing, three-year-old, white-fleshed fall chinook is very productive; in each of the last five years, as many as 250,000 spawners have been counted in the short stretch of the Harrison River. Although these chinook have been used as spawning stock in other local areas, such as the Chilliwack River, the Harrison population itself is not enhanced.

The other chinook Conservation Unit has a more normal life history, which includes a freshwater rearing phase. The spring chinook are particularly numerous in the Chehalis and Big Silver tributaries, while other runs occupy the Birkenhead River in the Lillooet portion of the drainage.

Also important to the proposed Stronghold are: a Conservation Unit of partly enhanced chum salmon, inventory of which is now poor except for efforts carried out by the Sts'ailes (Chehalis) First Nation; a Conservation Unit of a very abundant odd-year-spawning pink salmon; and a poorly studied coho population in Harrison tributaries, and the mainstem Harrison itself. (A separate coho Conservation Unit spawns in the Lillooet portion of the drainage.)

Persistent populations of steelhead trout occur in the Chehalis River, Weaver Creek, Cogburn Creek (tributary to Harrison Lake) and Big Silver Creek, in addition to populations in the upper Lillooet-Birkenhead watershed. Some of these populations have the unusual life history of migrating through a lake (Harrison) to reach their spawning grounds; others, such as the Chehalis and Weaver Creek steelhead, don't do this.

Steelhead populations in the basin are the second most abundant in the region. The Chehalis run, now a catch-and-release fishery, is particularly strong. In 2007, 367 wild steelhead were reported caught (Appendix 6), but in some years catches of up to 1,000 wild steelhead have been reported. There is an enhancement facility on the Chehalis, and anglers also catch marked steelhead. The Harrison has been noted in the past for its strong populations of cutthroat trout.

The appendices at the end of this document (under separate cover) summarize stock assessment data for all five species of salmon. Information from the Steelhead Harvest Analysis is included; although it was developed for a different purpose, it can prove useful as a stock assessment tool.

Salmon and steelhead enhancement projects are underway for some of the basin's salmon populations. A sockeye spawning channel was built in Weaver Creek (Maps 2 and 3) to offset the impacts of sediment inputs from the Hemlock Valley Ski development, and there is a moderate-size hatchery for chum, coho, chinook and steelhead in the Chehalis River, which also benefits some pink salmon. In the upper drainage, Fisheries and Oceans Canada operated a hatchery in the Birkenhead for chinook salmon until the late 1990s, when it was decommissioned. It was subsequently operated as a public involvement project (PIP) by local interests, who also used it for coho and steelhead enhancement; however, it was closed in the early 2000s and has not operated since then.

The upper portion of this watershed has been omitted from this application for several pragmatic reasons: there is currently no highway access joining the Harrison and the Lillooet-Birkenhead portions of the basin; although paved access to both areas is available, one route is to the north of Vancouver and the other to the east; as a result of these access issues, there are two sets of key contacts and potential Stronghold participants, and a different organization would therefore need to become involved to extend this application to both areas. These factors make it impractical to include both portions of the basin at this time.

Ultimately, however, it would be beneficial to extend the Salmon Stronghold to the entire Harrison-Lillooet-Birkenhead Basin. The basin in its entirety is of significant size, draining an area of 7870 km^2 and stretching 177 km from the Harrison-Fraser confluence to the head of the Lillooet River. The upper area of the watershed, particularly the Birkenhead, is home to important runs of coho, chinook and sockeye, with other species, such as steelhead, also present. Overall, an extension of this Salmon Stronghold will be wise in due course. The Mount Currie First Nation has great interest and expertise in the fisheries of the area and may well be interested in leading such an effort when the time comes.

II. APPLICANT CONTACT INFORMATION

Applicant Organization: Pacific Fisheries Resource Conservation Council

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KEY PARTNERS

To build widely inclusive participation, this activity will need to commence in earnest as soon as Salmon Stronghold status is obtained. The Pacific Fisheries Resource Conservation Council will work to identify key partners and will turn over the management of the partnership to a local community organization in due course. Key partners to be approached include the Sts'ailes (Chehalis) First Nation, Fisheries and Oceans Canada and BC's Ministry of Environment, as well as local sport fishing groups.

Other groups, with interests wider than fish, should also be approached. These should include the District of Kent, Town of Harrison Hot Springs and Fraser Valley Regional District; stewardship organizations working in the watershed, such as the BC Conservation Foundation and the Fraser-Harrison Smartgrowth Partnership; and local forest harvesters and agriculture organizations. Several other organizations, which operate in many areas in addition to the Harrison area, should also be approached. These include the Nature Trust of BC, the BC Salmon and Watersheds Program, the Pacific Salmon Foundation, Pacific Streamkeepers Federation and others.

III. INFORMATION RELEVANT TO NORTH AMERICAN SALMON STRONGHOLD PARTNERSHIP SELECTION

WHY MAKE THE HARRISON BASIN A SALMON STRONGHOLD?

The Harrison Basin is a "crown jewel" of the BC salmon resource. With all five species of salmon as well as steelhead trout present, it is perhaps the only basin that provides a home to all the anadromous species. Some of the species have unique life histories, such as river-run sockeye that migrate downstream to the Fraser estuary upon emergence from the gravel, and sockeye that migrate down Weaver Creek to the Harrison River and then up the Harrison River to rear in Harrison Lake. Harrison Basin stocks are numerous and increasing in number at the same time as other late-run Fraser River salmon stocks are decreasing in number. The Harrison chinook stocks are also exceptional and abundant, with over 250,000 spawners in some years

Habitat in the Harrison Basin is generally in good shape; a few problems are being addressed, other ones need to be, and several emerging threats to wild salmon have been identified. The Harrison chinook, and both Harrison River and Weaver Creek sockeye Conservation Units, have very good Salmon Stronghold expert analysis scores, ranging from 17–20 out of a maximum of 20 for these three Conservation Units. (Expert assessments for salmon are incorporated at the end of section III of this application).

Despite the importance of these wild salmon, local citizens are largely unaware of the significance of the Harrison salmon resource. The assignment of Salmon Stronghold status will be instrumental in raising public awareness of the basin's extraordinary salmon values, and in leading to proactive management and planning in the Harrison Basin.

Similarly, government fisheries agencies are not currently devoting extra care and attention to ensuring the viability of salmon and steelhead in the area; rather, new developments that can affect salmon are being reviewed via standard agency policies. A startling example of this is the Fraser Valley Regional District Aggregate Pilot Project (2009), undertaken by the Province of BC in conjunction with the aggregate industry to identify and examine potential aggregate sources in the Fraser Valley. The published report on this project includes a "for discussion only" map, in which most of the west side of the Harrison River and the large islands in Harrison Lake are identified as potential aggregate sources. Although the report mentions the environment, the words "fish" and "salmon" are not used. The report makes it clear that decisions on such matters rest with the Province and are not subject to municipal zoning, but it makes no mention of the role of the federal government, which is responsible for protecting fish habitat under the constitution.

Other activities, such as ongoing and increasing log booming in the Harrison River, pose serious risks to salmon and steelhead. In spite of this, these activities are not being given adequate attention to ensure that the strength and uniqueness of the salmon stocks spawning in the Harrison are preserved.

The Harrison Basin is a prime example of a crucial salmon system that is being taken for granted by those entrusted with its care. As in many other parts of BC, no proactive approaches are in place to avoid damage or screen out inappropriate development; neither are efforts being made to collect key information on the status of Conservation Units such as coho, chum and pink salmon for management purposes. Stronghold Status could be the driver for improved assessment of healthy populations and better information to manage the Harrison salmon and steelhead resource.

COMPLEX ISSUES FACING THE HARRISON BASIN

The proposed Harrison Stronghold is located less than 100 km from the city of Vancouver, BC. This large population base creates an inherent risk to nearby areas. A golf course and small residential community have already been developed in the lower basin, and additional urbanization poses a key threat to salmon and steelhead habitat.

The basin's proximity to British Columbia's largest population centre has also generated interest in local infrastructure projects, including:

- A proposed highway, dubbed the "Sasquatch Highway," which would follow the west side of Harrison Lake to add a new link from the Lower Mainland to BC's Interior. This project would compound the number of direct and indirect impacts to the basin many times over.
- A proposal to use Harrison Lake as a water supply for the Greater Vancouver Regional District. The District recommended this in 2000 as one of a number of options to be considered in the long term. This would pose serious concerns regarding conservation of salmon and steelhead habitat.

RESOURCE ISSUES FACING THE HARRISON BASIN

Aggregate removal is an emerging issue that might affect the Harrison watershed. As mentioned above, the 2009 FVRD Aggregate Pilot Project published a report and map identifying most of the west side of the Harrison River and the large islands in Harrison Lake as potential aggregate sources. These areas were coded yellow on the map, meaning that the potential for removal has to be assessed. However, it is of concern that this report, jointly undertaken by the Province of BC and the aggregate industry, did not even use the words "fish" or "salmon" or acknowledge risks to the fisheries resource; In addition, the report stressed that these decisions rest with the Province and are not subject to municipal zoning that could prevent or restrain it, and it made no mention of the role of the federal government, which is responsible for protecting fish habitat under the constitution.

Logging is another important resource issue in the Harrison Basin. Past logging practices in this area were not carried out to current environmental standards. Important side channels to the Harrison River were sedimented and, while some of these have been restored, remediation work remains. While the BC Forest Practices Code and the more recent Forest and Range Practices Act have improved practices, logging continues to challenge habitat protection. The Harrison River has long been used to boom logs to the Fraser River. Increased levels of this activity pose great concerns to the unique biodiversity and high productivity of the sockeye and chinook stocks. Impacts from scouring or from bark and other debris sinking to the bottom have not been assessed.

The integrity of groundwater-fed sloughs is another habitat-related concern, as they are important to salmon rearing. Increased urbanization associated with a growing population increases the number of houses being built along the banks of the Harrison River, which create water-use concerns, among other things.

Habitat protection is of particular concern in headwaters with respect to rate of cut, logging in riparian zones and land disturbance leading to sedimentation and changes to flow regime. It has been suggested that full protection be awarded to sensitive areas in the flood plain.

Another concern is the number of streams in the basin that are receiving serious attention for their potential to attract small hydro projects. Impacts of such projects can include changes in hydrology in the immediate vicinity of the project, habitat loss, channeling and diversions. Access roads and power-line right-of-ways can also be of considerable detriment to salmon habitat.

Other issues facing the Harrison Basin relate to competition and conflicts amongst those involved in fishing Harrison salmon. Responsible behaviour, respectful sharing of the resource, and widespread cooperation are essential to the long-term viability of the salmon fishery and the maintenance of the basin's remarkable attributes.

As is the case in many areas, water quality is also a concern (Neiner and Wernick, 1997). As one example, the Village of Harrison Hot Springs discharges sewage into Harrison Lake near the entrance to the Harrison River. Fortunately, a 2008 federal-provincial government announcement of funding to improve the treatment and collection of sewage included the pumping of Harrison Hot Springs sewage to the District of Kent's facility. This will allow the village to decommission its sewage plant in Harrison Lake in due course. While the stated reason for this is to improve drinking water, it should also have benefits in water quality and habitat conditions for the salmon resource.

In addition to resource issues within the basin, risks and threats of impacts come from outside the area. In particular, the maintenance of high quality rearing habitat in the Fraser River estuary, including its outer banks, is germane to the well-being of the strong fall white chinook, which leave the river upon emergence and rear in the Fraser estuarine area for a time.

Impacts of climate change and its implications to ocean productivity are also emerging as significant. However, the Harrison stocks are doing better than other Fraser River stocks and may be better adapted to climate change.

BENEFITS OF SALMON STRONGHOLD STATUS

The establishment of the Harrison Basin as Canada's first Salmon Stronghold would generate broad interest and draw public attention to the extraordinary nature of the region. It would serve as a rallying point for local residents, First Nations, fishing interests, environmental interests and local governments to work together to protect the uniqueness of the area.

The designation of Salmon Stronghold status would provide a marketable "branding" of the Harrison Basin as an exceptional environmental model. It would provide a tangible basis on which to promote the area as an example of good environmental stewardship, while supporting local residents to foster more sustainable development.

Salmon Stronghold status and associated branding regarding sustainability should also help in both conserving and marketing Harrison salmon. Earlier work in the drainage on traceability (tracking salmon through the harvesting, processing and distribution stages) would be enhanced by a Salmon Stronghold designation. There would be encouragement to reduce dependence on risky ocean fisheries in favour of more terminal fisheries in the Harrison region. The British Columbia Institute of Technology is promoting a River to Plate program that could operate in conjunction with Salmon Stronghold initiatives. Such a program would assist local residents, including First Nations, and help to conserve salmon stocks. It would also be consistent with recommendations in a recent paper by Kim Charlie and Ken Wilson (2008) with regard to fisheries targeting Harrison sockeye.

Implementing a Harrison Salmon Stronghold could be a catalyst enabling stakeholders to work together across a broad spectrum of interests on a long-overdue coordinated fisheries and land use management plan. As its initial focus, this planning initiative would require that activities be compatible with and supportive of the protection of the Harrison salmon resource, rather than considering salmon interests and values as secondary to other concerns.

Salmon Stronghold designation should assist in attracting interest and contributions from public and private sources to support salmon conservation projects in the Harrison Basin. The generation of new funds for high-

priority habitat projects, salmon stock assessment projects and key land acquisitions in the Harrison Salmon Stronghold has the potential to be a major benefit of Stronghold status.

The proposed Harrison Salmon Stronghold should itself benefit from its involvement with others in the North American Salmon Strongholds Partnership and Wild Salmon Center by drawing on their experience, technical support and sharing of best practices.

Finally, as Canada's first Salmon Stronghold, the Harrison Stronghold has the potential to provide impetus to establish other Salmon Strongholds in Canada. It would be the first of what could be several Canadian Strongholds, which would be highly beneficial to the North American Salmon Stronghold Partnership in fulfilling its original intent to include the entire coastal region, from the lower US to Canada and Alaska, as its founders hoped.

EXPERT RATING OF HARRISON BASIN SALMON AND STEELHEAD

CHINOOK ASSESSMENT

Dr. Brian Riddell, Executive Director, Pacific Salmon Foundation

Harrison White Chinook

(Harrison white chinook are genetically unique; they are one CU under the Canadian Wild Salmon Policy, and have a distinct life history.)

- Productivity = 5 (Among the most productive chinook on the coast but production can be highly variable due to fry migrations; habitat conditions are excellent overall.)
- Abundance = 5 (Usually the largest Canada chinook population.)
- Viability = 5
- Life History Diversity = 5 (Unique life history for chinook in BC.)
- Percent Natural Origin Spawners = 5 (Hatchery is present in the Chehalis River CU but the contribution is miniscule compared to wild.)
- Score = 20

Richard Bailey, Program Head Chinook and Coho. Fraser River Stock Assessment, DFO Science

Harrison White Chinook

- Productivity = 5 most years (Stock is highly productive which, as mentioned above, is linked to ocean productivity. If ocean environment is favourable, Harrison abundance explodes. It contributes very heavily to southern BC fisheries in the Gulf and off WCVI, plus US fisheries in Juan de Fuca and Western WA.)
- Abundance = 4-5. (Abundance is consistently high but very variable. Stock is very dependant on ocean regimes and can produce huge numbers, with fluctuation in escapements between about 25,000 and 240,000.)
- Life History Diversity = 5 Rare/unique. (Harrison is the ONLY natural fall white Lower Fraser stock and, as an immediate migrant, it is unique among Fraser chinook.)

- Percent Natural Spawners = 5 most years. (Hatchery contribution to Harrison is low and assessed annually.)
- Viability = 4.5–5
- Score = 19–20

Chehalis Stream-type Chinook

- **Unrated but score would be low.**
- Comments: This "stock" is not really assessed and may be the result of experiments by previous hatchery managers. Early timed returns to the Chehalis have been crossed with various upper Fraser origin springs, including Slim and Bowron, plus mid-Shuswap, in attempts to produce high quality early returning stocks for recreational fishing. It is likely that there were unique spring type stocks (perhaps similar to the lost upper Stave or like Birkenhead) in these areas but the present status of wild Chehalis spring-type chinook is unknown.

COHO ASSESSMENT

Richard Bailey, Program Head Chinook and Coho. Fraser River Stock Assessment, DFO Science

Chehalis Coho

- **Unrated but score would be low.**
- Comments: This is a hatchery dominated population that supports major sport fisheries both in the Chehalis and in marine and downstream freshwater areas. We don't try to assess it.

SOCKEYE ASSESSMENT*

Jeremy Hume, Research Biologist, Cultus Lake Salmon Research Laboratory, Science Br., DFO

Lower Fraser River type (LFR CU)

- Productivity = 5 (Highest return/spawner in watershed from 1994 to 2003.)
- Abundance = 3 (Comprise about 2–3 % of the Fraser River population, similar to many FR stocks, but 3 are each >20% of total.)
- Life History Diversity = 5 (Harrison River sockeye have a rare life history type, migrating to the ocean upon emergence. River type sockeye are rare in BC. This is one of 2 in the lower Fraser and one of 5 in the whole Fraser.)
- Percent Natural Origin = 5. No enhancement.
- Viability = 4
- Score = 18

Harrison Big Silver Sockeye (D/S-L CU)
(Fry migrate downstream to lake.)

- Productivity = 0 (Catch not counted, therefore productivity cannot be estimated in a manner similar to other stocks.)
- Abundance = 1
- Life History Diversity = 5
- Percent Natural Origin = 5. (Hatchery on Trout Lake Creek from 1905 to 1920. Not very successful and no lasting effect.)
- Viability = 0.5
- Score = 10.5

Weaver Creek-Harrison River
(Fry migrate down Weaver Creek, to Harrison River, then up to Harrison Lake CU.)

- Productivity = 4 (Was the highest in the Fraser River watershed but declined dramatically in 2002 and 2003.)
- Abundance = 3 (Creek and channel numbers are about 2–3% of total Fraser River abundance.)
- Life History Diversity = 5. (Weaver Creek Fry have a unique migratory pattern, down to the Harrison River and then up to Harrison Lake to rear.)
- Percent Natural Origin = 5. (There is no known effect on genetic diversity from spawning channel, which allows natural mating and spawning. It's possible that better egg to alevin survival conditions may affect fitness selection, but no data to evaluate.)
- Viability = 3.5
- Score = 17

Note: Expert certainty for all sockeye CU's = 5.

Note: Birkenhead CU also assessed but not included in this application for the Harrison portion of the Basin.

Note: References: Fisheries and Oceans Canada. 2009. Abundance and productivity data from DFO and Pacific Salmon Commission databases.

PINK ASSESSMENT

DFO determined this CU could not be assessed owing to lack of data.

STEELHEAD ASSESSMENT

Not yet assessed.

IV: STS'AILES (CHEHALIS) BAND, GOVERNMENT AGENCY AND PARTNER SALMON AND STEELHEAD PROJECTS IN THE WATERSHED

PRODUCTION AND HABITAT PROJECTS

The Harrison Basin has a production spawning channel on Weaver Creek and a hatchery on the Chehalis River. Information on species enhanced by year and releases are outlined in Appendix 7. As indicated above, there used to be a small hatchery in the Birkenhead, but Fisheries and Oceans discontinued its use in the 1990s. A local group took over and operated the Birkenhead facility as a Public Involvement Program (PIP) hatchery, but this also ceased operations in the early 2000s.

Numerous habitat improvement projects have also been carried out in the basin.

For instance, as a pilot project in the summer of 2008, the BC Conservation Foundation (BCCF) installed six "J-hook vane" woody debris habitat structures in the Chehalis River immediately downstream of the Morris Valley Bridge (Hryhorczuk, 2009 personal communication).

Recently, the BCCF, in association with the Greater Georgia Basin Steelhead Recovery Program, conducted a height barrier assessment on the Big Silver, and created a concept for a side-channel along the margins of Hornet Creek (a tributary to the Big Silver). Opening up the barrier would provide passage for coho and chinook salmon and steelhead trout into an additional upper 8–9 kilometres of high quality river habitat. The BCCF has identified other steelhead improvement projects in the watershed, including gravel placement, large woody debris complexing and refuge alcoves, and an annual stream enrichment program. Interestingly, BC Environment completed fertilization experiments a decade ago (Wilson et al. 1999).

While a number of habitat restoration projects have been carried out, additional work could involve creating better pool habitat, gravel augmentation and off-channel rearing.

ASSESSMENT PROJECTS

- **Chinook**—Fisheries and Oceans Canada conducts extensive work on chinook spawners in the Harrison. This fall-returning Harrison stock dominates other lower Fraser chinook stocks. Since 1984, mark-recapture studies have been conducted annually on the Harrison River to obtain reliable estimates of spawning escapements (PSC, 2009). Fisheries staff members utilize the fall chinook as an indicator stock, with good spawning estimates based upon mark-recapture work. This is a means to verify numbers recorded elsewhere, which have been based only upon visual surveys. As an indicator stock, it also provides useful information on production, ocean survival and fishing impacts over time. Unlike many populations, Harrison chinook have specific stock escapement goals.
- **Sockeye**—Fisheries and Oceans Canada conducts extensive work on sockeye spawners in the Harrison system.
- **Chum**—Fisheries and Oceans Canada has discontinued chum salmon escapement estimates for the Harrison system. Some work is still done on Harrison chum escapements by the Sts'ailes (Chehalis) First Nation, under agreement with Fisheries and Oceans.
- **Coho**—Fisheries and Oceans discontinued coho salmon escapement enumeration in various Harrison system locations in the 1980s and 1990s.

- **Pink**—Fisheries and Oceans discontinued pink salmon escapement some years ago, with the last enumeration taking place in the Weaver system in 1991.
- **Steelhead**—BC Environment does not enumerate steelhead *per se*, but does conduct a mail-out harvest analysis with licence holders. Those results have a long time period and are useful as indicators of abundance. The BC Conservation Foundation has conducted steelhead stock via electro fishing (Chehalis) and snorkel surveys (Chehalis and Big Silver). Snorkel survey counts are not reported in Appendix 7 but were relatively good for steelhead (summers and winters) in the Chehalis, with only a few (~10) being observed in the Big Silver. In addition, the BCCF has estimated Steelhead Smolt Capacity & Returning Adults (assuming 13% marine survival with estimates of approximately 6,000 smolts/700 adults, based on a regional review of existing information).

PLANNING

The only regional land-use plan existing in the area of the proposed Harrison River Salmon Stronghold is a Fraser River Management Plan (FRMP): Hope to Mission; this plan focuses on removing gravel in the Fraser River for flood protection.

The focus of the Fraser-Harrison Watersheds Stewardship Program (FHWSP) is on habitat-restoration projects, specifically for the endangered Salish Sucker.

PARTNERSHIP EXAMPLES

- Along with DFO and the Province, the Sts'ailes (Chehalis) First Nation and local sport fishers have established a Collaborative Angler Access Management Plan under the Fraser Watersheds and Salmon program. This is an example for the Salmon Stronghold to follow in bringing diverse interests together to make progress in the basin in areas such as better habitat management and cooperation among parties with diverse interests.
- Fraser Valley Regional Watersheds Coalition promotes watershed sustainability and has been active in the Chilliwack watershed to date.
- The Fraser-Harrison SmartGrowth program is another example of a partnership that emphasizes planting trees along fence lines and in environmentally sensitive areas as a means to maintain rural quality. They plan to build trails and greenways, among other activities.

LAND ACQUISITIONS

The Nature Trust of BC has been involved in acquisitions of key lands in the Harrison Basin, primarily for wildlife but with some secondary benefits for salmon habitat including:

- Chehalis River Conservancy (marshland)/Nature Trust DFO management (200.9 ha).
- Harrison River marsh and riparian habitat is at the confluence with the Chehalis and Harrison (7.5 ha).
- Harrison Knob (Canfor donation), located in the heart of Scowlitz Territory, is an important burial site and cultural heritage resource (22 ha).
- BC Environment is exploring the possibility of a Wildlife Management Area in the Harrison River area.

ACKNOWLEDGEMENTS

Several biologists, scientists and managers provided information relevant to this report. The Council is grateful for input from Tom Johnston and Greg Wilson of BC Environment for information related to steelhead; Marvin Rosenau of BCIT provided useful information on steelhead as well. We also thank Richard Bailey, Roberta Cook, Jeremy Hume, Sue Grant, Tracy Cone, Mark Johnson and Gayle Brown of Fisheries and Oceans Canada for information on salmon stocks. A particular note of thanks goes to Waleed Elmarimi of the GIS Unit of DFO for producing the maps used in this report. We also thank Brian Riddell of the Pacific Salmon Foundation for his expert assessment of the Harrison white chinook stock. In addition, this report benefited from information and input from Ken Beeson, consultant to the PFRCC. Jay Nicholas and Tom Miewald of the North American Salmon Stronghold Partnership also provided advice. Frank Kwak, Diane Ramage, Cory Hryhorczuk, Terry Slack, Craig Orr and Wendy Bales made useful comments on local issues. We are extremely grateful for the input and interest from the Sts'ailes Band. In particular, we thank Chief Willie Charlie, Kelsey Charlie, James Leon and Kim Charlie of the Sts'ailes (Chehalis) First Nation for their interest, input and assistance.

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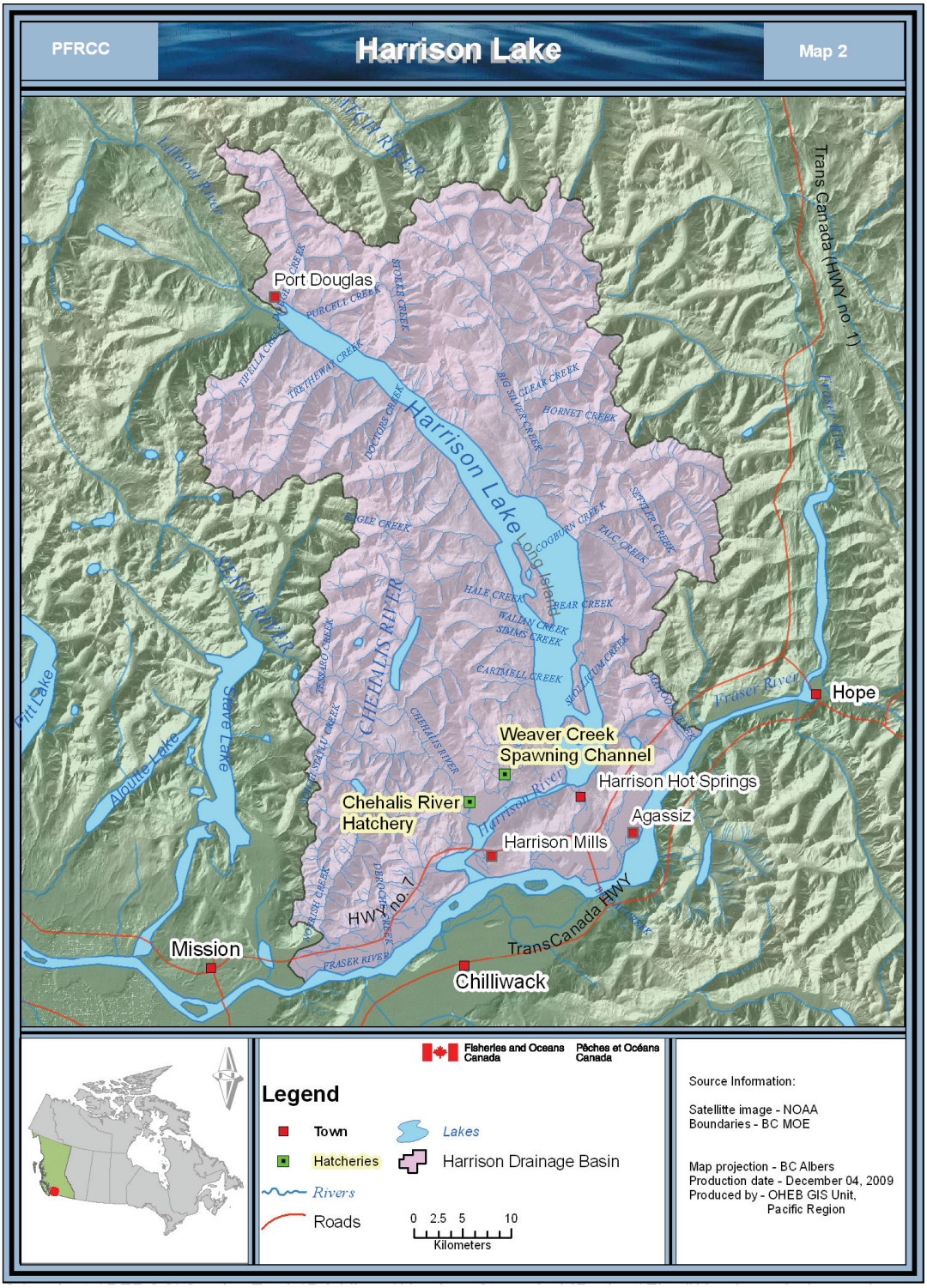
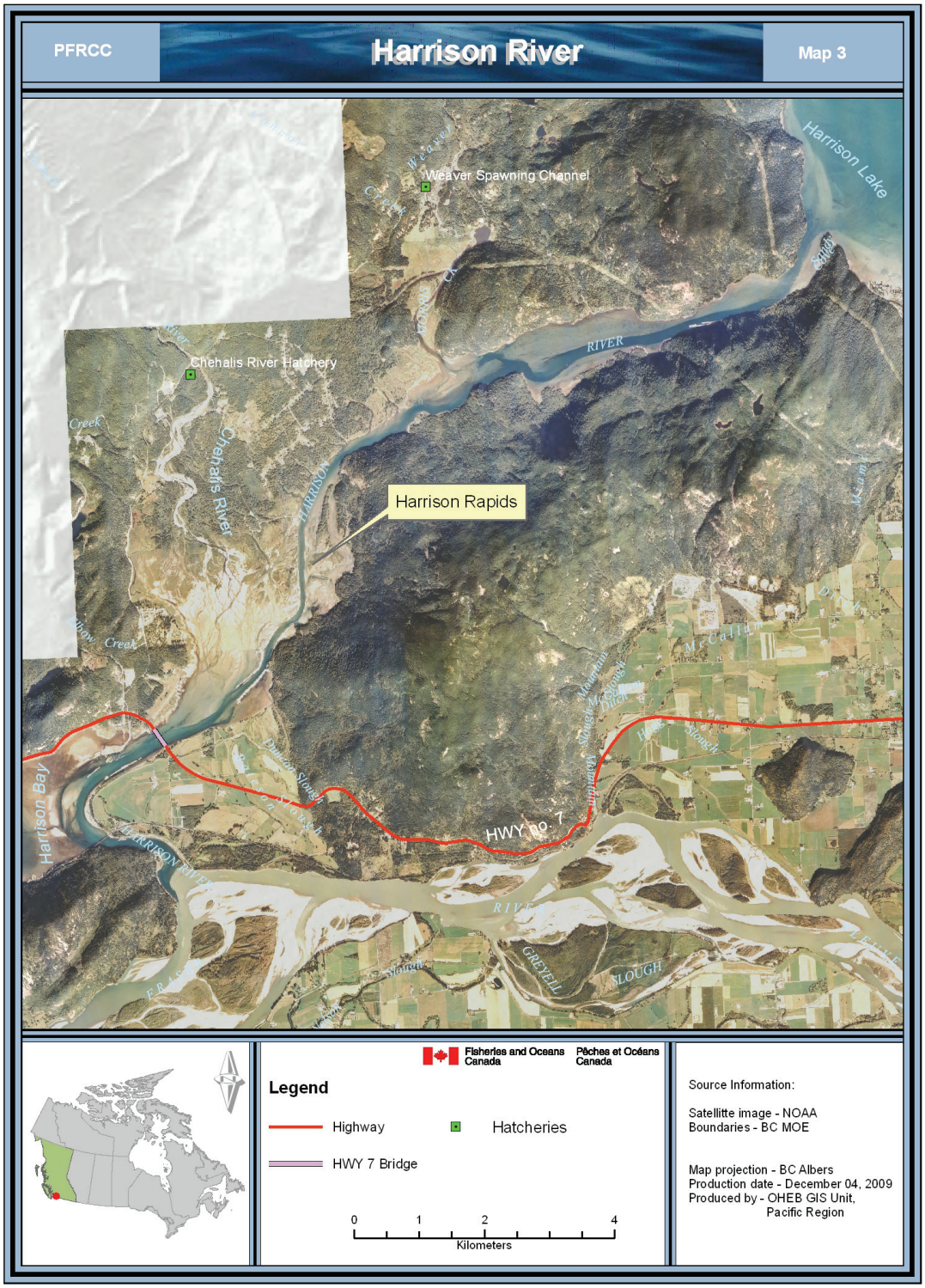
MAPS

MAP 1. The Harrison-Lillooet-Birkenhead watershed and its key features.
The lower Harrison watershed is shown in purple and the upper Lillooet-Birkenhead watershed, which should be added to the Stronghold as soon as feasible, is shown in light green.

MAP 2. The proposed Harrison Salmon Stronghold and key features.



MAP 3. Ortho photo map of the Harrison River proper with key features marked.



APPENDICES (UNDER SEPARATE COVER)

Appendix 1. Chinook Salmon Escapements to the Harrison System

Appendix 2. Chum Salmon Escapements to the Harrison System

Appendix 3. Coho Salmon Escapements to the Harrison System

Appendix 4. Pink Salmon Escapements to the Harrison System

Appendix 5. Sockeye Salmon Stock Status in the Harrison Basin

Appendix 6. Steelhead Harvest Analysis Information for the Harrison Basin: 1968–2007

Appendix 7. Enhancement Information for the Harrison System

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