

**TAC 2008 Environmental Achievement Award Submission
British Columbia Ministry of Transportation and Infrastructure**

**Sea-to-Sky Highway Improvement Project:
Environmental Enhancements and Project Legacies**

**Authors: Angela Buckingham, Chief Environmental Officer, BC MOT
Isobel Doyle, Senior Environmental Manager,
Par Terre Environmental Consulting Services Ltd.**

March 11, 2009

1.0 Introduction

The British Columbia Ministry of Transportation and Infrastructure (BC MoT) successfully implemented an innovative environmental mitigation and enhancement program for the Sea-to-Sky Highway Improvement Project (the 'Project'). A multi-faceted environmental program delivery model (see diagram below), involving several environmental strategies, was developed to protect and enhance the environment during highway construction and operation. This unique approach to environmental management on the public-private-partnership project protected the environment, offered valued-added opportunities for environmental enhancement and created important Project legacies. The approach resulted in infrastructure improvements of direct benefit to fish, wildlife and the public. This paper describes the Project environmental program delivery model and many of the successful results.

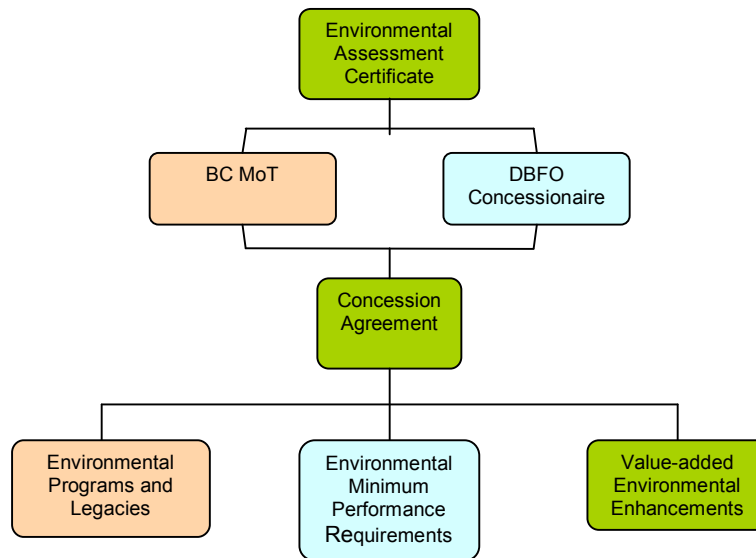


Diagram: Multi-faceted Environmental Program Delivery Model

2.0 Background

The Sea-to-Sky Highway winds its way alongside Howe Sound fiord through the rugged Coast Mountain Range from Horseshoe Bay in West Vancouver—host to 2010 Olympic Winter Games freestyle skiing and snowboarding events—through Squamish—the Outdoor Recreation Capital of Canada—to Whistler—host to 2010 Olympic Winter Games alpine, nordic and sledding events (Figure 1). BC MoT identified the need to increase the safety, reliability and mobility of the 100 km section of highway to serve future travel needs, including transportation demands during the 2010 Winter Olympics.

The Sea-to-Sky Highway (Highway 99) traverses landscape types of extremely high visual and scenic value. The highway corridor provides well-known public recreation access to several provincial parks, backcountry areas, bike and hiking trails, rock climbs, and ocean, lakes and rivers (Figure 2). Three biogeoclimatic zones and several different red- and blue-listed plant communities occur along the highway corridor. The corridor provides aquatic and terrestrial habitats for fish and

wildlife species including SARA-listed frogs, reptiles, raptors, water-associated birds, passerines, and small and large mammals.

3.0 Environmental Assessment Process

The Project successfully completed a harmonized environmental assessment review process at both federal and provincial levels, and received a federal screening decision and provincial environmental assessment certificate in June 2004, allowing the Project to proceed to the permitting phase and construction. The joint environmental assessment considered the potential environmental, economic, social, heritage and health effects of the Project, including planned mitigation strategies to avoid, reduce or compensate to offset potential adverse effects. The Project must comply with the environmental commitments set out in the environmental certificate, and applicable provincial and federal environmental guidelines and permits that are current at the time of design and construction. The Project also retained a multi-disciplinary team of qualified environmental specialists responsible for managing and auditing all environmental issues associated with the implementation of the Project.

4.0 DBFO Procurement Model

BC MoT delivered the Sea-to-Sky Highway Improvement Project using a Design Build Finance Operate (DBFO) procurement model. The procurement process required the short-listed proponents to prepare a technical submission in response to the Request for Proposals. Each submission was evaluated on the basis of the:

- 1) Completeness for Mandatory Submission Requirements;
- 2) Ability of the proponent to satisfy Minimum Performance Requirements (Pass/Fail); and
- 3) Extent to which the proposal exceeded the Minimum Performance Criteria (the value-added).

The technical proposals that satisfied the first two above requirements were then evaluated and scored on the basis of the extent to which the submission exceeded the Minimum Performance Requirements, with the highest scoring proposal selected as the Preferred Proponent. The environmental component was one of six proposal evaluation categories. The value-added approach to the procurement process resulted in numerous environmental enhancements that were in addition to the environmental design and best management measures required to protect the environment. The proposed environmental enhancements accepted by BC MoT were incorporated into the final Concession Agreement as environmental obligations at no additional cost to BC MoT.

5.0 Multi-faceted Environmental Program Delivery

The environmental management approach consisted of 3 delivery streams: (1) Environmental Minimum Performance Requirements delivered by the Concessionaire (Sea to Sky Highway Investment Limited Partnership); (2) Value-added Environmental Enhancements jointly delivered by the Concessionaire and BC MoT; and (3) Environmental Programs and Legacies delivered by BC MoT. These delivery streams and the direct benefits of each approach are described in the following three sections.

5.1 Environmental Minimum Performance Requirements

The Minimum Performance Requirements for the environmental component, resulting from the joint BC *Environmental Assessment Act* and *Canadian Environmental Assessment Act* environmental

review, were articulated in the Request for Proposals and formed the basis of the required environmental protection measures in the DBFO Concession Agreement. The agreement included not only protection measures to minimize adverse environmental effects, but specified construction requirements designed to bring the existing highway infrastructure up to modern environmental design and construction standards.

The Concessionaire responded to the minimum performance requirements for protection of the environment, as articulated in the Concession Agreement, by developing and implementing environmental protection measures. Examples of environmental protection measures are:

- a) The Concessionaire developed and implemented a Project Environmental Management Plan that consisted of various sub-component plans that described the measures that would be taken during construction to protect all environmental and ecological features (Figure 3). The plans covered everything from air quality monitoring and mitigation through sediment and drainage management to wildlife mitigation. In addition to the Project Environmental Management Plan, more specific Environmental Management Plans were developed for each design-build construction section. The Environmental Quality Management Plan and Procedures described the Concessionaire's quality management system, surveillance audit program and audit schedules.
- b) The Concession Agreement included restrictions on clearing of vegetation during the general bird breeding time period between March 15 to July 31 and clearing and blasting restrictions in the vicinity of heron and raptor nests between January 31 and August 15, unless pre-approved by environmental agencies on the basis of nest survey information. The Concessionaire retained biologists during these periods to conduct nest surveys and monitor courtship and breeding activities. As an innovative measure, the Concessionaire installed cameras above known eagles nests. The still photos were transmitted electronically and reviewed by biologists, providing up-to-date information on egg laying, hatch, rearing and when fledging was near or had occurred (Figure 4). This approach ensured that construction activities did not have an adverse affect on nesting success and had the additional benefit of allowing works to proceed as soon as a nest was determined inactive.

The Concession Agreement articulated the minimum performance requirements to bring the highway infrastructure up to modern environmental design standards. Examples are:

- a) Highway upgrading has provided an opportunity to improve crossing structures at fish-bearing watercourses. For example, near Pinecrest an 8m wide bottomless arch culvert has now been installed to replace the 3 old perched culverts on Widow Creek, which is habitat for rainbow trout (Figure 5). Similarly, just south of Whistler, Millar Creek provides excellent resident rainbow trout habitat. The Concessionaire decided that constructing a bridge over the stream and rail was more cost-effective, construction-efficient and environmentally effective than a new culvert. The new bridge crossing is a great improvement over the old corrugated steel multi-plate culvert, creating both fish and wildlife habitat and passage benefits (Figures 6 and 7). In Squamish, minimum performance requirements were to replace the Mamquam Blind North Channel and Mamquam Blind Side Channel pipe culverts with new, larger precast box culverts at prescribed elevations to facilitate the floodplain re-watering, known as the Mamquam Reunion Project. This project is discussed in greater detail under the section entitled Value-Added Environmental Enhancements.
- b) Highway upgrading has provided an opportunity to provide safer access, expanded parking and improved facilities and signage at sixteen viewpoints/pullouts and hiking/climbing trailheads throughout the corridor. As part of the cultural journey—an aboriginal tourism

experience on the Sea-to-Sky corridor—seven of the viewpoints along the route will include sign shelters with over 84 interpretive panels and freestanding interpretive panels. The cultural journey includes highway signage developed in partnership with the Squamish and Lil'wat First Nations (Figure 8). The signs incorporate the language and symbols of the First Nations, including the dual names of communities along the highway. Special community gateway signage will also include First Nations names.

- c) The Sea-to-Sky corridor, known for its scenic beauty and recreational opportunities, has 8 provincial parks: Cypress, Porteau Cove, Murrin, Shannon Falls, Stawamus Chief, Alice Lake, Garibaldi, and Brandywine Falls (Figure 1). Some encroachment on the parks was necessary to construct the highway improvements. Park facility improvements were implemented as one means to mitigate the impact. For example, at Stawamus Chief Provincial Park the Concessionaire was required to: construct a protected "T" intersection for safer access to the park, reconstruct parking areas for day-hikers, climber's staging, tourists and large vehicles, reconfigure the internal road network, construct picnic areas, and provide a pedestrian bridge (Figure 9) linking the Stawamus Chief to a new southbound Malamute viewpoint and trail.

5.2 Value-added Environmental Enhancements

The value-added approach to the procurement process resulted in numerous environmental enhancements that were in addition to the environmental design and best management measures required to protect the environment. The approach afforded opportunities for enhancement and innovation by allowing Proponents to offer more than the Minimum Performance Requirements at a cost that did not exceed the limits set by BC MoT for annual performance payments. BC MoT defined the environmental enhancement program categories in the Request-for-Proposals and retained a review and final approval role of the program in the Concession Agreement. The total value of the environmental enhancement program delivered by the Concessionaire is \$1.7 million, with additional spin-off and partnering benefits. The program details are described below.

- a) The Concessionaire developed an interactive web-based environmental data management system that provides a permanent record of all environmental documents, data, and permits and approvals. The site features a map that allows environmental information to be accessed by geographic area or station, a data base that allows data to be browsed, searched and queried in multiple ways and a tracking system for permits and approvals.
- b) The Concessionaire developed a sensitive area signage program, which consisted of the fabrication and installation of signs that identified environmental sensitive terrestrial areas and watercourses (Figure 3).
- c) In addition to minimum performance requirements for wildlife connectivity, the Concessionaire installed 2 small mammal/amphibian culverts in Squamish and 4 south of Whistler.
- d) The Project contributed \$190,000 funding to the District of West Vancouver in a collaborative effort to improve the Nelson Canyon, Whyte Lake, Black Mountain circle trail route (Figure 10). West Vancouver's parks staff concluded that the Nelson Canyon park trail would become the primary access/egress route for hikers using the Trans Canada Trail and the Baden Powell Trail. The package includes trailhead parking, trail re-construction, boardwalk construction (Figures 11 and 12), a wooden footbridge over Nelson Creek, trail routing signs, a kiosk with interpretive signage, and bear-proof garbage containers.
- e) The Project contributed \$450,000 funding to the District of Squamish for trail development. These funds are being used by the District of Squamish to construct a new, 9km long, non-motorized multi-use commuter trail, running north to south through the community and becoming the spine for the local trail network. The trail will be Squamish's portion of the Sea to

Sky Trail—phase 1 of which will wind its way from Squamish north for 190 kms through the communities of Whistler, Pemberton, Mount Currie and D'Arcy to end at Anderson Lake. The trail will also form part of the Trans Canada Trail, linking Squamish to our national trail system.

- f) The Concessionaire developed a management strategy to improve Larsen Creek water quantity and quality. The Concessionaire installed a continuous automated water quality monitoring platform that provided a detailed description of the water quality characteristics of the drainage, identified any significant changes to water quality and allowed monitors to isolate the ultimate cause of observed impacts. Water quality sensors were attached to the input connectors on the monitoring platform and the cell-phone-based monitoring platform was configured to poll the sensors once every 10 minutes and record measurements in memory. Once every hour the monitoring platform uploaded recorded data to the Internet. An alarm system was configured to immediately send text messages to multiple cell phones when any of the sensors exceeded pre-determined thresholds. The alarm permitted immediate manual water sample collection and site assessment. The physical works included the provision of greater catchment, provision of better storage, construction of bioswales and the installation of an oil/water separator.
- g) Early twentieth century diking and linear developments confined the Mamquam and Squamish rivers to relatively narrow corridors isolated from most of their historic floodplain. The Mamquam Reunion Project in Squamish, BC was initiated in 2005 with the primary goal of restoring the Mamquam River flows onto its historic southern floodplain so that various channels would be re-watered and freshwater flows would return to the upper reaches of the Mamquam Blind Channel (Figure 13). The idea began with members of the local community and grew into the clear vision of the Squamish Nation, District of Squamish, the Squamish River Watershed Society and Fisheries and Oceans Canada. The project demonstrates the depth of commitment by the many partners including the Squamish River Watershed Society, Fisheries and Oceans Canada, Squamish Nation, District of Squamish, Squamish Streamkeepers, BC Ministry of the Environment, BC Ministry of Transportation and Infrastructure, the Concessionaire, CN Rail, Pacific Salmon Commission, the Pacific Salmon Foundation, Terasen Gas Inc. and Canadian Hydro Developers Inc. The interconnected tidally influenced sloughs and channels provide exceptional quality habitat for numerous fish species including coho, chum and chinook salmon, while the adjacent lands are of prime importance for resident and migratory avian and wildlife populations. As discussed under the Minimum Performance Requirements section, BC MoT required the Concessionaire to replace the Mamquam Blind North Channel and Mamquam Blind Side Channel pipe culverts with new, larger precast box culverts at prescribed elevations to facilitate the floodplain re-watering from the Mamquam Blind Channel into the main and secondary channels. The concrete box culvert installed at the main channel reconnects Wilson Slough with the tidal waters of the Mamquam Blind Channel (Figure 14) and an intake installed under the CN railway corridor in upper Wilson Slough (funded by others) opens up the main and Mamquam Blind Channel for the first time in over 40 years to tidal waters from the central Squamish River estuary. The concrete box culvert installed at the side channel reconnects the lower end of the Britannia Slough with the tidal waters of the Mamquam Blind Channel.

As part of the enhancement program the Concessionaire installed a new concrete box culvert under Highway 99 allowing river flows from the Mamquam River and newly recharged channels of the Loggers Lane Creek system on the east side of the highway to enter the Britannia Slough system on the west side of the highway. The Britannia Slough and Wilson

Slough tidal channels on the west side of Highway 99 are now interconnected with the entire Mamquam Reunion project allowing fish passage through various routes from Howe Sound through the Mamquam Blind Channel up into the Mamquam River. As an additional enhancement, the Project contributed \$132,000 to the Squamish River Watershed Society for improvements to the Britannia Slough channels through installation of woody debris, boulder clusters and weirs and planting of native vegetation.

- h) The Project contributed \$122,500 to the purchase of a 5.83 ha forested island, DL 4265, within the historic channels of the Squamish River and bounded by Wilson Slough, Britannia Slough and Mamquam Blind Channel. The Squamish River Watershed Society secured funds from other sources for the balance of the purchase price and The Land Conservancy holds an environmental conservation covenant on the property. Rare and important riparian floodplain habitat has been protected (Figure 13).

5.3 Environmental Programs and Legacies

In addition to the benefits achieved as a result of the procurement approach as described above, BC MoT initiated and delivered a number of environmental programs, some of which will remain as Sea-to-Sky Highway Improvement Project legacies.

- a) In advance of Project procurement, BC MoT realized an opportunity to construct a fisheries compensation site and make available to the Concessionaire 2,128 m² of in-stream and 2,325 m² of riparian fisheries habitat banking credits (Figures 15 and 16). As a result of having sufficient banked habitat to draw on, the Concessionaire did not need to develop compensation for instream and riparian losses until well into the second year of construction. The banked habitat site, known as the Old Salt Shed site, proved to be very successful, allowing the Concessionaire to conduct works at fish sensitive sites in a timely manner. It is note-worthy that a balance of 1600 m² of banked in-stream habitat remained as unused credit at the end of construction.
- b) BC MoT provided \$300,000 funding to BC Ministry of Environment to conduct amphibian and reptile research along the Sea-to-Sky corridor, to undertake restoration of wetlands to address residual impacts associated with the loss of wetlands and to conduct post-construction monitoring of wetland mitigation measures.
- c) During the environmental review of the Project, BC MoT committed to provide measures to offset unavoidable losses of dry arbutus habitat in the Horseshoe Bay area, red- and blue-listed ecosystems throughout the corridor and wetlands near the communities of Pinecrest and Black Tusk. BC MoT concluded that they were in the best position to fulfill this commitment and therefore chose to retain responsibility for this Environmental Assessment Certificate obligation. To offset unavoidable losses to dry arbutus, red- and blue-listed ecosystems and wetlands, environmentally sensitive areas were protected by means of either a Section 106 *Land Act* transfer to BC Ministry of Environment or the addition of lands to parks through legislative park boundary amendments. Specifically, highway construction resulted in the loss 0.96 ha of Douglas fir/arbutus woodland-rock outcrop ecosystem. MoT protected 4.38 ha of arbutus habitat by means of a Section 106 *Land Act* transfer of property at Tunnel Point and Doodsons Corner (Figure 17). Highway construction resulted in the loss 3.08 ha blue-listed habitat and 6.49 ha red-listed habitats, for a total of 9.5 ha habitat loss. BC MoT protected 2.35 ha of blue- and red-listed habitat by means of a Section 106 *Land Act* transfer of property at Doodsons Corner, 10.6 ha of blue- and red-listed habitat by means of the addition of lands to Murrin Provincial Park (Figure 18) and 9.9 ha of red-listed habitat and recruitment area by

means of the addition of lands to Brandywine Falls Provincial Park, for a total of 22.85 ha protected area. Highway construction resulted in 0.42 ha total permanent wetland loss and 6.77 ha of footprint impact along the Pinecrest bypass. Given that red-legged frogs, a SARA-listed species of special concern (Figure 19), need both aquatic and terrestrial habitats to complete the different phases of their life cycle, and that exchange of individuals among local populations is important for maintaining amphibian populations within the larger region, BC MoT agreed to mitigate for the “indirect area of impact”, an approximately 72 ha area along the length of the Pinecrest bypass. BC MoT will protect 260 ha of relatively undisturbed mosaic of forests and wetlands known to support a breeding population of red-legged frogs, as well as supporting other amphibians and wildlife by means of the addition of lands to Brandywine Falls Provincial Park (Figure 20).

- d) Highway improvements resulted in some encroachments onto lands held by BC Parks. In some cases, these encroachments physically altered the land and impacted park activities and uses. At Brandywine Falls Provincial Park a 16-unit campground was converted from to a day use area and additional parking stalls for cars and RVs were constructed. BC MoT contributed \$600,000 to the park conversion, which included installing underground water and electrical lines and a toilet building. At Porteau Cove Provincial Park and Alice Lake Provincial Park, BC MoT contributed \$1 million towards the electrification of the 108 campsites for RV hook-ups.
- e) In November 2003, prior to Project procurement, BC MoT established a Recreation Focus Group (RFG). The purpose of the RFG is to provide a forum for recreation groups and user representatives to meet with BC MoT to discuss the proposed highway improvements and potential impacts on recreational features along the Project corridor, and where possible to identify mitigation measures to ameliorate any potential impacts. Membership consists of a wide array of corridor stakeholders: cyclists (highway and mountain bikers), rock climbers, hikers and mountaineers, snowmobilers, kayakers, BC Parks staff, and municipal and district governments. Once the Concession Agreement was in place, the Concessionaire’s Environmental Manager also joined the RFG and assumed responsibility for the publication and distribution of the Recreation Resource User’s Monthly Bulletin. The RFG, which once met monthly, now meets on an issues-driven basis. The RFG has provided an avenue for information and feedback to the Project Team on recreational interests, as well as a venue to discuss and present Project updates.

6.0 Summary

The Project successfully implemented innovative management strategies that protected and enhanced the environment during construction and operation and resulted in: infrastructure improvements of direct benefit to fish and wildlife; safer public access to Provincial parks, trailheads and rock climbing areas; improvements to Provincial park facilities and trailhead and viewpoint parking areas; funding of community trail initiatives; additions of ecologically important habitat to Provincial parks; and partnering on community-based conservation and enhancement projects. Our experience suggests that the multi-faceted approach to environmental management offers valuable opportunities to not only protect the environment, but to enhance it and create important Project legacies.

APPENDICES

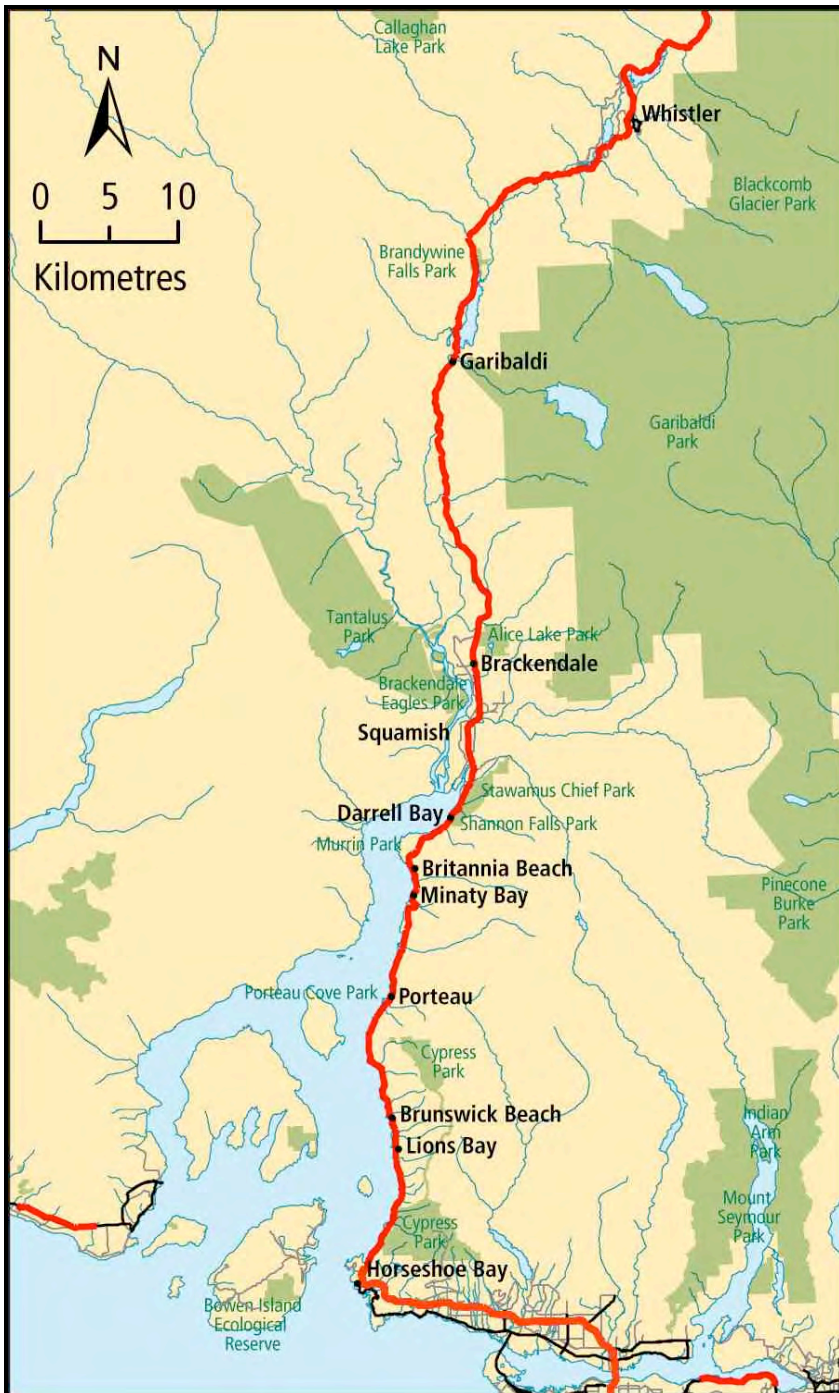


Figure 1: Sea-to-Sky corridor showing Highway 99 and provincial parks

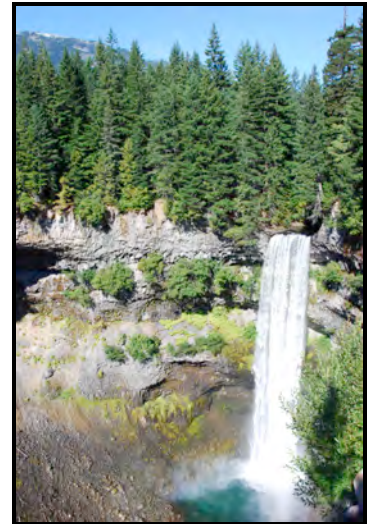


Figure 2: Brandywine falls



Figure 3: Environmental protection sign and fisheries 35(2) Authorization



Figure 4: Bald eagle with egg



Figure 5: Bottomless culvert replacing 3 round culverts at Widow Cr.



Figure 6: Existing culvert at Millar Creek



Figure 7: New bridge at Millar Creek



Figure 8: Cultural Journey sign



Figure 9: Stawamus Chief pedestrian bridge



Figure 10: Trail enhancements near Horseshoe Bay

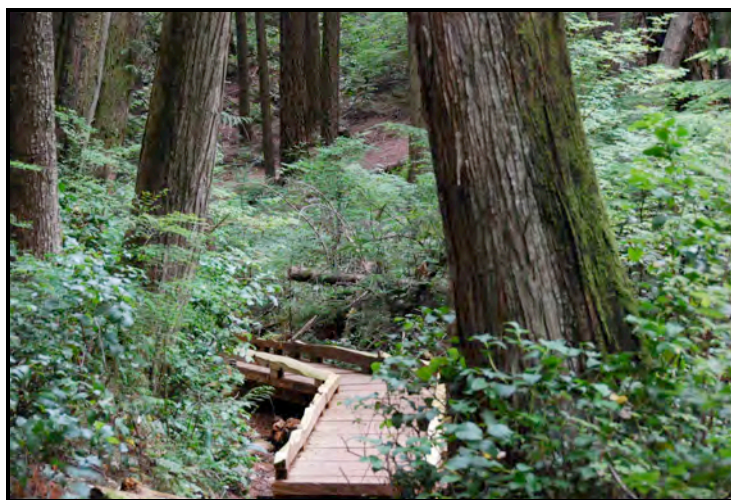


Figure 11: New boardwalk

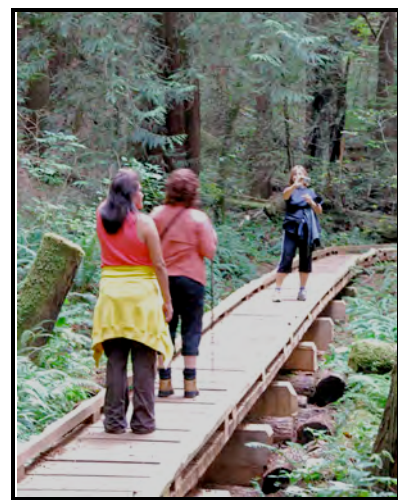


Figure 12: New boardwalk

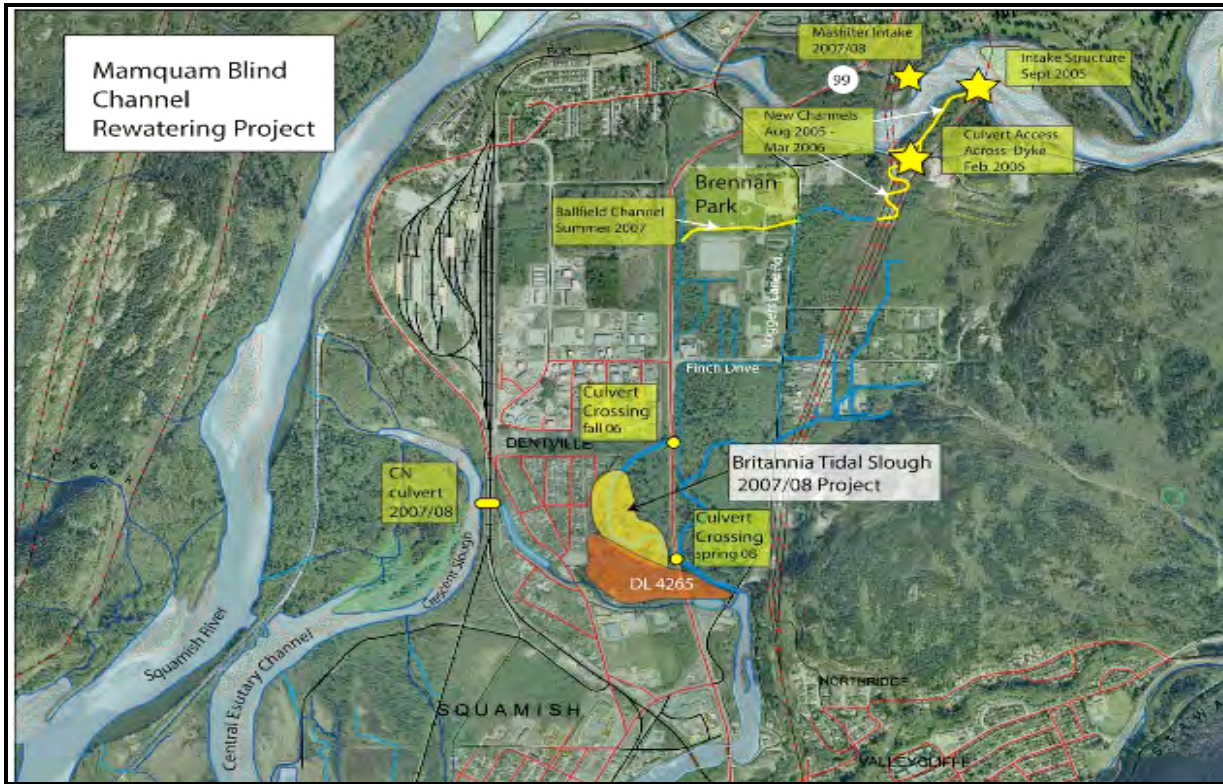


Figure 13: Mamquam Blind Channel rewatering

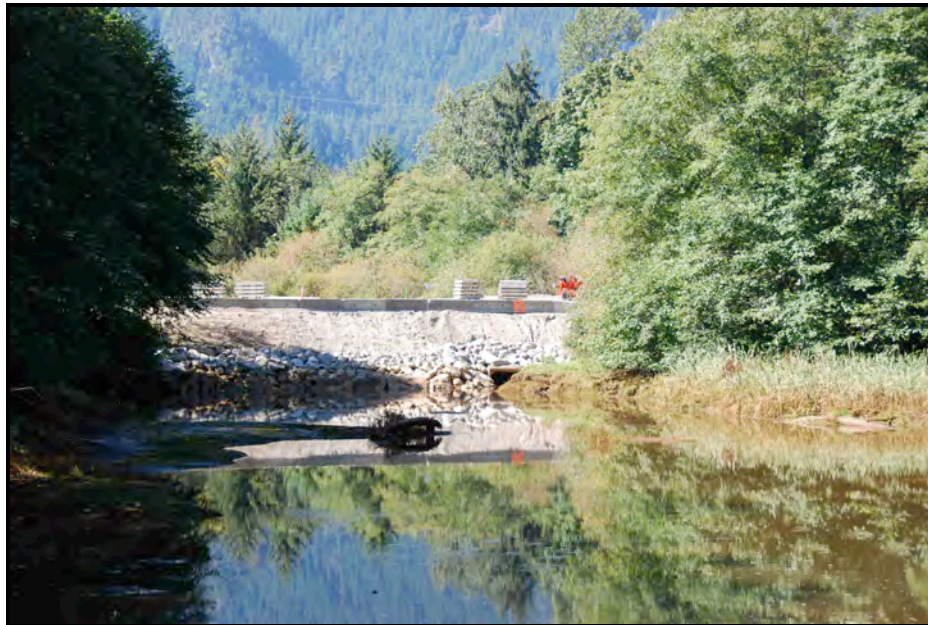


Figure 14: Lowered culvert and tide-influenced pond



Figure 15: Salt shed compensatory fish habitat



Figure 16: Heron over salt shed fish habitat



Figure 17: Protected arbutus habitat



Figure 18: Area added to Murrin Park



Figure 19: Red-legged frog

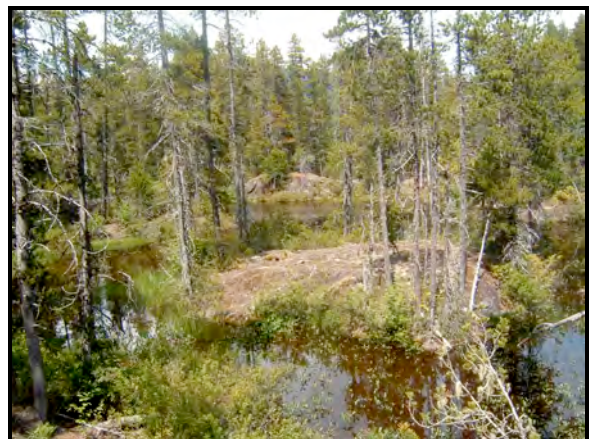


Figure 20: Area added to Brandywine Park