# EXCHAMSIKS BACKCHANNEL REHABILITATION 2008

Prepared for:

***The Pacific Salmon Commission***
*600 – 1155 Robson Street*
*Vancouver, British Columbia*
*V6E 1B5*

***June 2009***

Prepared by:


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*North Coast Area*

*and*

***Skeena Fisheries Commission***
*Allen Gottesfeld – Head Scientist*
*Stu Barnes – Financial Officer*

## Acknowledgements

The proponent of this project was the Skeena Fisheries Commission. The Department of Fisheries and Oceans provided personnel and technical expertise and supervised construction. The DFO components, personnel, labour, travel, equipment and technical expertise were provided as 'in-kind' contributions to the Pacific Salmon Commission (PSC) funded project. Skeena Fisheries Commission provided the financial administration.

DFO personnel directly involved included:

Don Hjorth - Restoration Engineer, Resource Restoration Unit
Sandra Devcic – Restoration Engineer, Resource Restoration Unit
Lana Miller - Restoration Biologist, Resource Restoration Unit

Skeena Fisheries Commission personnel directly involved included:

Allen Gottesfeld – Head Scientist, Skeena Fisheries Commission
Stu Barnes – Financial Officer, Skeena Fisheries Commission

Additional assistance was provided by:

Mr. Matthew Jarnagin, Fisheries and Oceans Canada and Richard Roberts, Kitsumkalum First Nation provided regular beaver dam maintenance throughout the fall.

Cambria Gordon Ltd. and Triton Environmental Ltd. provided environmental services to salvage and identify fish during the project construction phase. Cambria Gordon also assisted with some of the air photo development for the 2007 condition photo.

Far-ko Contracting Ltd. provided the crew, equipment and the materials to undertake the majority of the onsite construction.

Billabong Road and Bridge Maintenance for providing all traffic control services throughout the construction phase.

Signs were created by ArtCraft Signs and installed by Greywolfhound Contracting Ltd.

AllNorth Consulting Ltd. and Dediluke Land Surveying performed site surveys.

Bell Enterprises Ltd. hydroseeded the disturbed areas adjacent to the highway, Bandstra Transportation brought some of the freight to the site, and Yuer Way Construction constructed the death hole slab covers.

Ken Rabnett, formerly with Skeena Fisheries Commission, assisted with the preliminary project preparations and the proposal writing.

Appreciation for their co-operation is heartily given to:

Mitch Drewes - Habitat Technician, OHEB, DFO,
Rob Dams – Community Advisor, OHEB, DFO,
Chris Broster – Ecosystem Specialist, MOE,
BC Ministry of Transportation and Infrastructure,
Canadian National Railway Company, and
Nechako Northcoast Construction Ltd.

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## *1.0 INTRODUCTION*

The Skeena River is the second most important salmon producer in B.C. Downstream from Terrace the river is characterized by an extensive network of sidechannels and wetlands that range from channels many kilometres in length, to intermittent channels only a few hundred meters long. This portion of the Skeena is a classic wandering gravel-bed river. It is a dynamic fluvial system. It contains abundant channels of various ages, many being filled in by sediment, others being reopened widened and reused. The Exchamsiks Backchannel area is composed of two relatively large channels on the Skeena River floodplain, east of the Exchamsiks River. Since construction, Highway #16 and the CN Rail grade have cut off the project area from the main stem of the Skeena River, Water supply for the Exchamsiks Backchannel area is supplied by runoff from the surrounding mountainsides and groundwater upwelling. The railroad and highway have protected this area from extensive sedimentation for nearly 100 years. The project is intended to capitalize on the sidechannels' watered remnants, and improve the quality and connectivity of the valuable fish habitats.

The Exchamsiks Backchannel was recognized as an area having tremendous potential to provide necessary juvenile salmonid habitat in the lower Skeena River. The area was identified by several parties over the past 30 years and continues to rank high on area priority lists done by groups such as the Ministry of Transportation (MOT), Skeena Fisheries Commission, Pacific Salmon Commission (PSC), and the Department of Fisheries and Oceans (DFO). The four main overall project objectives are to:

- Restore fish access to the Exchamsiks Backchannel;
- Establish rearing opportunities and high water refuges for juvenile coho;
- Create and rehabilitate coho spawning habitat and;
- Restore self-sustaining habitats by allowing high water river flows to flood through the coarse material that comprises the CN Rail and Highway 16 subgrades.

In 2005, MOT and the Canadian National Railway Company (CN) jointly provided funding to the DFO to make access improvements and design the overall project in 2005. On the ground work began in 2006.

In 2007, Skeena Fisheries Commission (SFC) applied for funding through the Pacific Salmon Commission to continue the work planned for the Exchamsiks Backchannel area. By agreement with the North Coast Resource Restoration Unit, SFC became the proponent for the 2008 work plan and would arrange for involvement with the local First Nations where possible, but DFO continued to direct the design issues and onsite work.

## 1.1 Project Area

The Exchamsiks Sidechannel area is located approximately 55 km west of the community of Terrace in north-western British Columbia. The project area extends approximately 4.8 km along the north side of Highway 16 and is separated from the main stem of the Skeena River by the Canadian National Railway tracks and the highway. Aerial photographs of the project area, taken in 2006 and 2008, can be found in Appendices 2 and 3, respectively.

Based on a site survey prepared by AllNorth Consulting Ltd. in early 2006, the project was broken up into several "sites" where work was planned. Site 1 is the most easterly site, while Site 4 is the most westerly site. Each site represented a separate location where improvements for the accessibility or water quality within the sidechannel area were to be investigated. A rough outline of the sites can be seen in Figure 4. Figures 4 includes some of the work planned for 2008 and some that was undertaken in previously funded phases of the project.

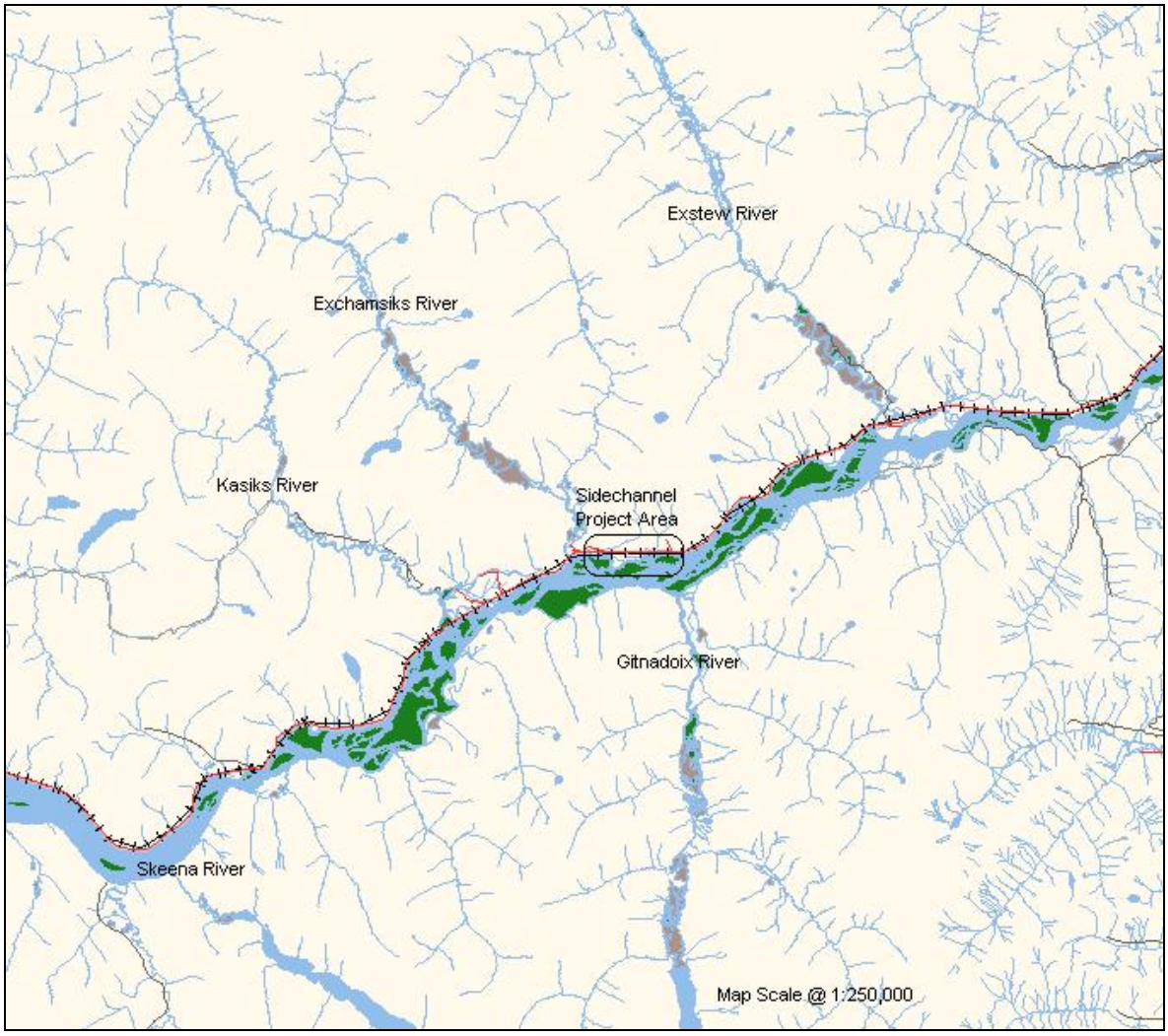



Figure 1: Map of Exchamsiks Sidechannel Area.

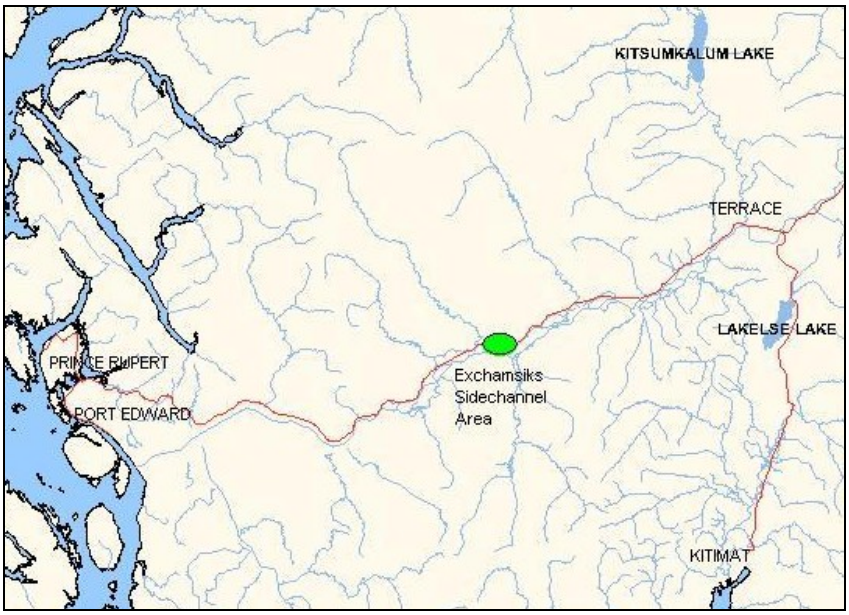


Figure 2: Index Map of the Project Area

## 1.2 Project Plan

The project goal as stated in the proposal was to provide fish access to and rehabilitation of 4.8 km of quality coho juvenile rearing habitat, and to create enhanced coho spawning conditions in order to increase wild stock productivity. Project outcomes include established and functional high quality habitat for juvenile coho rearing, constructed and rehabilitated coho spawning habitat, and restoring a self-sustaining floodplain ecosystem. Since previous year's work included steps to correct the identified problem of limited fish access to the project area, the work planned for 2008 focused on connectivity within the sidechannel and water quality improvements.

Figure 4 shows the proposed work plan for the overall project. A phased approach was selected due to the uncertainty associated with the proposed works and the availability of funding. The early phases of the project have allowed for design considerations to be elaborated, such as fish presence and use, hydraulics, channel entrance and fish passage, risks of channel changes, water supply and quality, and assessment of flow potential. The overall phasing for the proposed works is as follows:

***Phase 1 - Feasibility and Reconnaissance (2005 - 2007)***
The Exchamsiks Backchannel Rehabilitation project was initiated by the Department of Fisheries and Oceans, the site selected, available information was compiled, and study was undertaken to identify the data and assessments required. The data and assessments required included:

1. A review of fish, habitat, and water quality studies;
2. Elevation surveys;
3. Hydrological assessment (ground water, surface water, and main stem flows and reliability);
4. Development of the conceptual plan and detailed site designs;
5. An overall review by consultants with backchannel restoration experience;
6. Meetings with B.C. Ministry of Transportation, CN Rail, and DFO to finalize roles, responsibilities, and funding for various project components.

All Phase 1 activities have been completed.

***Phase 2 - Backchannel Access (2007 - 2008)***

Phase 2 involved restoring access to the backchannels at Site 3 by installing two 2400 mm diameter culverts under Highway 16 and two 2400 mm diameter culverts under the CN Rail grade, and excavating a connecting channel from the outlets to the Skeena River. The outlet channel and other connectivity channels within the marsh area were excavated in January 2008, the highway culverts were installed in March 2008, and the CN culverts were installed in May 2008. Construction, surveys, permits, and environmental monitoring work totalling approximately $558,000 (CAN) was funded by project partners under the direction of DFO.

All Phase 2 activities have been completed.

***Phase 3 – Central & Western Backchannel Flows and Connectivity (2008 – 2009)***

The work for Phase 3 encompassed improving backchannel flows, connecting up various ground and surface water channels, and sealing the existing culvert located at Site 4 and the highway subgrade berm to lessen outflow leakage. The majority of the activities took place in the central and western portion of Exchamsiks Backchannel. Timing was dependent on the site conditions at the time of construction. Specific sequencing of activities was adjusted to take advantage of water levels and weather.

Specific site works included:

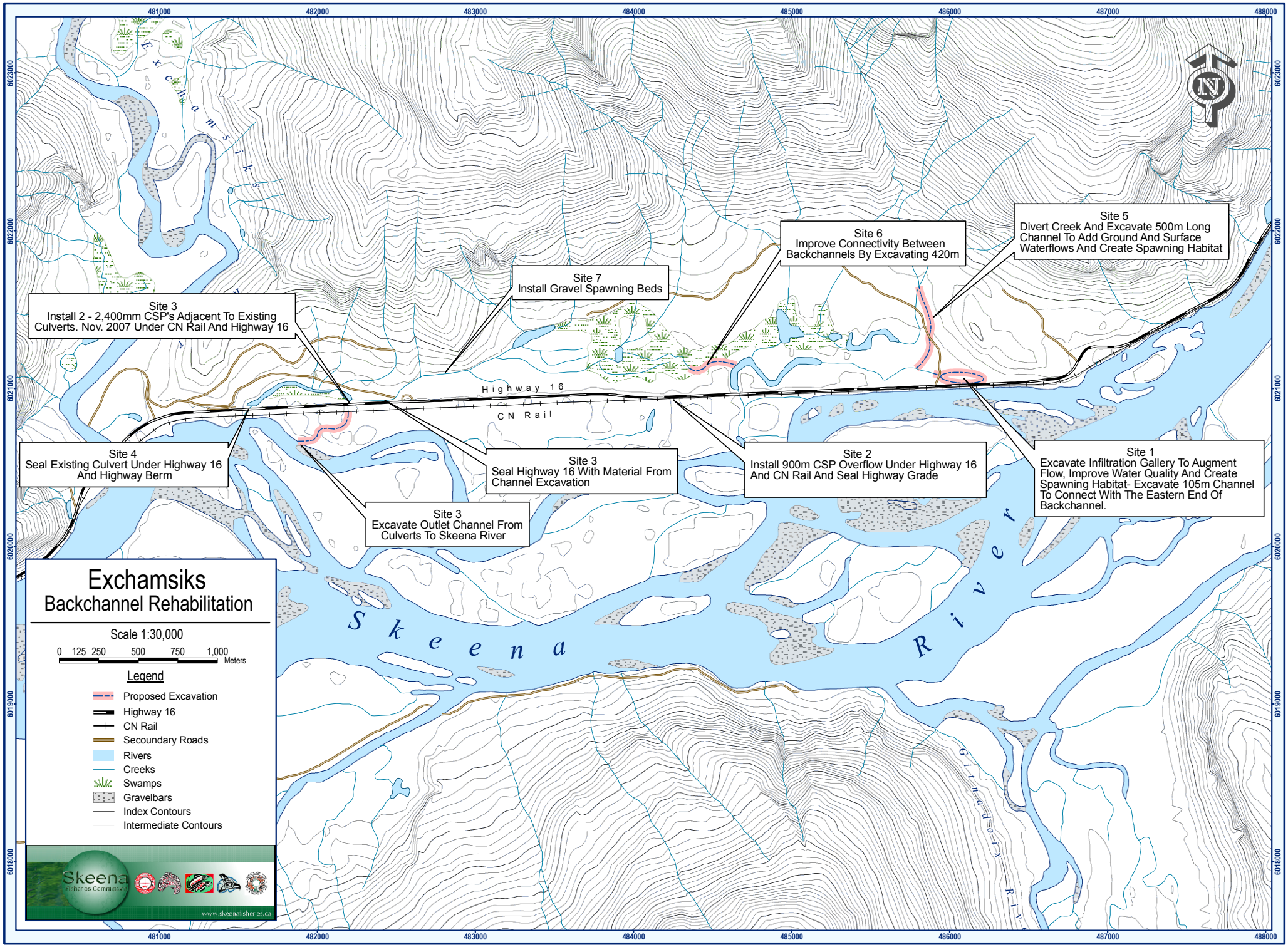
1. Excavate and grade the backchannel where needed to facilitate flows to the outlet;
2. Improve the connection between the eastern and western backchannels at Site 6;
3. Create deep water refuge habitat for summer low flow periods;
4. Install gravel spawning pads;
5. Seal the highway subgrade where needed;
6. Seal the existing culvert at Site 4;
7. Install a 900 mm culvert at Site 2 to help release seasonal high water flows and allow additional access for fry in-migration and smolt out migration.

Material required to seal the subgrade and existing culvert at Site 4 was sourced at the existing borrow pit at the east end of the project area. This pit was also utilized for spoil material, then trimmed, and hydroseeded following completion of the construction activities. Progress was monitored by the on-site DFO engineer and/or engineering technician, and accomplishments were adjusted to suit available funding.

The schedule of key project activities revolved around high water events such as the spring nival flood and in-stream work windows periods, which are times when there is a lower or reduced risk from work activities to aquatic resources, fish, and their habitats. Provincial and Federal Best Management Practices (BMPs) were utilized to adequately manage and conserve any fish and habitats. Environmental monitors were involved to ensure fish salvage operations are thoroughly carried out, ensure that silt fences and hay bales are on-site during construction and are utilized as sediment control structures well in advance of activities that could result in sediment mobilization.

Some of the work included in Phase 3 was originally planned for completion in 2009/2010 as Phase 4, but for ease of construction, we decided to accomplish as much of the identified tasks as possible.

Figure 3: An aerial view of the Site 3 and Site 4, looking east, May 2007.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Exchamsiks
Site 3
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Site 7
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Site 6
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Highway 16
CN Rail
Secoundary Roads
Rivers
Creeks
Swamps
Gravelbars
Index Contours
Intermediate Contours
Skeena
Fisheries Commission
www.skeenafisheries.ca

Figure 5: Site 3, looking downstream at the section between the CN and MOT right of ways at the newly constructed sidechannel outlet.
Work was done with the funding acquired in 2007 from MoT and CN. Photo taken in August 2008.

Figure 6: Site 4 (the Death Hole) on May 21, 2008.
The visible (2600 mm diameter) culvert through the highway grade does not have a match through the railway grade (on the photo right). The isolated pool frequently stranded fish when the floodplain water levels dropped and the fish were unable to retreat back into the sidechannel due to the elevation of the culvert outlet.

# 2 CONSTRUCTION PROGRESS

The following section provides a summary of the main achievements for the project, including the planning, assessment of existing conditions and preparation, construction and post-assessment.

Figure 7: April 3, 2008 – Water within the sidechannel area at late winter low-flow conditions, a time of year when other creeks and rivers are low.

## 2.1 Pre-Construction Activities

Once the preceding phase of work had been completed in the spring of 2008, preparations for the 2008 Construction stage were started. Blanket environmental approvals had already been obtained for the project from Fisheries and Oceans Canada and the Ministry of Environment, but it was important to keep the agencies informed of the construction timing, objectives and respond to technical questions that they had. A large amount of time was invested in notifying the local Forest District and licensees with tenure to the area to inform them of the project, its fish values, the size of the investments to date, and appeal to the companies to not log any portion of the project area in the next few years.

In the early summer, we were notified by the Ministry of Transportation and Infrastructure of a timber cruise going on for possible logging on the hillside above the project. The result of the timber cruise indicated that the value of the wood was not significant enough at the time to warrant harvesting and associated road building.

Some professional services were obtained to assist with project planning and construction set up. Mapping services were obtained from Cambria Gordon Consultants to merge aerial photographs taken by Don Hjorth and allow us to see the overall project as one long sheet. Dediluk Land Surveying was retained to verify the geodetic benchmarks existing onsite and provide a series of control points to provide elevations for work in various parts of the project. This is intended to eliminate the error possible by using several datums. AllNorth Consultants performed an as-built survey for the CN and MoT culvert installations at Site 3 as well as the Stenquist Channel (the outlet channel constructed downstream of the railway grade).

The water levels, flow patterns within the sidechannel area, and the influence of the Skeena River was visually monitored over the summer. Measurements were taken to confirm the material quantities needed for construction. Survey markers were placed along the highway to provide elevation control for work at the different sites, and additional field investigation and planning continued until the water levels were appropriate to begin construction. Much of the water flow in the Exchamsiks Backchannel derives from the adjacent mountains, however the Skeena River stage controls the water level on the the floodplain, even that part cut off by Highway 16 and the railroad grade. After the nival flood of June 2008, the water level within the project area did not drop to the point where construction could begin until the end of August.

Figure 8 – The backchannel at Site 2 on September 18th, before the lower water connection to the outlet culverts at Site 3 was opened up.

## 2.2 Construction

Far-ko Construction Ltd. was the primary contractor on the previous phase of the project. Due to their understanding of the project objectives, reasonable rates, and willingness to work with the undetermined project timetable, they were the contractor selected to be onsite for the first portion of the construction phase. Although the scope of work for the project was outlined in the preliminary work plans, the unknown nature of the exact site conditions meant that a careful eye was kept on the budget and tasks were doled out in a "time and materials" manner to make sure that the portions of the project were completed to the satisfaction of the on-site supervisors.

The project proposal envisioned environmental monitoring being a way to engage local first nations in the project. Unfortunately, due to the short notice in the project schedule due to the weather dependency of the work plan, local assistance was not available. In order to continue with the work, local environmental consultants were contracted to undertake specific fish salvaging and sediment control duties as needed, and the Resource Restoration Unit was onsite throughout the construction phase. Both, Cambria Gordon Ltd. and Triton Environmental Consultants Ltd were onsite for the construction phase when needed.

During the week of August 18th, it was noticed that the water quality in the lower end of the project area was declining, resulting in some juvenile mortality of both salmonids and nonsalmonids. In order to take steps to prevent further fish loses, and due to the seasonal low water levels, we decided to move forward with the identified work planned for the Exchamsiks project area for 2008-2009.

Far-ko Contracting began work onsite during the last week of August and construction began with sealing the problem culvert at Site 4. The objective of the work undertaken at Site 4 was to prevent juvenile fish from moving into the area between the highway and the railway. Because the railway and highway grade are porous, and the elevation of the culvert often leaves fish stranded on in an exposed isolated pool, the water in the pool often became lethal to fish due to high temperatures and low oxygen levels in late summer at relatively low Skeena stages.


Figure 9: Sealing off the culvert at Site 4 (Death Hole) on the north side of the highway. The photo shows the concrete cap in place before the area was sealed off with backfill.

The first step to correcting the problem was to install a specially fitted concrete cap to the upstream end of the highway culvert, completely isolating the pool. Cambria Gordon Ltd. was retained to conduct a salvage at Site 4 (the Death Hole). They were able to trap out the pool in between the highway and the railway, prior to the culvert being sealed off and the depression being backfilled. There were approximately 562 Salmonids, 2539 Trout and Stickleback, and 108 fish of other species removed from the pool, over approximately 1 week. All of the aquatic life removed from the pool were relocated upstream of the Site 4 culvert.

After the culvert was sealed and the fish had been removed, backfilling the low area on the south side of the highway culvert began. The first step was to move the large organic debris around to accommodate a filter cloth liner which will slow down the flows through the grade and block fish from migrating through the area. Backfill, donated by the Ministry of Transportation from the nearby Polywog Pit, was then brought to site, placed, and compacted.

Once the backfill was in place between the railroad tracks and the highway grade, a second seal on the north side of the highway was added. This seal was intended to slow down the amount of water lost by percolation through the highway fill at this location. We estimate that the fill backed up water the extent that it provided an additional 20 cm of depth to the water flowing through the culvert at Site 3.

Figure 10: The completed grade seal at the north end of the highway culvert at Site 4.

Grade seals are a low berm wrapped in filter cloth constructed along the shoulder of the highway in locations where there is concern about the amount of flow that is flowing through the grade. The grade seals are not intended to completely stop the percolation of water from balancing out between the sidechannel area and the Skeena, but are more for preventing fish from migrating through the coarse rubble of the grade and becoming trapped in a pool if they cannot move further due to their size. The grade seal also slows the flow out of the sidechannel area, so an immediate increase in the water depth above the highway was noticed once the seals started to be constructed.

In all, approximately 937m of grade seal was constructed during this phase of the project during dry summer and fall conditions. Grade seals were installed on either the north or south side of the highway approximately in the locations identified in the original proposal. In all, 7,356 m2 of geotextile was used. The backfill material was donated by the MoT.

Figure 11 – Backfilling completed at the area between the highway and railway at Site 4.

At Site 2, once the grade seal was installed on the north side of the highway, some time was required to allow the water levels within the marsh to balance out. Weather and river stage were favorable and the seal functioned as predicted. The next stage of work within the sidechannel area was to attempt to prevent the beavers from blocking fish passage in the fall. Triton Environmental was hired to undertake the fish salvaging for the work at Site 2.

The channel which improves the connection between the east and west side of the project area, the Salter Channel, was constructed in a previous phase, and was left with an earthen dam preventing the flow of water from the west side of the project to the east side. Once the site 2 grade seal work was in place, the earth dam was removed and the connectivity was achieved. The inlet of the Salter Channel was intentionally set lower than the inlet of the 600 mm diameter culvert in the highway. The channel is the primary connection to the sidechannel, and the culvert is an overflow that maintains the channel on the south side of the railway tracks. The grade seal appears to be effective in slowing down the flow of water out of the project area but the outlet channel to the adjacent Skeena network still flows year round as there is still some leakage coming from below the road and rail grades, plus the flow from the small culvert. It appears that the flows at this location are enough to still attract juvenile coho to the site in the spring. Access into the sidechannel is still possible through the highway and railroad fill, but now that there is a culvert which increases access at high water. A future phase of work may include improvements to assist with fish passage when the water levels on either side of the transportation corridor are not balanced.

Figure 12 – The grade seal being constructed on the north side of Site 2 where there is a 600 mm culvert through the road & rail grade.

## 2.3 Other tasks

### 2.3.1 Project information signs:

Two large signs were installed in the summer of 2008 explaining the project and acknowledging credit (Figure 13).

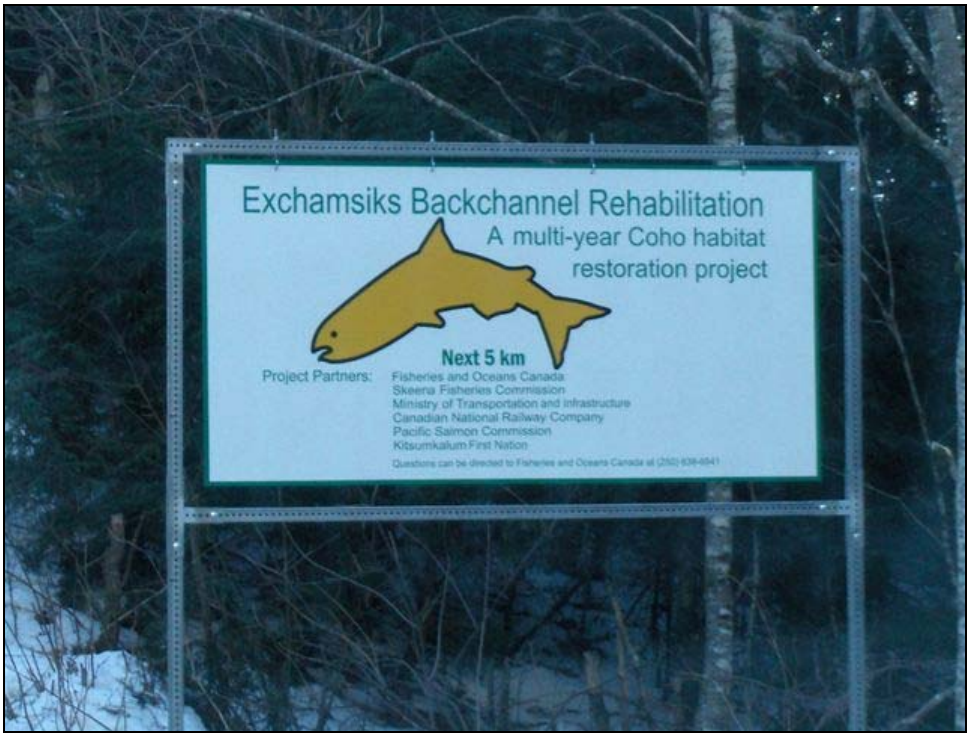


Figure 13 – Project information sign.

### 2.3.2 Connectivity

A small diameter culvert was installed south of the Highway 16 grade, through the east CN berm to connect an isolated pond area to the outlet channel at Site 3. The pond is wetted for most of the year and is fed by the upstream flows percolating through the grade. The pool is typical juvenile coho habitat. This was confirmed by trapping when the berms at Site 3 were constructed in 2007 (Figure 14).

Figure 14 – An additional culvert was inserted into the east CN berm at Site 3.

### 2.3.3 Modification of Site 3 Outlet Channel

A low rock weir was added to the outlet channel from Site 3, immediately downstream of the CN culverts. The small weir is intended to give juveniles additional time to retreat into the marsh during periods of low flow, before they become stranded (Figure 15).

### 2.3.4 Hydroseeding

All areas disturbed by construction were revegetated by hydroseeding in the late fall (Figure 15).

### 2.3.5 Beaver Control

Beavers occupied portions of the side channel prior to construction. In order to ensure that flow through the sidechannel was not affected during the first winter, the primary dam impacting the elevation of the water was manipulated until the area froze over for the winter. Beaver stops were installed at an abandoned road crossing of the back channel (Figure 16).

Figure 15 – A view of the outlet area downstream of the culverts put in at Site 3 by CN. A low weir has been added to the outlet channel.
Note the vegetation cover has been restored by hydroseeding.

### 2.3.6 Air photos of restoration area

Following the completion of construction in 2008, an aerial photo mosaic of the site was compiled to serve as an as-built record.

Figure 16 – Beaver stops on both ends of a culvert installed through an old corduroy bridge.

This location was identified in the original studies as a partial barrier to fish movement within the project. The beaver stops alleviate this problem.

# 3 Concluding remarks

The detailed Phase 3 objectives for 2008/9 were:

1. Excavate and grade the backchannel where needed to facilitate flows to the outlet at Site 3;
2. Improve the connection between the eastern and western backchannels at Site 6;
3. Create deep water refuge habitat for summer low flow periods;
4. Install gravel spawning pads;
5. Seal the highway subgrade where needed;
6. Seal the existing culvert at Site 4;
7. Install a 900 mm culvert at Site 2 that to help to release seasonal high water flows and allow additional access for fry in-migration and smolt out migration.

We met all of these objectives except for improvement of spawning habitat. We took advantage of excellent construction conditions to expand the amount of highway subgrade sealing and to fill in the “death hole” at Site 4. These activities provide greater benefit than installation of gravel pads.

In the coming seasons we will need to carry out a series of implementation effectiveness surveys to see how many migratory coho use the improved rearing areas and how many coho spawn in the Exchamsiks Backchannel and the extent of production from these spawners.

We will be seeking funding for these activities from a variety of sources.

# APPENDIX 1

# Proponent Information

## Proponent Information

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Sandra Devcic, P.Eng. – Resource Restoration Engineering Technician
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# APPENDIX 2

## Pre-Construction Air Photo Record of the Project Area


ECHAMSIKS SIDECHANNEL RESTORATION PROJECT
DFO NORTHCOAST AREA RRU
Km 30 HWY 16W
from Terrace

# APPENDIX 3

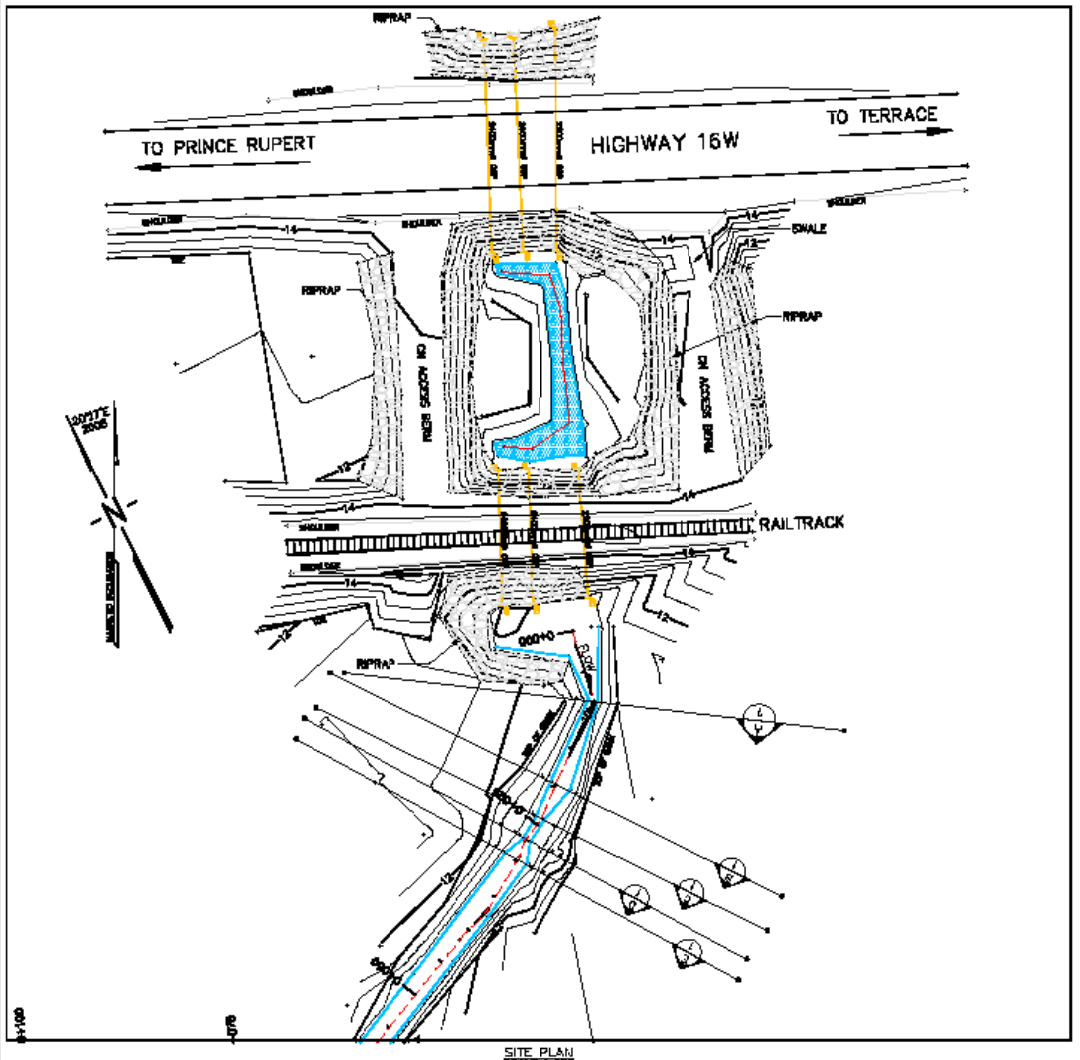
## Post-Construction Air Photo Record of the Project Area

The east half of the project.  North is on the right of the page.

The west half of the project.  North is on the right of the page.

# APPENDIX 4

## Survey and Drawings




CULVERT PIPE INVERTS

| PIPE SIZE | LOCATION | INLET ELEVATION | OUTLET ELEVATION |
|---|---|---|---|
| 2400mmØCSP | HIGHWAY 16, WEST SIDE | 10.874 | 10.572 |
| 2400mmØCSP | HIGHWAY 16, MIDDLE | 10.615 | 10.500 |
| 2200mmØCSP | HIGHWAY 16, EAST SIDE | 10.796 | 10.410 |
| 2400mmØCSP | CN RAIL, WEST SIDE | 10.615 | 10.524 |
| 2400mmØCSP | CN RAIL, MIDDLE | 10.351 | 10.435 |
| 2200mmØCSP | CN RAIL, EAST SIDE | 10.258 | 10.400 |

PACIFIC SALMON COMMISSION PROJECT FOR 08-09

EXCHAMSIKS SIDE CHANNEL REHABILITATION PROJECT STEKQUIST CHANNEL

ASBUILT SITE PLAN
SITE 3
(CN MILE 33)

ALLNORTH CONSULTANTS LIMITED
TERRACE
www.allnorth.com

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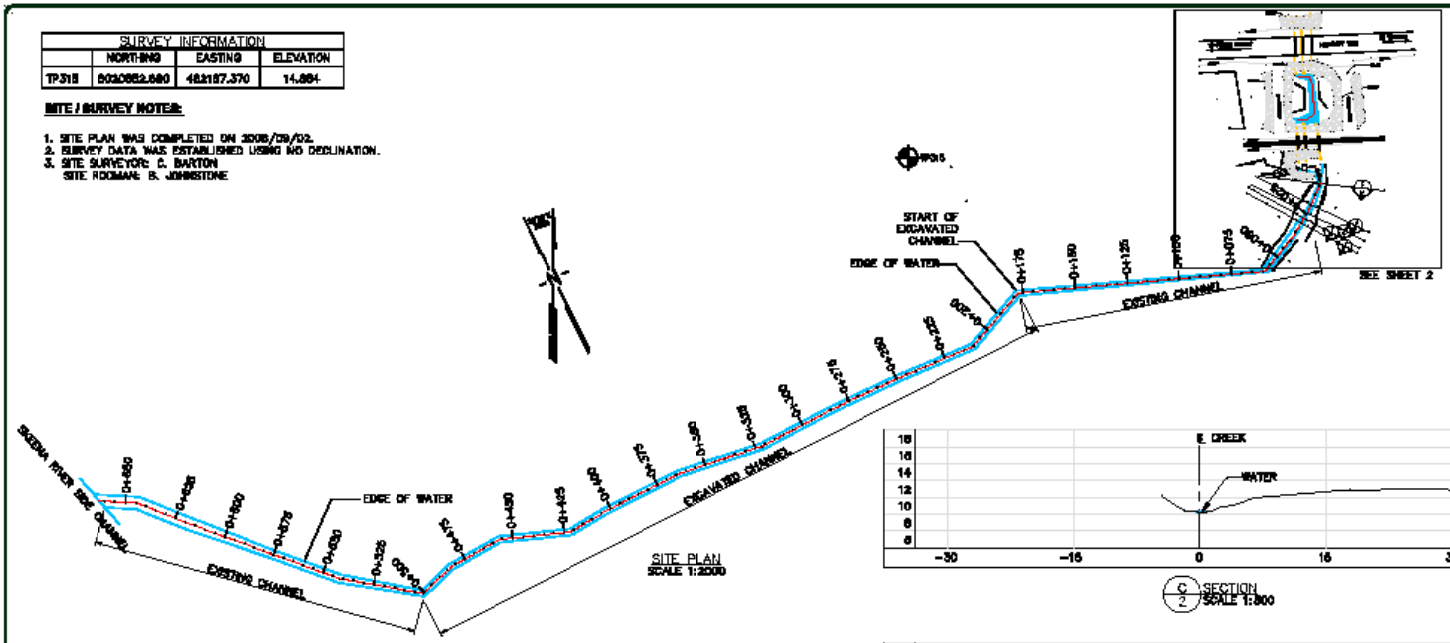
| no. | date | by | chkd | subject |

drawing no. 08-TC-0107-2
revision 0
sheet no. 2 of 3

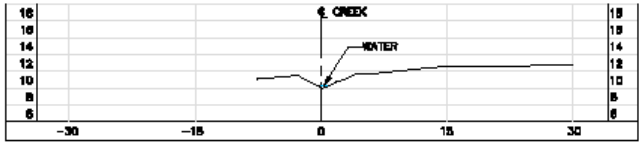
| SURVEY INFORMATION | | | |
|---|---|---|---|
| | NORTHING | EASTING | ELEVATION |
| TP318 | 6030852.680 | 482187.370 | 14.884 |

**SITE / SURVEY NOTES:**

1. SITE PLAN WAS COMPLETED ON 2008/09/02.
2. SURVEY DATA WAS ESTABLISHED USING NO DECLINATION.
3. SITE SURVEYOR: C. BARTON
   SITE RODMAN: B. JOHNSTONE




SITE PLAN
SCALE 1:2000

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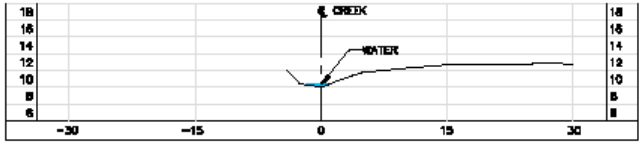
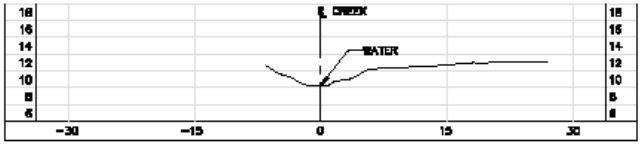


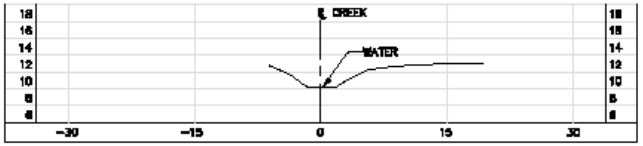

B/2 SECTION
SCALE 1:500




C/2 SECTION
SCALE 1:200




D/2 SECTION
SCALE 1:500




E/2 SECTION
SCALE 1:500

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PACIFIC SALMON COMMISSION PROJECT FOR 08-09

EXCHAMSIKS SIDE CHANNEL REHABILITATION PROJECT STEWQUIST CHANNEL

ASBUILT SITE PLAN AND SECTIONS


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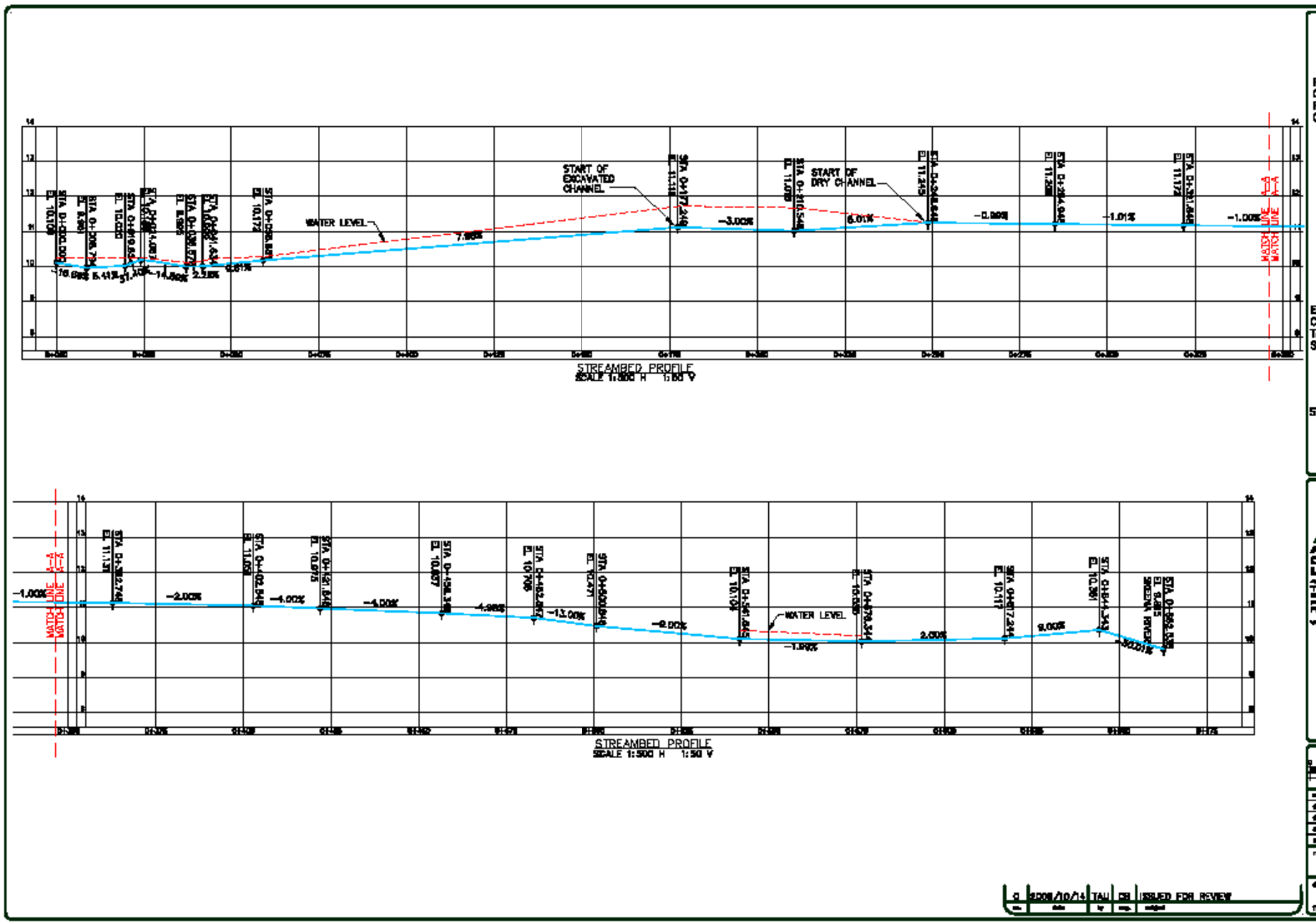
drawing no. 08-TC-0107-1




PACIFIC SALMON COMMISSION PROJECT FOR 08-09

EXCHAMSIKS SIDE CHANNEL REHABILITATION PROJECT STENQUIST CHANNEL

STREAMBED PROFILE

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