

# Siwash Creek Project Scope

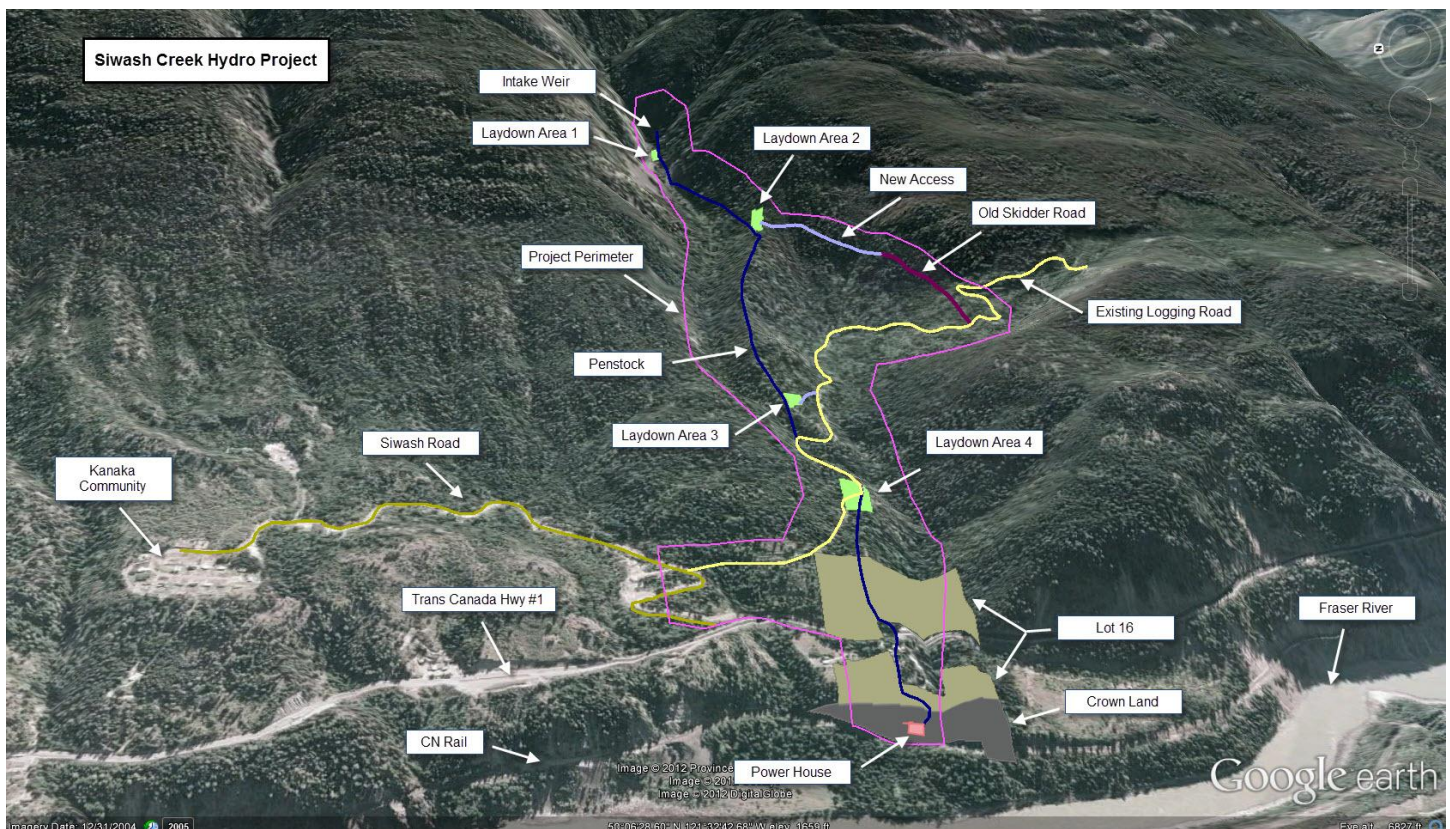
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## 1.1 Executive Summary

The Siwash Creek Project is a proposed 1.8MW run-of-river project which will be located 15km south of Lytton. It will produce 7.9GWh per year (an average of 900kw) of clean renewable electricity. The electricity will be sold under BC Hydro's Standing Offer Program. The Intake weir will be located on Siwash Creek 680m above the powerhouse. The intake pond will be approximately fifteen meters by ten meters, averaging one meter deep. The water will then travel approximately three kilometers down a sixteen inch penstock to a small single Pelton turbine with one three inch nozzle. The maximum flow needed to produce this amount of energy is only  $0.33\text{m}^3/\text{s}$ , and then it will be returned to the creek. The powerline connection point is located on private property along Hwy 1, and no new transmission lines need to be built.

The electricity produced will contribute to the supply of power to BC Hydro's 1.7 million customers. BC's Government Energy Plan sets out the goal to be self-sufficient by 2016, and that all new electricity generation projects in the province will have zero net greenhouse gas emissions. The Siwash Project will help offset some of the electricity that BC Hydro imports each year. BC Hydro currently imports between 5 and 15% of its electricity mostly from coal and natural gas sources in the US and Alberta. The proposed Siwash Project will help reduce greenhouse gas emissions created by the imported energy by 3,100 tonnes and bring BC one step closer to being a net exporter of electricity.

In-stream flows and environmental monitoring parameters will be followed according to the water license. Erosion control and minimizing the removal of trees are a few of the measures in place to reduce the impact on the environment. First Nation referrals have been sent to twenty different bands for comment.



**View of proposed Siwash Creek Project**

## 1.2 Proponent Information

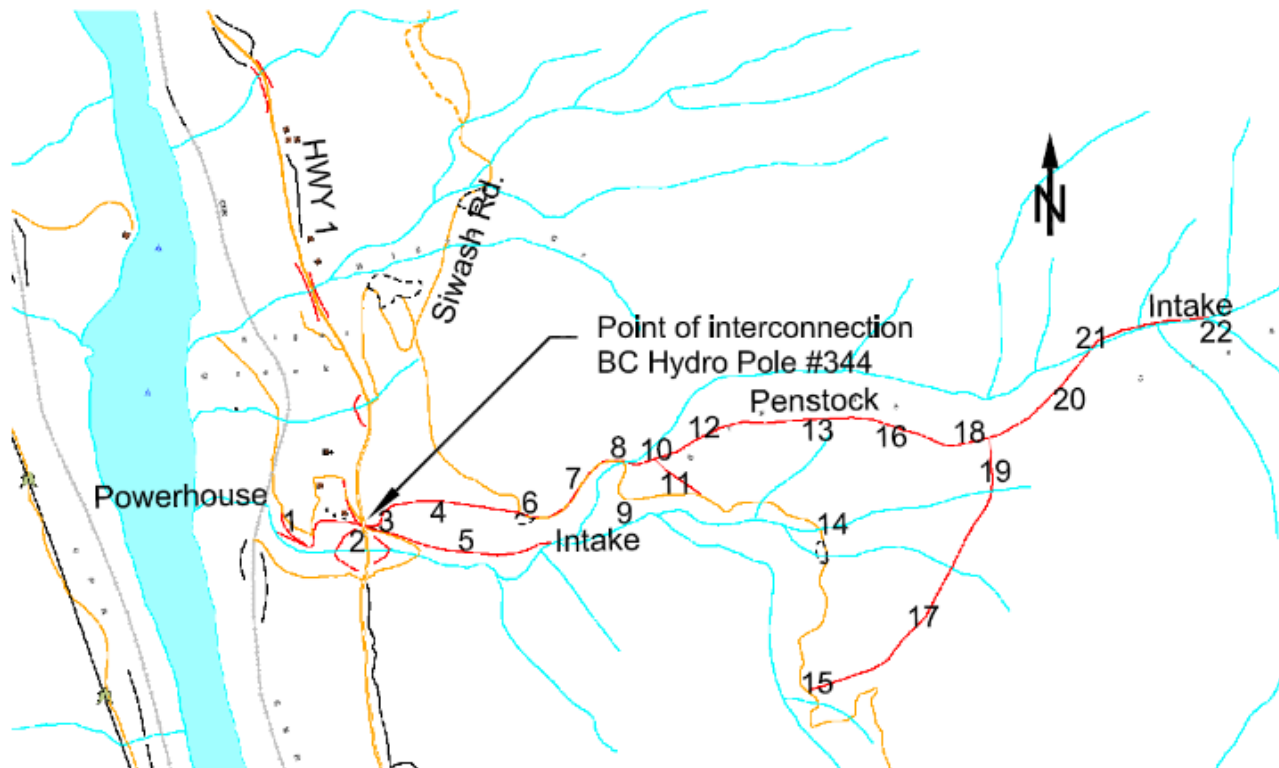
Morehead Valley Hydro, incorporation #893511279 is the water license holder and is under a 100% share purchase agreement by Ryan Mowat and Chad Peterson, each with 50% ownership. Either Ryan or Chad can be contacted for further information.

- Jason Dorey of Triton Environmental: Environmental monitor
- Kane Sanders of Triton Environmental: Forester assigned to the project
- Cullinane and Powell Consulting Inc: Geotechnical Engineers
- Pentti O. Sjöman, P.Eng.: Independent engineer for the project
- Ryan Mowat, P.Eng.: Design and construction engineer
- Micheal Sohy, MBA P.Eng. P.M.P: Project Coordinator
- Bruce Campbell, P.Eng. of Roy Campbell Engineering: Electrical protection and one line engineering designs
- Terra Archaeology Ltd.: Archaeological field reconnaissance
- Arc Environmental: Green criteria compliance review completed by in May 2004
- Ecoscape Biological Consulting: Tailed frog survey of Siwash Creek

### 1.3 Project Concept and Description

This is a High Head Single Nozzle Horizontal Pelton Wheel Hydroelectric Project. It has 680m of head, and utilizes  $0.33\text{m}^3/\text{s}$  of water before returning it to the creek. The intake pond is small, and does not store water therefore it is a run-of-river operation as it only uses the water available on hand. The intake is filtered through a Coanda screen, which strains out particles as small as one mm, and does not require manual or automatic trash rack raking. The powerhouse is located above CNR property, and an electronic meter will be located there. The energy produced will be sold to BC Hydro, with an expected maximum output of 2000kw, and 200kw during low flows. Operation is automatic and remotely monitored, and requires minimal site visits.

Below is a map overview of the project, identifying features of interest:

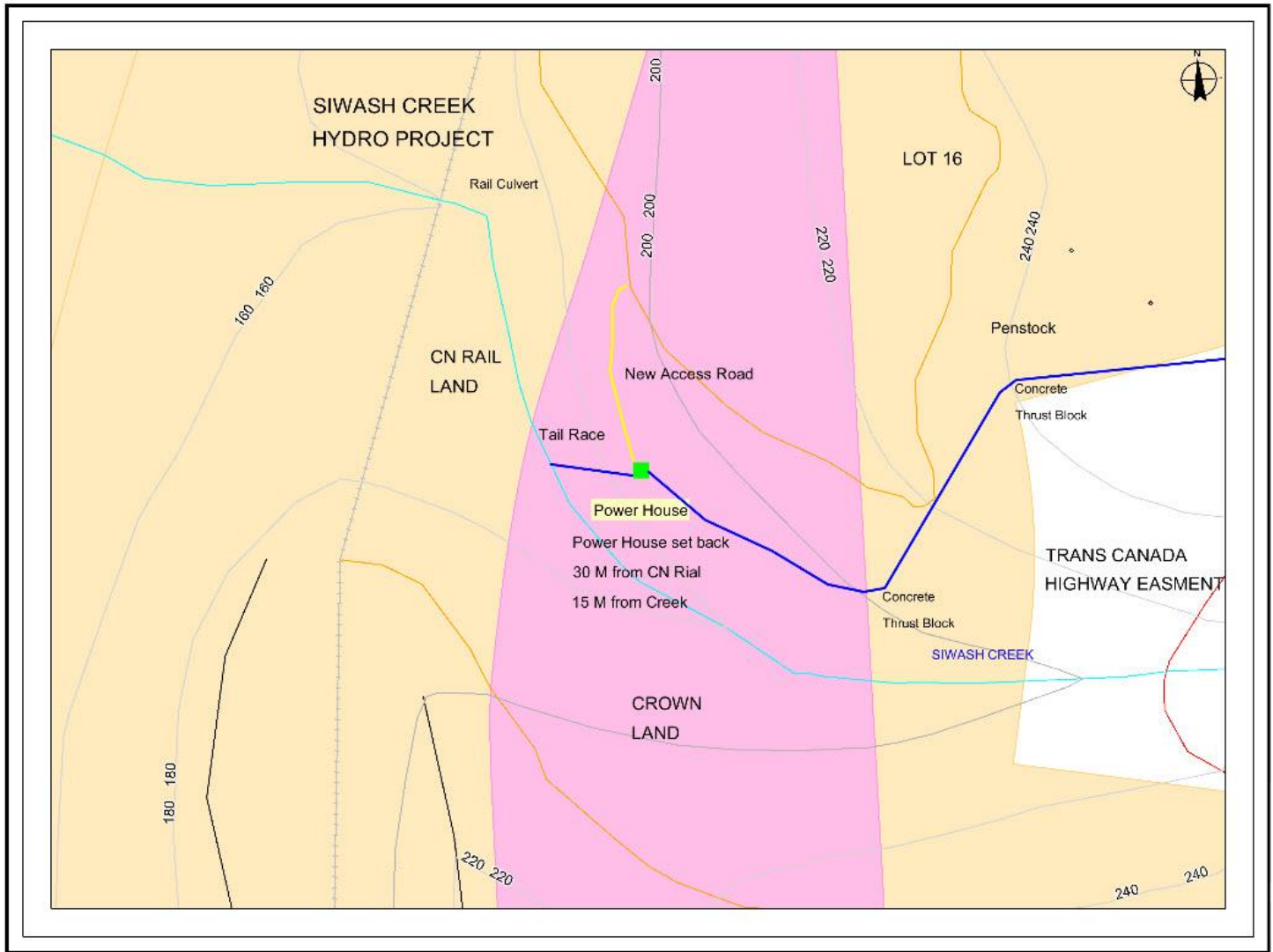


1. Powerhouse access road 110m long to avoid using CNR property. Will be maintained and graveled to point #2. (Topography map showing details of powerhouse location, and picture of existing culvert near this point provided in the following section.)
2. Highway pipe crossing designed and engineered to highway standards. (Picture of existing culvert near highway provided in the following section.)
3. Concrete thrust block 30m back from highway at a bend in penstock.
4. Penstock route on private property (PID 014-695-758).
5. Pipeline to lower intake. (Purpose of lower intake is for joint, local water use – not energy production.)
6. Existing gravel pit. The penstock starts on crown land near this point, and follows the existing abandoned logging road.
7. The ditch beside of the logging road between points #6 to #8 will be monitored for erosion, and maintained after the project is complete.

8. A culvert will be placed at this point, as the pipe crosses the creek in this location. (See detailed drawing in the following section.)
9. Location of existing slide on the old logging road. It will be assessed for safety and erosion control.
10. The pipe starts on the ridge at this point and is buried deep to provide an anchor point before it crosses the creek at point #8.
11. A small spur road will be built for construction access, and decommissioned after project construction is complete.
12. The steepest section of the pipe line starts here. Grades up to 50% are found between points #12 and #13. (Picture of ridge provided in the following section.)
13. High points between points #13 and #16 along the ridge will cause the penstock to side cut for short sections to limit the amount of necessary earth moving. Side cuts will be silt fenced and watched for erosion. (Picture of ridge provided in the following section.)
14. A recently removed culvert will be reinstalled at this location on the old logging road. It will be observed until the construction road is decommissioned.
15. Beginning of new road construction on old skid road to point #17.
16. High points between points #13 and #16 along the ridge will cause the penstock to side cut for short sections to limit the amount of necessary earth moving. Side cuts will be silt fenced and watched for erosion.
17. Side cutting of the new construction road starts here. It will need to be inspected for erosion, and will be built to Forest Service code. (Picture of road location provided in the following section.)
18. Existing helipad and staging area on the ridge. (Picture of helipad provided in the following section.)
19. Small culvert is needed for the new road between the talus at point #19 and point #17.
20. Side cut section of the penstock with a 3 to 5% grade from points #18 to #21. (Picture provided in the following section.)
21. A culvert will be placed at this point, as the pipe crosses the creek in this location. (See detailed drawing in the following section.) Flow gauging will take place between points #21 and 22 (Pictures provided in following section.)
22. Location of the Coanda screen intake. (Picture of an existing Coanda screen at another project provided as an example in following section.)



## Site Location Pictures and other Detailed Drawings



**Point #1 Detailed location of the Powerhouse on Crown land**



**Point #1 Culvert at CN at freshet.**

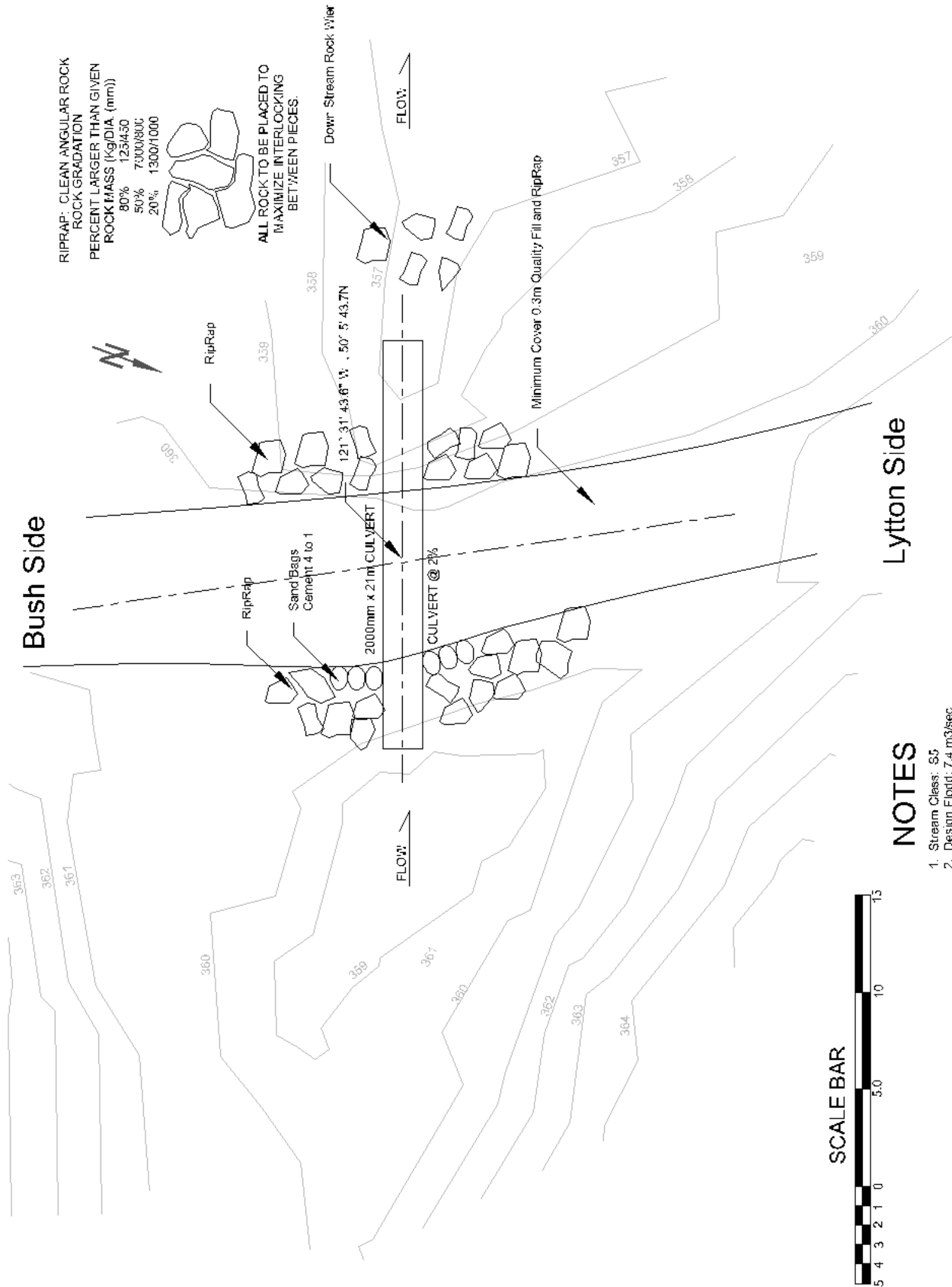




**Point #2 Culvert at the highway.**



### Point #8 Detailed drawing of culvert where penstock crosses Siwash Creek



RIPRAP: CLEAN, ANGULAR ROCK  
ROCK GRADATION  
PERCENT LARGER THAN GIVEN  
ROCK MASS (kg/DIA. (mm))

**ALL ROCK TO BE PLACED TO  
MAXIMIZE INTERLOCKING  
BETWEEN PIECES.**

Dover Stream Rock Pier

121° 31' 43.6" W, 50° 5' 43.7" N

2000mm x 21mm CULVERT

Minimum Cover 0.3m Quality Fill and RipRap

## NOTES

1. Stream Class: S5
2. Design Flood: 74 m3/sec
3. Average Stream Gradient: 20%
4. Average Stream Width: 4 meters
5. Streambed/banks: Gravel, sand and cobbles
6. Expected Design Life: 40 years
7. Culvert Slope 2%

# Site Plan Lower Crossing

DWG NO. 360-1

Sheet: 1

Scale: none

Date: Jan 22 2012

Approved:

Drawn: Chad B.



**Point #12 To avoid erosion the penstock will follow the ridge.**





**Point #13 High points on ridge that will require side cuts.**





**Point #17 New access road location.**





**Point #18 Old helipad that will be used as a staging area. (Remains of forest fire visible.)**





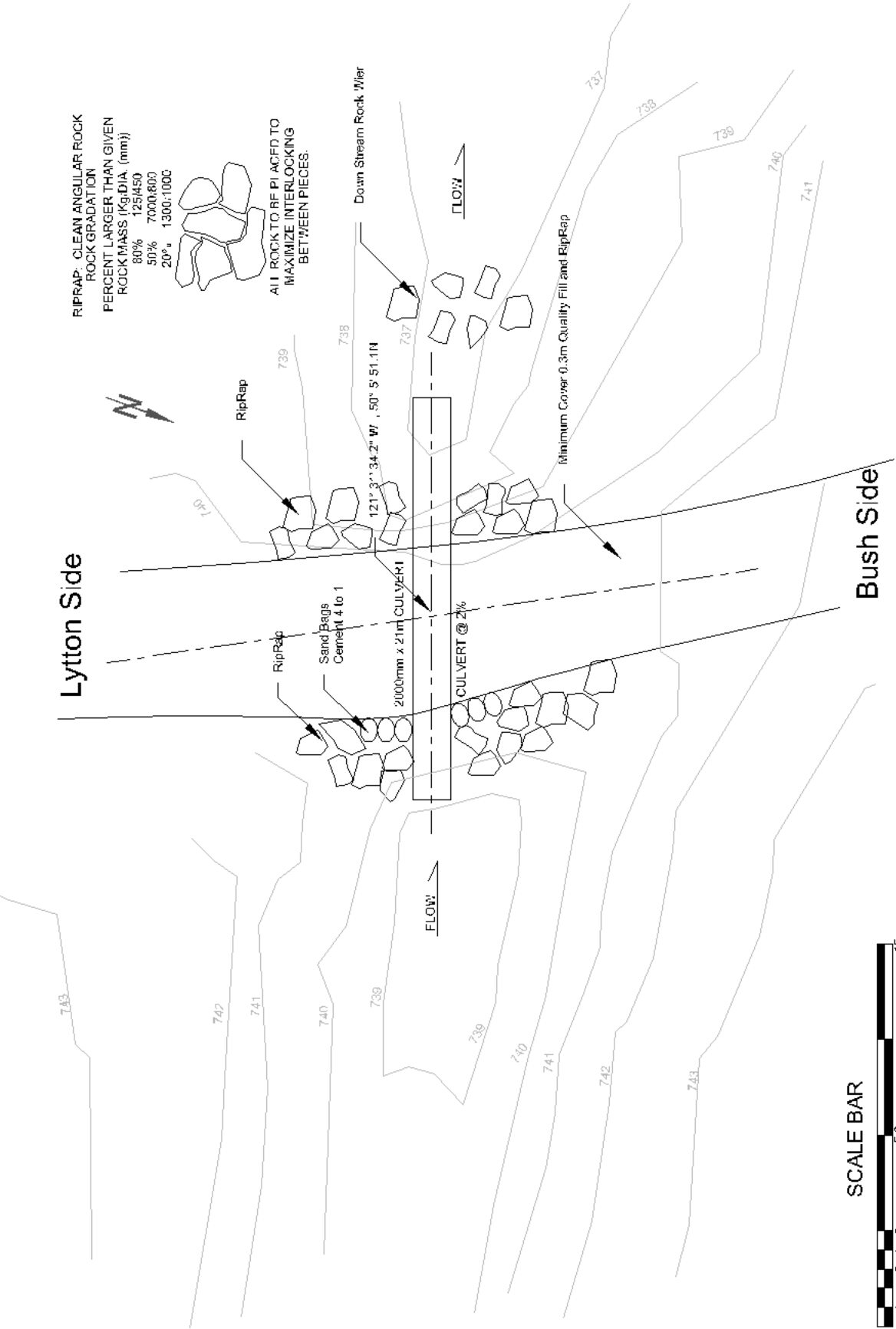
**Point #20 Sidehill low grade penstock route to upper creek crossing at point #21.**





**Point #21 Looking upstream at creek crossing location.** (Steep talus on right and bolder material on left.)

Point #21 Detailed drawing of culvert where penstock crosses Siwash Creek



NOTES

1. Stream Class: S6
2. Design Flood: 6 m3/sec
3. Average Stream Gradient: 15%
4. Average Stream Width: 3 meters
5. Streambed/banks: Gravel, sand and cobbles
6. Expected Design Life: 40 years
7. Culvert Slope 2%

SCALE BAR



Site Plan Upper Crossing

DWG NO. 740-1	Sheet: 1
Scale: none	Date: Jan 22, 2012
Approved:	Drawn: Chad P.





**Flow gauging location between points #21 and #22.**





**Point #22 Proposed intake with Coanda screen will be built similar to this one.**

## Various Project Details

The intake location on Siwash Creek is made up of large slabs of bedrock, and will provide good anchor points for the concrete weir walls. There are no fish present at the Siwash Creek intake, so a fish screen is not required. The Coanda screen is made from stainless steel wire with 1mm spacings. This will easily prevent sticks, leaves, and small debris from entering the penstock. The intake pond will be approximately 15m x 10m and 1m deep, and will not be used for water storage. Its sole purpose is to raise the water level just high enough to flow over the screen and sweep away any debris.

The penstock will be 3000m of steel pipe. The majority of the run will be utilize 16" diameter steel pipe, and 780m will be constructed from 18" diameter steel pipe. The joints will be welded, and the inside coated to reduce friction and increase its longevity.

The existing forest road and old skidder road are currently not in use, but sections will be required during project construction. Once the project is complete, the roads will be returned to a deactivated status. In regards to trails used by animals, the pipe will be buried and will not interfere with the natural habitat of the forest. The right of way for the penstock will be up to 10m wide and 3000m long. It will be reseeded to natural vegetation when complete.

400m of new construction road will be built to forest practice code, and will be deactivated after project construction. Also, approximately mid-way along the penstock, there will be a spur road built for tracked equipment to access the penstock.


## License to Cut

Triton Environmental Consultants Ltd has prepared a Timber Evaluation and License to Cut (LTC) submission in accordance with the policies and procedures of the Forest Act of British Columbia. A field review done by Kane Sanders, RPF of Triton Environmental Consultants Ltd. was undertaken on January 12, 2012 to confirm timber types and review the Project layout. (The License to Cut Application Map will be attached to this Project Scope.)

**Table 1: Licence to Cut Area Description**

Feature	Cleared Area	Reserve Area
Siwash access routes	10m total width centered on the route	30m total width centered on the route exclusive of the cleared area
Penstock route	10m total width centered on the route	30m total width centered on the route exclusive of the cleared area
Laydown areas	Entire area defined by Client	No reserve area
Intake location	No merchantable timber to be cleared	No merchantable timber to be cleared
Pumphouse location	16mX9m building footprint with 10m setback for construction situated with the long side parallel with the creek	The portion of crown land bounded by the creek to the South and 15m North and parallel to the access road (see LTC map)

Table from the technical memorandum by Triton Environmental describing the proposed cut areas.

<h1 style="text-align: center;">Interior Stumpage Rate Request Form</h1> <p style="text-align: center;"><u>REFER TO ATTACHED PROCEDURES DOCUMENT WHEN COMPLETING THIS FORM.</u></p>				
Licencee	Morehead Valley Hydro Inc		Licence/CP	TBD
Forest District	Cascades		Timber Mark	TBD
Forest Zone	SW		Point of Appraisal	Lillooet
Timber Supply Area	15		Area (ha)	4.2
Timber Supply Block	15B		Effective Date (Ministry Staff)	
Competitive Licence?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		Expiry Date (Ministry Staff)	

**Information on the Stumpage Rate Request Form submitted for the Siwash Project**

Species Volume Estimates			
Species		Volume	
Balsam (BA)		0	m <sup>3</sup>
Cedar (CE)		0	m <sup>3</sup>
Fir (FI)		230	m <sup>3</sup>
Hemlock (HE)		0	m <sup>3</sup>
Larch (LA)		0	m <sup>3</sup>
Lodgepole Pine (LO)		23	m <sup>3</sup>
Spruce (SP)		0	m <sup>3</sup>
White Pine - SIFR Only (WH)		0	m <sup>3</sup>
Yellow Pine SIFR Only (YE)		84	m <sup>3</sup>
Net Conifer Vol.		337	m <sup>3</sup>
Aspen (AS)		1	m <sup>3</sup>
Birch (BI)		0	m <sup>3</sup>
Cottonwood (CO)		0	m <sup>3</sup>
Other	0	0	m <sup>3</sup>
Net Deciduous Vol.		1	m <sup>3</sup>

Table from the Stumpage Rate Request Form that indicates the species that may need to be cut for the project.




## Connection to BC Hydro Grid

The Siwash Creek project does not require a transmission line, but will connect to an existing 25Kv distribution line that runs to Boston Bar where it enters a BC Hydro substation. The interconnection point for the project will be Pole #344, located on private property (PID 014-695-758, details attached below) 15km south of Lytton.

0/13/2012 11:3:41 AM

Page 1 of 2




300 - 465 Victoria Street  
Kamloops, B.C. V2C 2A9  
Tel: (250) 377-8673 Fax: (250) 372-5048  
Email: admin@tnrd.bc.ca

TNRD Online Property Information Report

Location

Address: 3021 TRANS CANADA HWY  
Community: Kanaka Bar  
Administrative Area: Electoral Area "I"  
1:5,000 TNRD Map Grid: 2023A  
1:20,000 TNRD Map Grid: 0921.003  
Longitude (DMS): -121° 33' 18.0"    Latitude (DMS): 50° 5' 38.0"

Map



Property Detail

PID: 014-695-758  
Plan:  
District Lot:  
Section: 13  
Legal Description: KAMLOOPS DIVISION OF YALE DIST, SECTION 13, TOWNSHIP 13, RANGE 27, MERIDIAN 6 LEGAL SUBDIVISION 16, MERIDIAN W6, MANUFACTURED HOME REG. # 10154.  
  
Approx. Lot Size (sq m): 126966.84  
Actual Use: 2 ACRES OR MORE (SINGLE FAMILY DWELLING, DUPLEX)  
School District: GOLD TRAIL

Folio: 730.12308.000  
Lot:  
Land District: KDYD  
Township: 13  
Range: 27

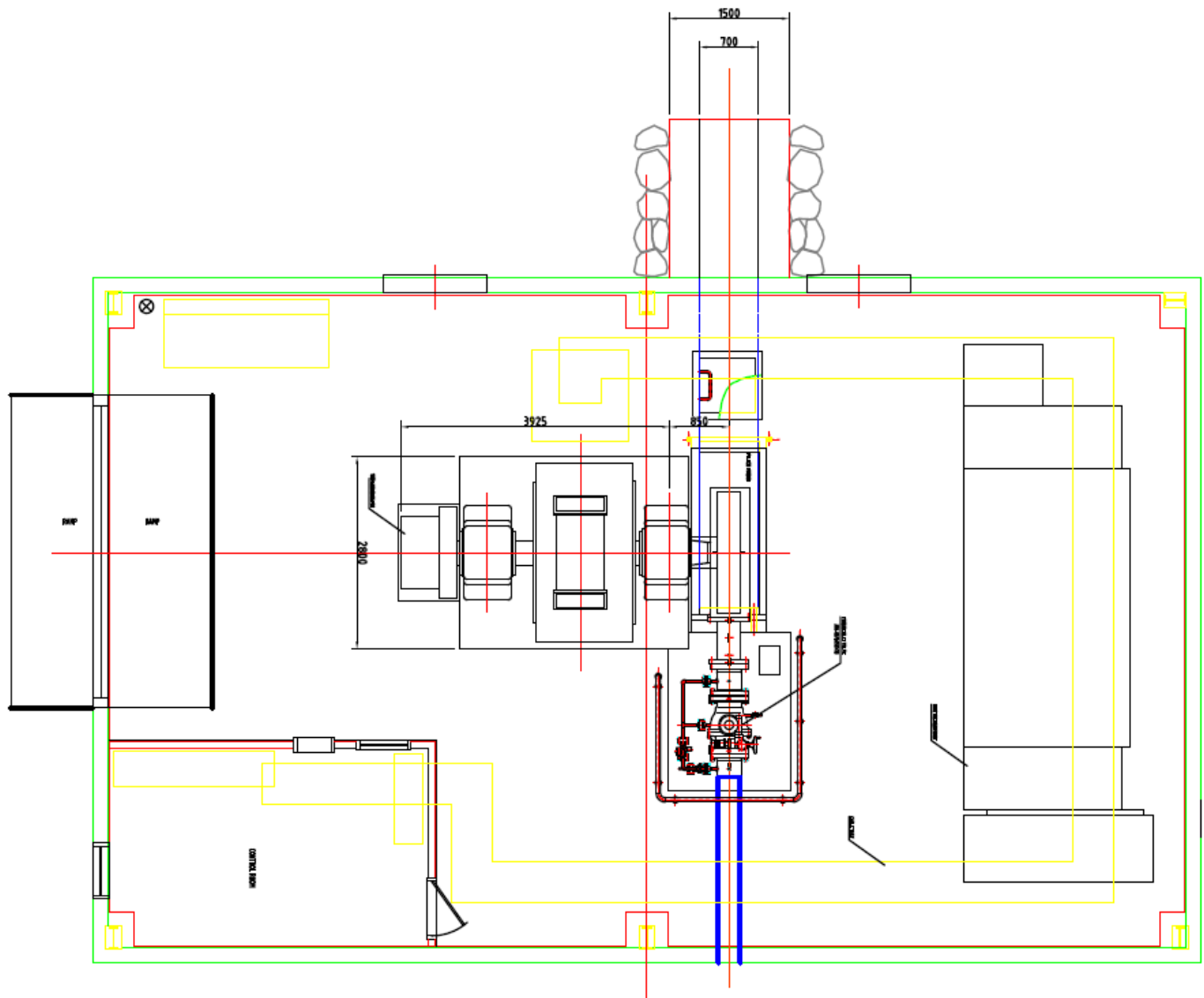
GIS Link: P35308  
Block:

Disclaimer: The information provided is compiled from various sources for your convenience and is derived from a number of sources with varying levels of accuracy. The TNRD disclaims all responsibility for any damages, loss or injury that may arise from the use of the materials contained on these pages.

Details of private property where pole #344 is located.

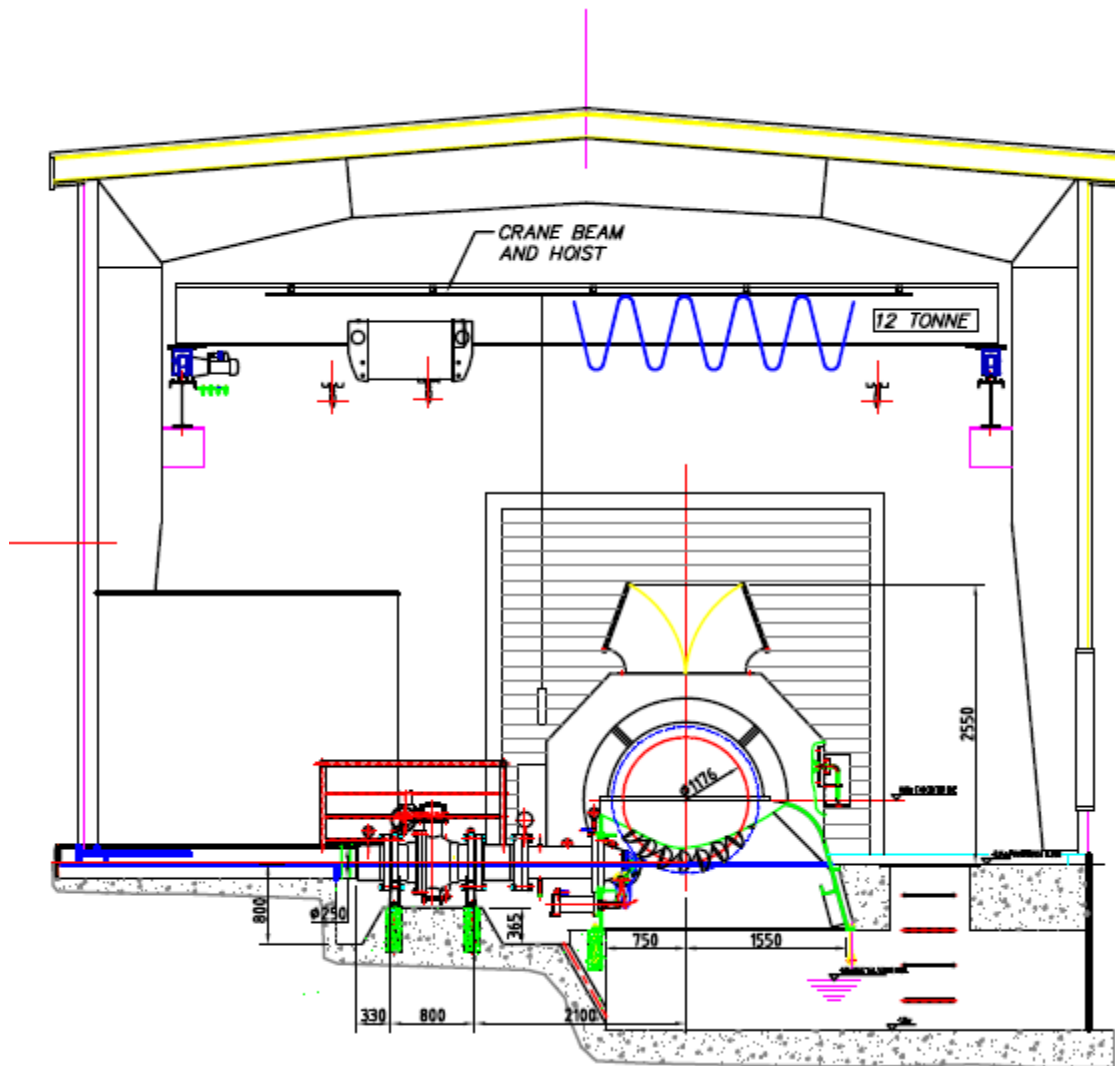
## Powerhouse

The powerhouse is a concrete structure that houses the turbine and generator. The size of the powerhouse will be approximately 50'x30'. The turbine and generator occupy about a 10' x 16' portion of the floor space, and the remaining floor space is allocated for electronics and switch gear. Water contamination is not an issue, as the water will not come in contact with grease or oil. The water will be returned to the creek, and any heating or changing of water quality will be negligible.

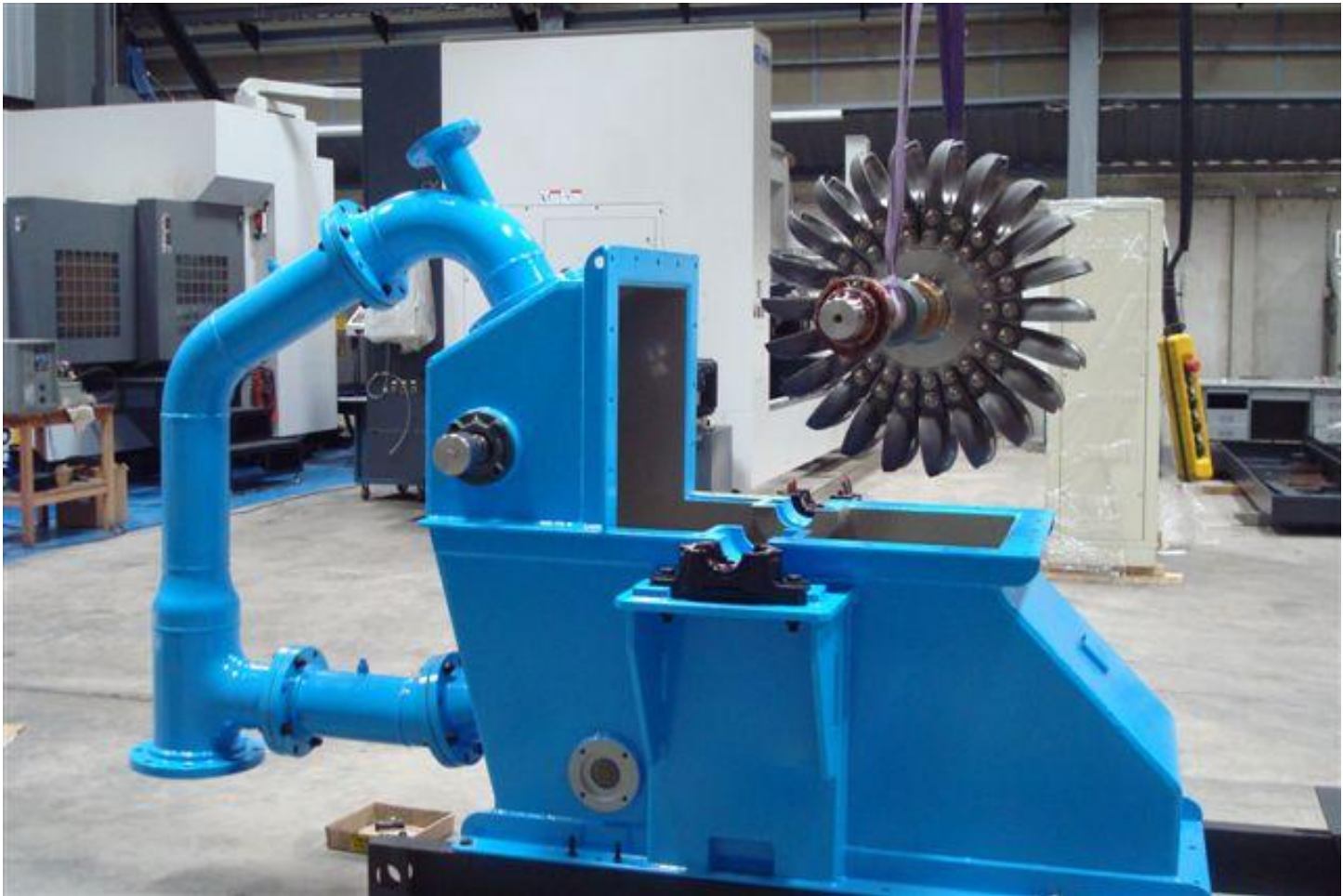


Plan view of the Powerhouse





**Section view of the Powerhouse**



**Example of turbine.** (Siwash will have a similar turbine as this one. Instead of two nozzles, Siwash will only have one nozzle.)

**1.3.1 Capacity of the Project**

Single turbine direct coupled to a 900rpm 4160volt 1800kw generator. The maximum water diverted is 0.33m<sup>3</sup>/s. The amount of electricity produce in a year would vary from 7000 to 8000 MWhrs.

**Average production in kilowatts each month**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
450	506	673	1635	1749	1749	1533	338	225	450	1002	561

**1.3.2 Watershed Characteristics and Availability of Water**

The Siwash Creek Watershed is approximately 10.6km<sup>2</sup>, and flows from an elevation of over 6,400ft (at Kanaka Mountain and Jackass Mountain), down to a 460-500ft elevation (at the Fraser River). It is headed by two, small, deep lakes located at about 6000 feet. These deep water bodies appear to provide additional hydraulic spring flow throughout the year. The creek gradient is very steep, and averages between 20-30% at the bottom



reaches, and up to 40-45% at the upper reach just below the lakes. There are also numerous waterfalls and cascades that occur along the creek. Even though the watershed is relatively small, the result of the large elevation difference between its high and low elevations are: different precipitation patterns, as well as different snowmelt and rain characteristics during the summer, fall, winter, and spring seasons.

The hydrology studies on Siwash Creek include a formal engineering report from Rivers Consulting in 2002. This report outlines 20%, 50%, and 80% probabilities that flows at the intake elevations will exceed their published data. A further statistical 11 year estimate was completed by an independent professional engineer in 2006. These published estimates from August 29, 2002 and April 10, 2006 have been verified by physical in-creek measurements by Ryan Mowat, P.Eng. The engineering reports correctly correlate with measurements and photographs documented since 1987. Additionally, automatic electronic gauging equipment has been installed at the intake elevation, and records flow data every 30 minutes. With over 20 years of flow observations and physical measurements correlating closely with the Rivers Report, we feel confident that the hydrology report accurately estimates the flow probability of the water shed at the intake design location.

### **1.3.3 Parameters for the Operation of Works**

The upper intake (located at elevation 860m) will provide water via 3000m of 16 inch diameter penstock to the turbine (located at elevation 180m). The single turbine will turn a single 1800kw 4160V generator, and then the power is transformed inside the building to distribution voltage. It will be routed by underground cable across the Trans Canada Highway, and then connected to BC Hydro pole #344, which will then supply BC Hydro customers.

There will be a second intake (located at a lower elevation of 360m) which will provide water to five existing water licenses. (These license holders are currently using a decades old canal system.) The new intake and pressure system will provide a much more reliable source of water. This pipeline will share the highway crossing of the penstock that feeds the powerhouse.

#### **List of water license holders:**

C065603 92.I.003 L (PD47844) Siwash Creek (Irrigation) 37004.4 MY  
MOREHEAD VALLEY HYDRO INC  
ASH - LYTTON Current Sec. 18 Amendment 1983/04/21

C044675 92.I.003 Q (PD44327) Siwash Creek (Irrigation) 5550.66 MY  
SYMES CLAIRE H & BOURGEOIS SCOTT D  
ASH - LYTTON Current Sec. 18 Amendment 1941/08/09

C059310 92.I.003 Q (PD44327) Siwash Creek (Domestic) 2.273 MD  
SYMES CLAIRE H & BOURGEOIS SCOTT D  
ASH - LYTTON Current Sec. 18 Amendment 1981/08/24

Siwash Creek (Irrigation) 7400.88 MY  
SYMES CLAIRE H & BOURGEOIS SCOTT D  
ASH - LYTTON Current Sec. 18 Amendment 1981/08/24

F014641 92.I.003 Q (PD44327)  
Siwash Creek Irrigation 9867.84 MY  
VON LOESSL JOHANN O & KATRIN  
ASH - LYTTON Current Sec. 18 Amendment 1946/01/09



**Photo of existing canal that supplies water to properties of water license holders.**

## **1.4 Linkages with other Projects and Roads**

Siwash Rd. is the main access to the Kanaka Bar Indian Band. With their permission, it will be used to access the forest road. There is also a deactivated logging road that connects to Siwash Rd, and it will be used for construction purposes. Once construction is completed, the logging road will be once again deactivated.

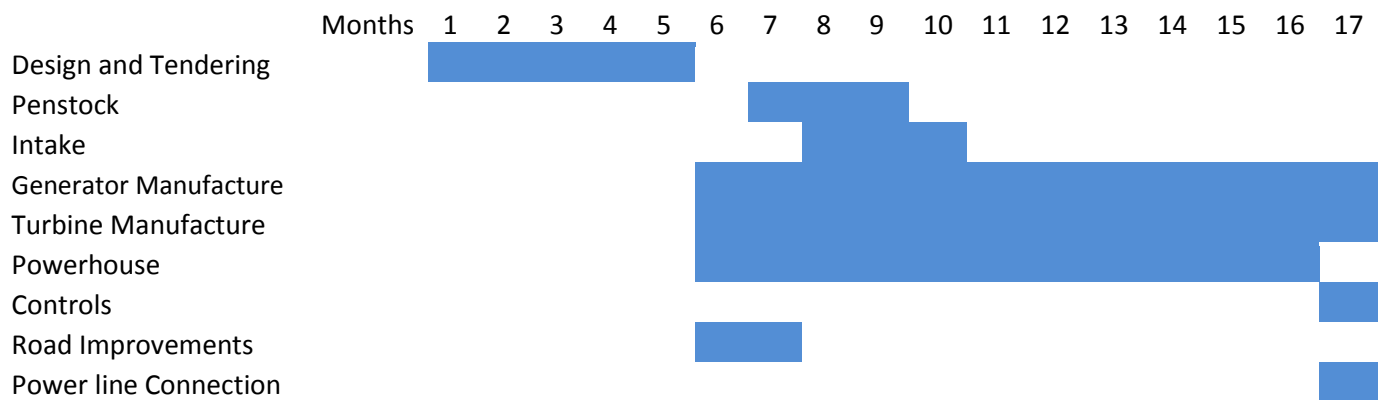
The Kwoiek Hydroelectric Project is located on the west side of the Fraser River (the Siwash Creek Project is on the east side). Its transmission line passes over the watershed of Siwash Creek, and its right of way is 30m wide and is 80km long. The substation and transmission line of the Kwoiek project will not be used by the Siwash project.

## **1.5 Market for Electricity**

The electricity will be sold to BC Hydro under the Standing Offer Program.



## 1.6 Schedule for Completion of Project



Once “Leave to Construct” has been reissued it will take approximately 17 months to complete the project. Turbine and generator manufactures require up to one year to build the equipment, once the order is placed. While the equipment is being manufactured, the intake, penstock and powerhouse are being constructed.

## 1.7 First Nations Involvement

We have consulted with the First Nations in the vicinity of the project, and generated a consultation list using iMap BC. The following First Nations and Tribal Councils have been identified as being potentially affected by the project and have been contacted by letter dated Jan 5, 2012:

- Nlaka’pamux Nation Tribal Council
- Esh-kn-am Cultural Resources Management Services
- Nicola Tribal Association
  
- Ashcroft Indian Band;
- Boothroyd Indian Band;
- Boston Bar Indian Band;
- Coldwater Indian Band;
- Cook’s Ferry Indian Band;
- Kanaka Bar Indian Band;
- Lower Nicola Indian Band;
- Lytton Indian Band;
- Nicomen Indian Band;
- Nooaitch Indian Band;
- Oregon Jack Creek Indian Band;
- Shackan Indian Band;
- Siska Indian Band;
- Skuppah Indian Band;
- Spuzzum Indian Band; and,
- Upper Nicola Indian Band.

The above sixteen First Nations comprise the Nlaka’pamux Nation. The governance structure of the Nation is made up of one Tribal Council and a Tribal Association. The Tribal Councils are the Nlaka’pamux Nation Tribal Council (NNTC) and the Nicola Tribal Association (NTA).

### ***Ethnography***

The Kanaka Bar Indian Band is part of the larger Nlaka’pamux Nation. Nlaka’pamux peoples are also referred to as Thompson in the ethnographic literature. The Nlaka’pamux language is spoken along the Fraser River from Spuzzum to Lytton, along the Thompson to its border with the Shuswap, and into the Nicola Valley (Kinkade *et al.*, 1998; Maud, 1978). This language was traditionally spoken by members of the present-day Nlaka’pamux Nation Tribal Council (Ashcroft First Nation, Boothroyd Indian Band, Boston Bar First Nation, Kanaka Bar, Lytton First Nation, Oregon Jack Creek First Nation, Skuppah First Nation, and Spuzzum First Nation), Nicola Tribal Association (Nicomen Indian Band, Nooaitch Indian Band, and Shackan Indian Band), and independent Bands (Coldwater Indian Band, Cooks Ferry Indian Band, Lower Nicola Indian Band, and Siska Indian Band) (Government of British Columbia, 2007).

Today there are few speakers of the Nlaka’pamux language, English having become the dominant form of communication. Present-day Kanaka Bar Elders are the keepers of the histories of the people, their stories and their teachings. Access to the resources of the different watersheds is realized through a complex social system of intermarriage and the protocols that have lasted through the centuries.

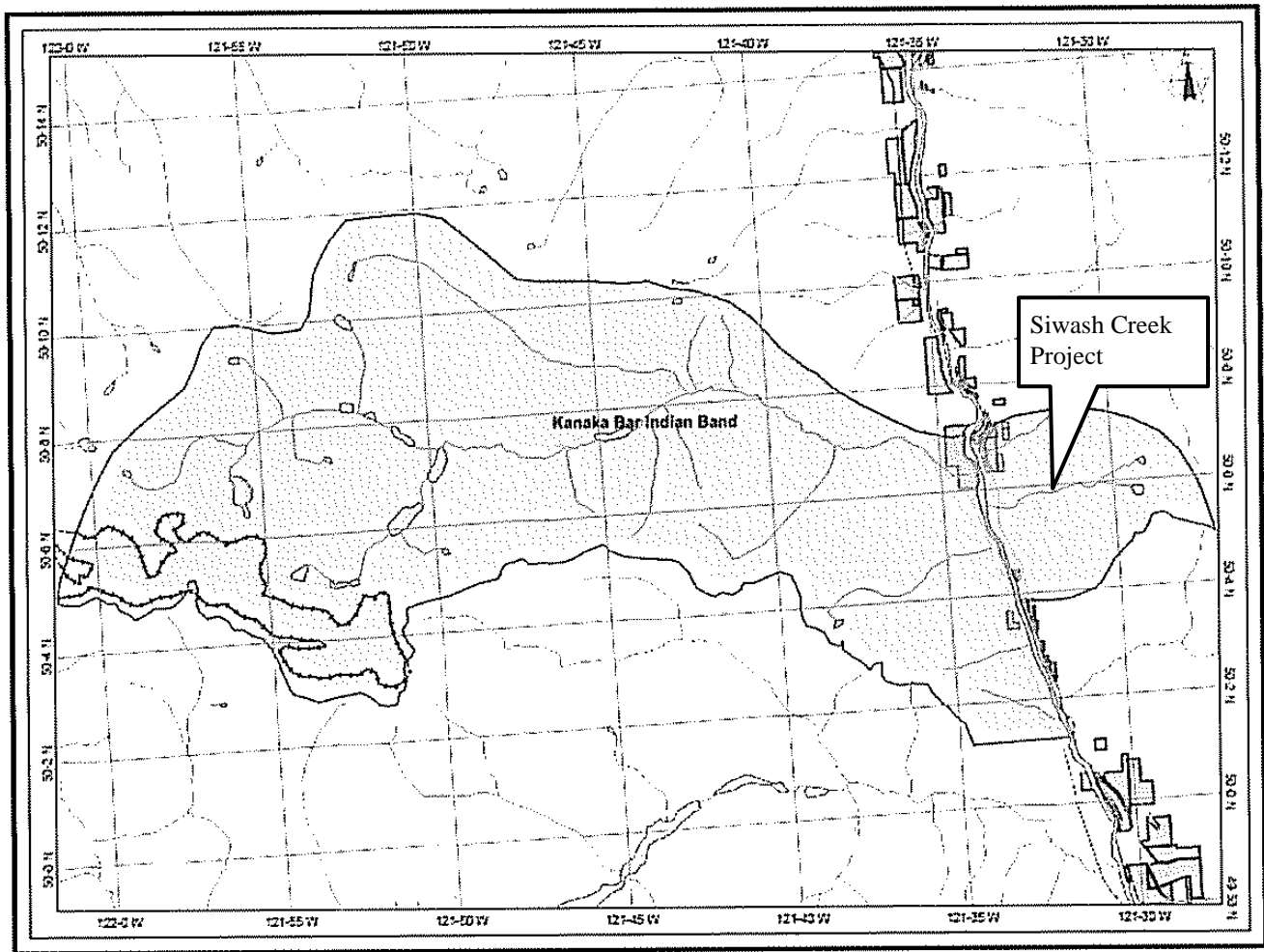
### ***Traditional Use***

The developers of the Siwash project recognize that the Project area lies within the asserted traditional territory of the Nlaka’pamux Nation. The Courts have held existing aboriginal title and rights in respect of lands and



resource use are recognized and affirmed under the Canadian Constitution. The developers of the Siwash project has been holding ongoing discussions with First Nations to determine their interests in the land and to assess Project impacts and/or infringements on their interests in order to develop workable accommodation strategies to address those impacts through mitigation and participation.

Map #2: The map based on information provided by staff regarding a focused area of interest for the Band within the Nation.



## Correspondence Between Morehead Valley Hydro and Kanaka Bar Indian Band

Date	Type	Description
Sept 12 2001	Letter	Project Proposal to the Kanaka Community
April 15 2002	Phone	Telephone conversation between Ron Williams and Chief James Frank
April 19 2002	Letter	Follow up letter to telephone conversation and previous letter
April 19 2003	Meeting	Meeting to discuss the Power Project
May 21 2002	Letter	Follow up letter from April 19 2002
Sept 30 2002	Letter	Submitted Geotechnical Report - Cullinane & Powell Consultants
Sept 30 2002	Attachment	Submitted Siwash Creek Fish Assessment report by Arc Environmental
Sept 30 2002	Attachment	Submitted Hydrology Report by BC Rivers Consulting
Sept 30 2002	Attachment	Submitted Tailed Frog Survey of Siwash by Ecoscape Biological consulting
June 18 2002	Phone	Discussed Meeting Schedule
June 26 2002	Meeting	Meeting with Mike Edwards, Ron Williams, and Chief James Frank
Nov 28 2002	Letter	From Land and Water BC -
July 15 2002	Letter	From Land and Water BC -
June 4 2011	Letter	Ron Williams to Patrick Michell - Exploring potential opportunities with the Kwoiek Project
Jan 5 2012	Letter	Chad Peterson, Ryan Mowat to Nlaka'pamux Nation
		Application to Cut
		Crown Land Tenure
		BC Hydro SOP
Jan 10 2012	Phone	Chad Peterson and Patrick Michell
Jan 11 2012	Email	Patrick Michell sent a number of questions that he would like to discuss at the upcoming meeting
Jan 12 2012	Meeting	Chad Peterson, Ryan Mowat, Michael Sohy met with Patrick Michell and Chief James Frank
Jan 13 2012	Letter	Summary of meeting from Jan 12, 2012
Jan 18 2012	Email	Six pages of questions from Patrick Michell to be answered and discussed at the Jan 26th meeting
Jan 24 2012	Email	Patrick would like a summary of the presentation and handout to be distributed before the meeting
Jan 26 2012	Meeting	Chad P, Ryan M, Michael S to meet with Kanaka Community



## 1.8 Fish and Wildlife Information

### Fish and Aquatic

The project will prepare a monitoring program suitable to determine the nature of any impacts on fish, tailed frogs, aquatic habitat and wildlife to the satisfaction of the Regional Water Manager.

This program will be continued for five years after construction. Then a report will be prepared that identifies the nature of any impacts on fish, tailed frogs, aquatic habitat and wildlife.

Triton Environmental (previously ARC Environmental), has prepared a fish study and will be our environmental monitor for the project. They have identified that “the stream section upstream of the sampling location immediately downstream of the highway is steeper and more dynamic with more evidence of channel instability and unsuitable for fish use.” The only sample section on Siwash Creek that had fish, is an area that is 100m long near the railway culvert at the lower end of the project. This section requires base flows of 30 liters per second to provide stable habitat, and engineering measures will be in place to maintain that minimum flow at all times.

### Birds

Provisions will be made to ensure that birds will not be disturbed during the nesting season. The environmental monitor will be consulted before any tree cutting takes place.

### Wildlife

The following wildlife have been identified in the vicinity of the project: the mountain beaver, ungulates (mule deer), and the grizzly bear.

***Mountain beaver*** (*Aplodontia rufa rainieri*)

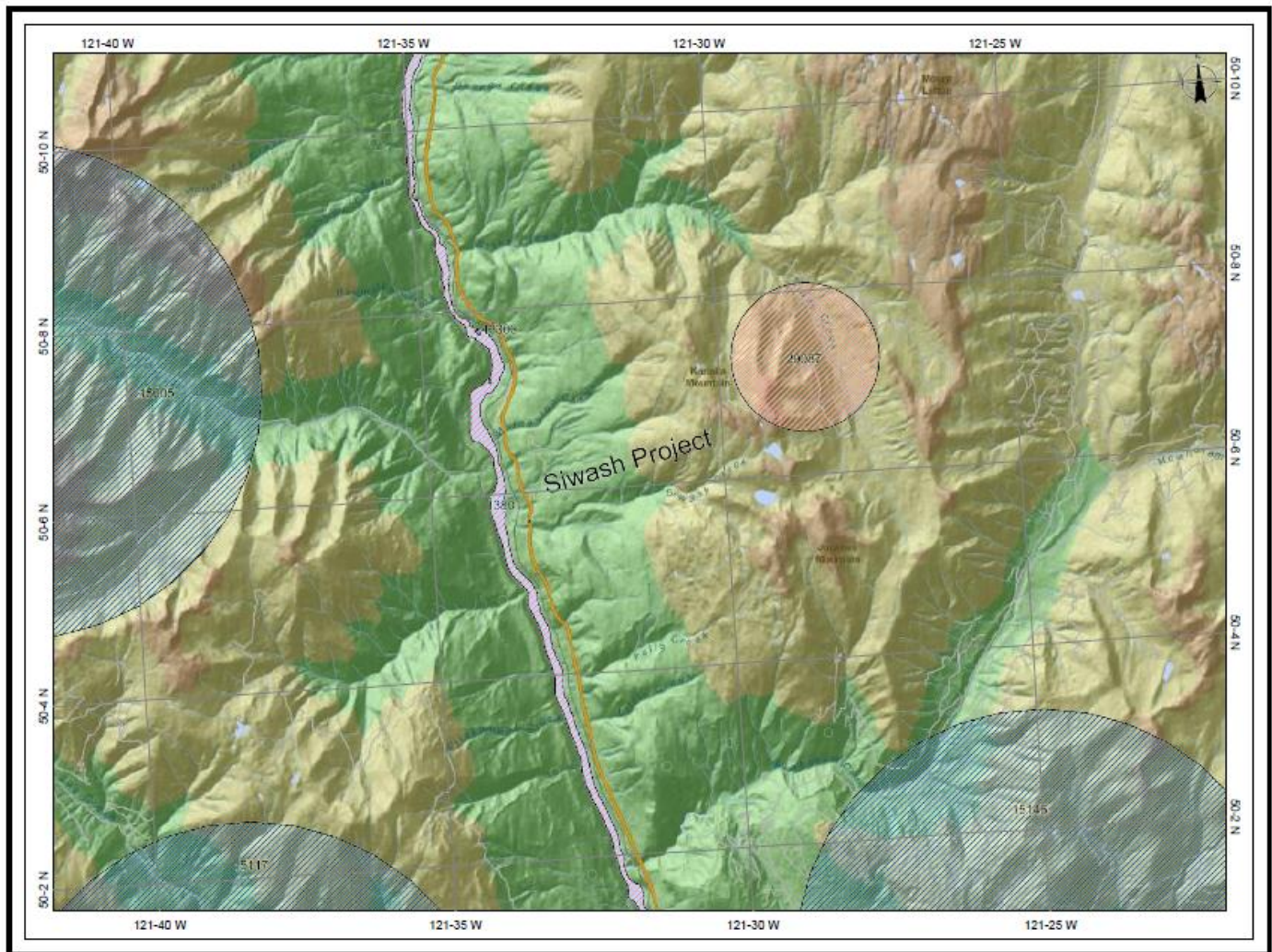
CDC “blue-listed”, SARA Schedule 1 species of “Special Concern”

In 1997, signs of the mountain beaver, *Aplodontia rufa rainier*, were found north east of the proposed Siwash Project. The following information concerning the mountain beaver is summarized from the Species at Risk Public Registry:

The Mountain Beaver is the most primitive living rodent. It resembles a medium-sized muskrat, except the tail is well furred and exceedingly short. The body is thick, heavy, and covered with coarse, dull, uniformly dark brown fur. The average adult weighs 806 g and is 300-470 mm long (of which the tail is 20-40 mm).

Mountain Beavers occur in forested areas from near sea level to timberline, often preferring early to mid-seral stages. Specific requirements include soils that allow tunnel, burrow and runway construction; a cool and moist microclimate within tunnels and burrows; and suitable forage within 50 m. Deep soils with subsurface drainage that keeps the majority of the tunnels and burrows wet, even to the point of having water trickling through them, appear ideal for these rodents. The underground nest sites must remain dry and above the water table, however. Slopes around nests tend to have a grade of < 31%.

There are two mapped occurrences of mountain beavers in the vicinity of the proposed project: a museum specimen collected from the Neville Creek watershed on May 3, 1947 (CDC Occurrence No. 20085), and signs observed in the Siska Creek watershed in 1997 (CDC Occurrence No. 20087).



**Map of Mountain Beaver Occurrence No. 20087 in the Siska Creek Watershed** (North East of Siwash Project footprint.)

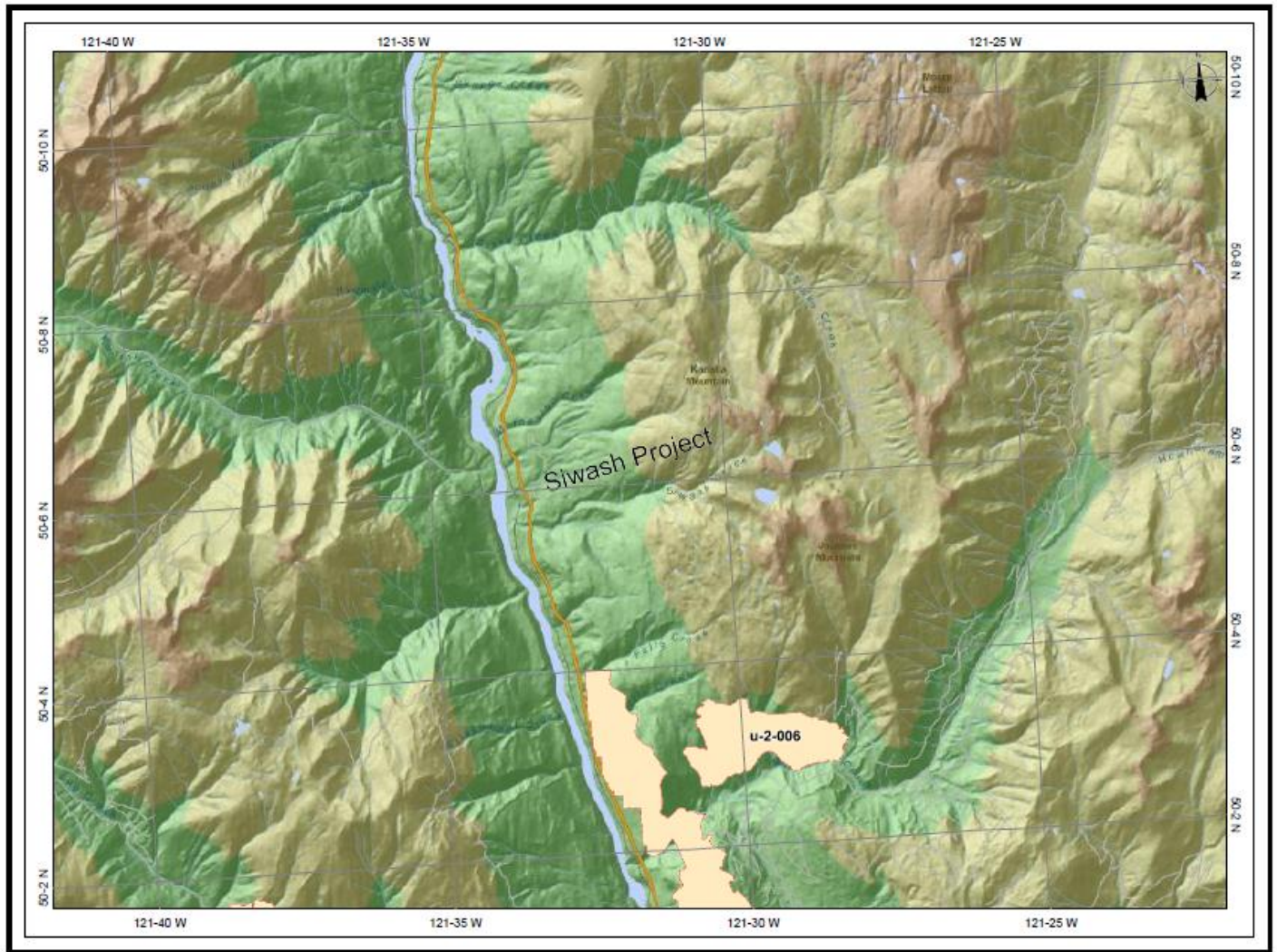
### *Ungulates* (Mule deer - *Odocoileus hemionus*)

Mule deer have a wintering range located 4km south of the proposed Siwash Project, and should not be impacted by the project. Mule deer are not in danger of becoming a species of concern. The following information regarding mule deer is summarized from the Integrated Land Management Bureau of the BC Government:

The mule deer is the most numerous ungulate in British Columbia and is second only to moose as the most widely distributed (Petticrew and Jackson 1980; Petticrew and Munro 1979). The numbers and range of this species have increased in British Columbia since European settlement because logging, burning and agricultural activities have increased forage by creating large areas with early and intermediate seral stages (Mackie *et al.* 1987). Mule deer are 'intermediate feeders' grazing on



herbaceous material and browsing on woody forage (Anderson and Wallmo 1984). Their diet includes a variety of grasses, forbs, shrubs, trees, sedges, agricultural crops, mushrooms and lichens, depending on season (Petticrew and Jackson 1980).



**Map of Ungulate Winter Range Number U-2-006 for Mule Deer** (Note that it is approximately 4km south of the Siwash Project.)



## ***Grizzly Bear*** (*Ursos arctos*)

CDC “blue-listed”, COSEWIC (Committee on the Status of Endangered Wildlife in Canada) “Special Concern”

As per the Kwoiek Creek Transmission Corridor study, “There is no high quality grizzly bear habitat along the transmission corridor route.” (Please note that the Kwoiek Creek area study overlaps the Siwash Creek project area.) The following information concerning the grizzly bear is from the Species at Risk Public Registry:

The Grizzly Bear is larger than the Black Bear, has a stout body, a large head, and a short tail. It has a distinctive hump between its shoulder blades that is formed by the muscles of its powerful forelegs. Its nose turns up at the end, unlike the Black Bear, whose nose arches down. Grizzly Bears are typically brown, but can range from nearly white through blond to black. The guard hairs on the shoulders and back are often tipped with white, which gives the fur a grizzled appearance from a distance. Size is quite variable in Grizzly Bears. The weight of individual females ranges from about 100 kg for those in interior populations to about 200 kg for those in coastal populations, and typically males are almost twice as heavy as females. Body mass also increases greatly between spring and fall and declines over the winter.

In Canada, the Grizzly Bear has been extirpated from the Prairies Provinces. With the exception of a few isolated groups in southern British Columbia, the Grizzly Bear continues to persist as one essentially continuous population across Alberta, British Columbia, the Yukon, the Northwest Territories, and Nunavut.

There are estimated to be between 26 916 and 29 150 Grizzly Bears in Canada. These numbers were compiled in 2001/2002 and are based on figures obtained from the provincial and territorial jurisdictions. British Columbia has the largest population, with at least 14 000 bears. There are estimated to be 1000 Grizzly Bears in Alberta, 6000 to 7000 in the Yukon, and 5100 in the Northwest Territories. The population in Nunavut is unknown but is probably between 800 and 2000 bears. Overall, the population of Grizzly Bears in Canada is believed to have been generally stable since 1990.

Although it will not be very likely that the project will come across grizzly bears, the following mitigative measures will be in place to prevent Human-Bear Conflict:

- Maintain attractant-free work site (*e.g.* ensure adequate food storage and garbage management); and
- Minimize the total length of active roads;
- Complete construction phase as quickly as possible;
- Avoid the use of herbicides in favour of manual cutting to achieve vegetation objectives;
- Implement strict garbage management protocols at temporary work sites.

These strategies will be employed to mitigate the effects of the Siwash Project on grizzly bear. For example, no camp will be required for this project given the close proximity to Lytton, and thus reducing the human/bear interactions during construction. It is anticipated that these strategies will reduce the risk of increased human-induced mortality, and habitat avoidance, where there is new access into unroaded areas.

## 1.9 Land Access

During construction, access to the proposed project will be from two locations. The powerhouse and lower 350m of penstock will be accessed from Hwy 1 located at Siwash Creek (15km south of Lytton). The upper 2600m of penstock and both intakes will be accessed from Siwash Rd.

Access to the powerhouse will be from the west side of Hwy 1 on private land. The powerhouse will be remotely monitored, and site visits will be as frequent as daily visits during high flows (May, June, and July), and weekly or less for the rest of the year. The intake will be accessed from Siwash Road for twice yearly inspections and cleaning (April and September). The forestry access road is on crown land, and is currently inactive and will be deactivated after construction.

The project is a small one, and will not put a strain on the transportation infrastructure. For example, the entire penstock will arrive on twelve trucks over a two month period, and the trucks will not travel during the hours that the Kanaka Bar school bus is running. Also, the concrete at the intake will be mixed on site by hand and will not require ready mix trucks.

To prevent increased access to the Siwash Creek watershed, gates and decommissioning of roads are part of the access plan. This will prevent the project from having a negative effect on the animal population in the area through increased illegal harvest, habitat displacement and increased human disturbance.

Game trails will not be blocked. The pipe will be buried to prevent disturbance of animals. The right of way for the penstock will be up to 10m wide and 3000m long. It will be reseeded to natural vegetation when construction is complete.

