BC Hydro

Columbia River Projects Water Use Plan

Feasibility Study for Boat Launch Ramps at Nakusp on the Arrow Lakes Reservoir

MOFFATT & NICHOL
777 W. Broadway Suite 301
Vancouver, BC, V5Z 4J7

In association with

Atek HYDROGRAPHIC SURVEYS LTD.
4740 Joyce Avenue
Powell River, BC, V8A 3B6
ph: 604 485 0205 fax: 604 485 0200

Golder Associates

TRITON ENVIRONMENTAL CONSULTANTS LTD.

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1.0 Introduction

1.1 Project Background

The existing boat launch ramp at Nakusp was constructed as part of the January 12, 1968 Agreement between Her Majesty the Queen in right of Canada ("Her Majesty"), and British Columbia Hydro and Power Authority ("Authority"). In 1969, BC Hydro (BCH) constructed the boat launch ramp on behalf of the Federal Department of Public Works (DPW) as compensation for the old ferry dock that had to be demolished for the construction of the new reservoir.

DPW provided BCH with the plans and specifications to construct a timber trestle boat launch ramp. After the boat launch ramp was constructed, BCH transferred the ramp and the land occupied by it to DPW. DPW operated the facility under the Small Crafts Harbour Branch until 1995 when the facility and a maintenance fund were transferred to the Village of Nakusp. Currently, the Village of Nakusp operates the facility, and BCH maintains it.

The objectives of this feasibility study are to review options, and to provide recommendations for a facility that will allow long-term public boat access to the Arrow Lakes Reservoir at, or in the vicinity of, the Village of Nakusp. Such a facility could include the existing ramp or a new ramp, or any combination thereof.

1.2 Scope of Work

In accordance with the TOR provided by BCH, the feasibility study includes the following tasks:

- Perform a reconnaissance survey of the existing boat launch ramp location and site visits at other possible locations[1] as identified by BCH and the Village of Nakusp.
- Determine the feasibility of the boat launch ramps based on engineering technical feasibility, a cost-benefit analysis, heritage and environmental criteria, and also provide recommendations for each site as per section 2.2 of the TOR.

1.3 Report Organization

The data collection and field investigation program for this study are described in Sections 2 and 3 below. The analysis of ramp design alternatives is provided in Section 4. Sections 5 and 6 respectively present a summary of the environmental and heritage issues associated with the proposed developments. Cost-benefit analyses of the development options are presented in Section 7, with conclusions and recommendations for further work in Section 8. Our closing remarks are in Section 9.

[1] The M&N proposal to BCH dated February 13, 2008 has assumed that the project team would investigate the existing boat launch ramp site, and two potential boat launch ramp sites in the vicinity of Nakusp.

Appendix A contains drawings including a project location map, site map with opportunities and constraints, and concept layout plans of the existing facility and potential locations. Appendix B contains photographs taken during the field visits. Appendix C contains the full Environmental Overview Assessment report prepared by our team partner, Triton Environmental (Triton). Appendix D contains the Archaeological Overview Assessment (AOA) report prepared by our team partner, Golder Associates (Golder).

2.0 Data Collection

The following background data and information were provided by BCH and referenced for this report:

- Reservoir Access Obligations under Conditional Water License 27066 – Clause (m) Arrow Reservoir, BC Hydro, 2005;
- Order under the Water Act (File No. 0236915), Provincial Comptroller of Water Rights, January 23, 2006;
- Report for Nakusp Boat Launch Ramp Inspection, Westmar Consultants, 2001;
- Report for Nakusp Boat Launch Ramp Inspection, Westmar Consultants, 2006;
- Nakusp Boat Ramp Facility Inspection Report, Westmar Consultants, December 2007; and,
- Notes of the Village of Nakusp Public Meeting on October 10, 2007, prepared by BC Hydro.

3.0 Inspection Findings of the Potential Boat Launch Ramp Sites and Existing Boat Launch Facilities

3.1 Site Locations

The project team of Moffatt and Nichol (M&N), Golder Associates (Golder), Triton Environmental Consultants (Triton), and one member each from the Neskonlith and Splatsin First Nations participated in the field investigations for the potential boat launch ramp sites that were conducted between May 2 and 3, 2008.

Initially, the project team met with Harry Brownlow of BC Hydro at the existing boat launch ramp site, and shortly after, Harry Brownlow and the project team met with Bob Lafleur of the Village of Nakusp and on Friday, May 2, 2008 at the Village of Nakusp offices. At that meeting, four site locations were identified for investigation. These sites are shown on Drawing No. 6537 – 100 in Appendix A and are listed as follows:

- North Nakusp site;
- Nakusp Public Beach site;
- Existing Nakusp boat launch ramp site; and,
- South Nakusp site.

The initial South Nakusp site was identified as the marsh area near the island and south of the existing boat launch. However, after inspection of the site, the project team determined that this location had challenging engineering requirements as well as archaeological interest and significant environmental value, so the project team decided to investigate the light industrial area at Rothwell Point south of the marsh area as a potential boat launch location. The light industrial area at Rothwell Point is described in the report as the South Nakusp site.

3.2 Site Opportunities and Constraints

A review of the Nakusp sites and its surroundings identified a number of opportunities and constraints for boat launches as described below. The main opportunities and constraints are summarized on Drawing 6537-101 in Appendix A, with discussions as follows:

3.3 North Nakusp Site

The North Nakusp site is located north of the mouth of the Kuskanax Creek. The site is approximately 3.5 km from the existing boat launch ramp in the village, and about 1 km from the intersection of Canyon Road and the resort development area. Access to the site is via 13th Avenue NW Road which is mainly an asphalt road and is located at the end of Kuskanax Road. As shown in Figure 3.1, there are two man-made bays, located at the southern end of Kuskanax Road.

Figure 3.1 – Aerial View of Potential Boat Launch Ramp Site at North Nakusp

Source: Google Earth

The area has undergone extensive excavation to create berms on either side of the North Bay as protective structures at the informal boat launch ramp site. This is because the location is exposed to wind and wave attack from both the north and south directions, and in particular from the north where the fetch is the longest, see Photograph No. 2 in Appendix B. The south direction is partially sheltered by the delta formed by sediment deposits at the mouth of Kuskanax Creek. We understand that residents currently use this location to launch boats when the existing boat launch ramp in Nakusp is unusable. This area is also susceptible to dust storms when strong winds blow in the area.

Based on the online cadastral map obtained from the BC Ministry of Agriculture and Lands web site, the area north of Kuskanax Road is designated Crown Lands, see Photograph No. 1 in Appendix B for a pictorial view of the north fetch.

In this area, there are suitable gradients along the shoreline to allow for the construction of a potential boat launch ramp, and upland area is available for vehicular and trailer parking.

The advantages of this site are:

- Relatively short distance (less than 4 km) from the Village of Nakusp;
- The existing access road to the potential boat launch site is in good condition;
- There is sufficient upland area for siting the upland parking area;
- Protective berms would provide shelter for launching boats at the site at low water levels; and,
- There is sufficient water depth for year-round boat launches.

The disadvantages of this site are:

- The land use designation for the area has recently been changed from "Commercial/Industrial" to "Resort Development". A public boat launch ramp may be in conflict with any potential resort development at this location;
- The site is exposed to wind and waves from both the north and south directions;
- This potential site is not as convenient as the existing boat launch ramp which is centrally located in the village.

3.4 Nakusp Public Beach Site

The Nakusp Public Beach site is located at the end of 8th Avenue South West on the west side of the Village of Nakusp as shown in the aerial photograph in Figure 3.2 below. Eighth Avenue South West is bounded by a sloped landscaped area and the public beach to the west and residential properties on the east side.

The site is also downstream of the mouth of the Kuskanax Creek as shown in Photograph No. 13 in Appendix B. The sandy public beach area is located on the south-eastern side of the creek as shown in Photograph No.14 in Appendix B. The potential boat launch site could be located adjacent to the east of the existing public beach area.

The upland area is divided by West Broadway, the main road through the village, and the park area to the north. There is also a war memorial erected at the south east corner of the park.

The site is partially sheltered from the northerly winds by the headland to the east; however, it is exposed to the wind and waves from the south. Based on the Canadian Hydrographic charts for the Arrow Lakes Reservoir as shown on Drawing No. 6537-100 in Appendix A, the lake bed contours in this area appear to have a sufficiently steep slope into the lake which would allow year round boat launches. It is also possible that the upland vertical profile at this site may be ideal for construction of a boat launch ramp. However, the required upland area for parking of vehicles and boat trailers is not readily available at this site as shown in Photograph No. 18 in Appendix B due to the differential elevation of the main road and the beach area. Thus, any potential parking area would result in loss of public beach area.

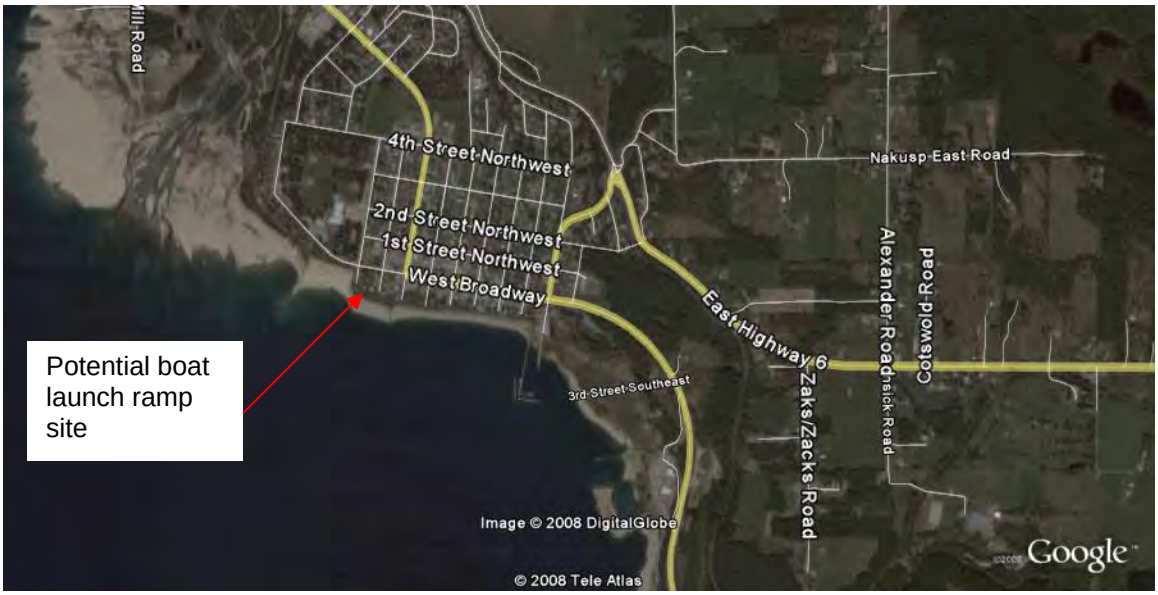

Figure 3.2 – Aerial View of Potential Boat Launch Ramp Site near the Public Beach area

Source: Google Earth

The advantages of this site are:

- Close proximity to the Village of Nakusp;
- The upland grades for the boat launch ramp slope are suitable for boat ramps; and,
- Water depths are available at this location for year-round boat launches.

The disadvantages are:

- Narrow corridor for access to the boat launch site;
- Large amount of fill would be required to create upland parking area on the south side of West Broadway Street;
- Potential traffic conflict with vehicle and boat trailers and other vehicles using West Broadway Street; and 8th Avenue; and,
- Existing landscaped area, Japanese garden, and gazebo would have to be removed or relocated to provide access for boat launch ramp.

3.5 The Existing Nakusp Boat Launch Ramp Site

The existing Nakusp boat launch ramp is a single lane, timber trestle structure located at the southern end of Nelson Avenue as shown in Figure 3.3. It is approximately 72 m long, 8.5 m wide with a 10% slope and is supported on creosote treated timber piles, pile caps and stringer beams with deck planks and timber guard rails along the edges of the ramp as shown on Photograph No. 22 in Appendix B. The ramp area is enclosed by L-shaped walkway floats which form the mooring area for the marina, situated immediately west of the

boat launch ramp as shown in Photograph No. 24 in Appendix B. There are two floats outside of the existing walkway floats that act as floating breakwaters and also form a protective barrier from wind and wave for the marina and the boat launch ramp.

At the time of the site visit, the repairs to the boat launch ramp were almost complete with replacement of guard rails and decking with new untreated timber. A new walkway float was also installed recently to replace the old rotted walkway float.

The upland parking area has approximately thirty-eight designated spaces for cars and trailers. This parking area is also shared with users of the adjacent Nakusp marina.

This site has the following advantages and disadvantages:

Advantages:

- Conveniently located in the Village of Nakusp;
- Provides year-round access to low water levels, as the end of ramp elevation is at El. 420.0 m;
- Protected from wind generated waves by the floating breakwater/walkway floats surrounding the end of the ramp;
- Available upland asphalted turnaround and parking area; and,
- Untreated timber deck planks and guardrails were recently replaced (early 2008) thereby making the ramp serviceable possibly for another 10-15 years with routine maintenance.

Disadvantages:

- 40 year old timber structure supported on creosote treated timber piles and structural timber deck members;
- Single lane boat launch ramp which is limited to one boat launch at a time;
- Potentially long delays at the boat launch ramp when the ramp is used by inexperienced drivers due to long ramp without a turnaround; and,
- Upland parking area is limited to a maximum of 38 vehicles with limited expansion potential (unless private property to the east becomes available).

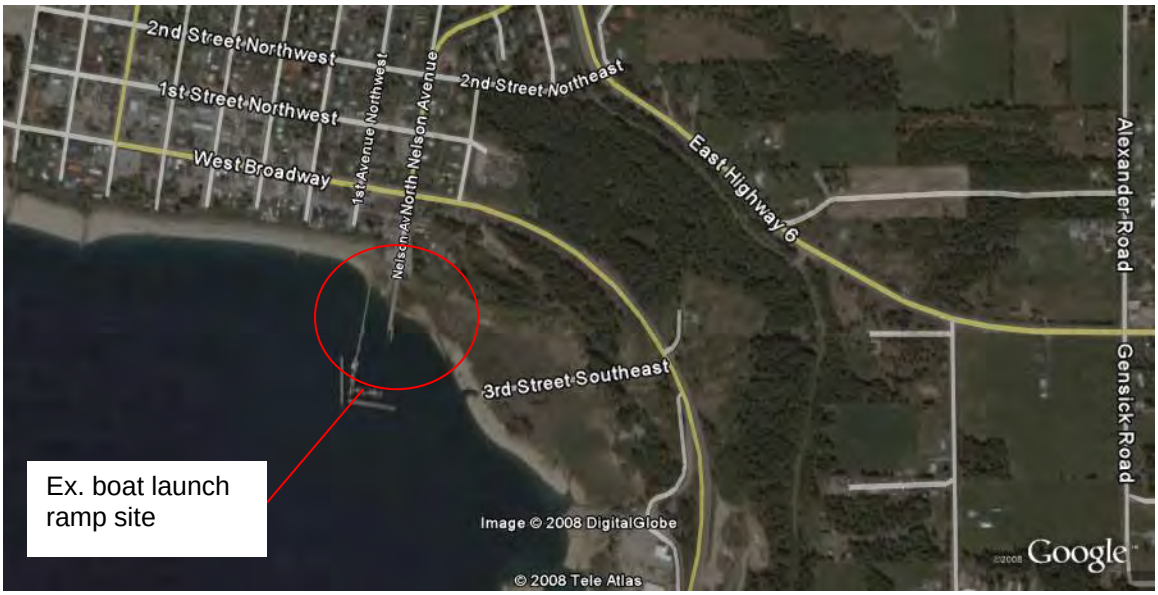

Figure 3.3 – Aerial View of existing Nakusp Boat Launch Ramp

Source: Google Earth

3.6 The South Nakusp Site

The South Nakusp site that was initially suggested by the Village of Nakusp as a possible boat launch ramp site is located between the area bounded by the existing boat launch ramp site and the light industrial area at Rothwell Point, see Figure 3.4. This area is a low lying marsh with a wild life sanctuary island created by BC Hydro in the 1960's for environmental habitat compensation. The project team investigated this location, and it was not considered to be feasible because potential ramp construction would require large volumes of fill to build an access road (due to the flat low lying terrain), upland parking area and ramp slope in order to access the deep water located approximately 300 m offshore. It is likely that the magnitude of the boat launch ramp construction would adversely impact the environment of the area.

The project team also observed that the adjacent light industrial site at Rothwell Point and the upland area could be a potential site for a boat launch ramp. This site is located south of the marsh area and is currently occupied by several light industrial businesses. We understand that the property is privately owned by the Waterfield family.

The potential boat launch area is also bounded by a creek to the north and earth berm to the south as shown on Figure 3.4.

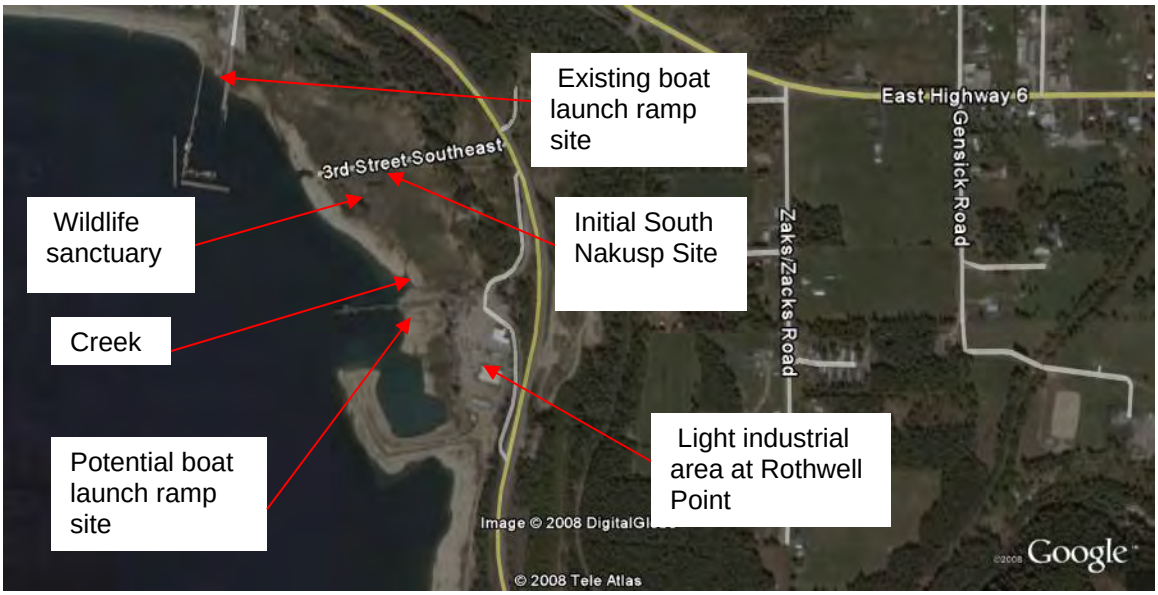

Figure 3.4 – Aerial View of Potential South Nakusp Boat Launch Ramp Site

Source: Google Earth

In the waterfront area of the site, a 205 m long derelict timber floating wharf runs east to west as shown in Figure 3.4. The floats are supported on timber piles.

To the south of the floats, a pair of rails leads down to the shoreline into the water, and are remnants of an old log dump operation as shown in Photograph 33 in Appendix B.

There is adequate upland area available for parking vehicles and trailers. This parking area is also currently used by businesses in the industrial park.

This site has the following advantages and disadvantages:

Advantages:

- Located just south of the village of Nakusp;
- The site has access to deep water depth for year round boat launches;
- The potential boat launch ramp location is sheltered from wind and wave attack from the south by the existing rubble mound breakwater; and,
- The location has an asphalted parking area with adequate space for vehicle and trailer parking.

Disadvantages:

- The upland area is private property ;
- Current commercial use will conflict with recreational use; and,
- The potential boat ramp location is exposed to wind and wave from the west.

4.0 Feasibility Design of Boat Launch Ramp at the study locations

4.1 Design Basis

This feasibility study is based on the following parameters and assumptions:

Design Elevations

The design water levels in the Arrow Lakes and ramp elevations are as follows:

- Maximum Water level (Design High Water Level) – El. 440.7 m
- Minimum Water Level (Design Low Water Level) - El. 421.1 m
- Elevation of the top of the ramp – El. 443.0 m
- Elevation of the toe of the ramp - El. 419.9 m

Water Areas

The general requirements for water areas are as follows:

- Minimum water depth: 1.2 m at design low water.
- Minimum bottom width: not less than the combined width of the launching ramp, boarding floats and rip rap shoulders or other shore protection immediately adjacent to the launching ramp.
- Minimum length 15.24 m (50 ft) beyond toe of ramp at design low water. Area in front of the ramp will be clear of navigational obstructions.

Launching Ramps

The general requirements for the launching ramps are as follows:

- 4.6 m lane widths for launching ramps of two (2) or more lanes.
- 4.9 to 6.1 m for single lane launching ramp
- The number of launching lanes will be dictated by the demand and the characteristics of the site. One launching lane will handle up to 50 launchings and 50 retrievals per day at a well designed and operated facility.
- On launching ramps over 61 m long and less than 16.3 m wide or 4 launching lanes, a 16.3 m minimum diameter turn-around should be provided every 61 m to minimize car-trailer backing distances.
- The head of the ramp should be constructed to an elevation not less than 0.6 m above design high water.
- The toe of the ramp should not be constructed less than 0.9m below design low water level.

- Slope of ramp – 10% - minimum, 15% - maximum.
- 4.6m to 6.1 m vertical curve must be constructed at the head of the ramp, thus providing a smooth transition between the launching ramp and the launching apron.

Boarding floats

The general requirements are:

- Minimum overall width shall not be less than 1.8 m. Floats that are less than 1.8m wide tend to be unstable and could roll over in the water.

Vehicle and Trailer Traffic

- The pavement thickness for the parking areas will be designed to support car and light truck loads using the latest version of the AASHTO "Guide for the Design of Pavement Structures".

4.2 Conceptual Design of Boat Launch Ramps

The layout and general features for the conceptual design of the boat launch ramps will be based on the design basis in Section 4.1 and comments from the notes of the public consultation meeting with the Village of Nakusp on October 10, 2007. A summary of the main issues for the ramp feasibility design identified at the public consultation meeting include but are not limited to:

- Provision of a concrete surface ramp;
- Provision of more parking areas;
- Provision of bigger and better turnarounds;
- Provision of turnaround at low and/or mid water level;
- Ramp wide enough to accommodate three vehicles;
- Easy access back to parking areas;
- Walkway on both sides of ramp; and,
- Provision of breakwater for protection from wind/waves.

Conceptual layout for boat launch ramps will be presented for the following potential locations:

- North Nakusp site;
- Public Beach site;
- Existing Nakusp Boat Launch Ramp Site (Three options); and,
- South Nakusp.

4.3 North Nakusp Site

The main features for the conceptual design for the boat launch ramp are shown on Drawing Nos. 6537 - 200 and 6537-201 in Appendix A.

As shown on the drawings, the main features of the facility shown on the plan layout are described as follows:

- A double lane ramp is approximately 200 m long and 9.2 m wide with a turnaround area located midway along the length of the ramp. A future third lane, 4.6 m wide is also shown. The ramp surface will be made of concrete for resisting the damaging effects of wave action and for ease of maintenance. The slab surface will also have a grooved pattern for improved traction on the ramp. The slope of the ramp is 10.5% including the turnaround which is less than the recommended minimum of 12%. However, the ramp is still functional and minimizes the excavation effort and cost to achieve the recommended gradient;
- A floating walkway to allow people access to their boats when launching and retrieving;
- A parking area approximately 60 m x 40 m to accommodate 24 -30 vehicles and trailers and future expansion of the parking area to double the parking capacity; and,
- Two rubble mound breakwaters on either side of the boat launch ramp to shelter the launch ramp area from wind and wave attack.

4.4 Public Beach Site

The main features of the conceptual design of the boat launch ramp are shown on Drawing Nos. 6537 - 300 and 6537-301 in Appendix A.

As shown on the drawings, the main features of the facility are described as follows:

- A double lane ramp is approximately 200 m long and 9.2 m wide with a turnaround area located midway along the length of the ramp. A future third lane, 4.6 m wide is also shown. The ramp surface will be made of concrete for resisting the damaging effects of wave action and for ease of maintenance. The slab surface will also have a grooved pattern for improved traction on the ramp. The slope of the ramp is 15% to match the existing ground levels;
- A floating walkway to allow people access to their boats when launching and retrieving;
- A parking area approximately 60 m x 40 m to accommodate 24 -30 vehicles and trailers and future expansion of the parking area to double the parking capacity. The fill for the parking area will be retained by vertical retaining walls to minimise the encroachment of the beach area; and,
- A floating breakwater to the south to shelter the launch ramp area from wind and wave attack.

4.5 Existing Nakusp Boat Launch Ramp

The options for long term public access to the Arrow Lakes Reservoir near Nakusp are as follows:

Option 1 –Existing timber trestle with turnaround area;

Option 2 –Gradual upgrade of the existing timber structure with a steel structure;

Option 3 – Full replacement with all weather surface; and,

Option 4 – Full replacement with a rock fill ramp and a concrete slab-on grade ramp.

These options are described in detailed below:

4.5.1 Option 1 – Existing timber trestle with turnaround area.

This concept considers the retention of the existing timber trestle assuming that the ramp will be kept functional with routine maintenance and replacement of structural members. In order to relieve some of the congestion currently experienced by users of the ramp, Option 1 considers providing a proposed turnaround to reduce the distance and effort required to reverse a vehicle and boat trailer when launching a boat.

The main features for the conceptual design for Option 1 are shown on Drawing Nos. 6537 - 400 and 6537-401 in Appendix A.

As shown on Drawing No. 6537-400, the main feature of this option is to provide a steel pile supported concrete deck turnaround approximately 36 m long and 20 m wide.

4.5.2 Option 2 – Steel Pile Supported Deck.

The main features of the conceptual design for Option 2 are shown on Drawing Nos. 6537 - 402 and 6537-403 in Appendix A. This concept involves a two-phase construction methodology. Phase 1 includes the construction of a steel pile supported precast concrete deck single lane launch ramp immediately adjacent to the existing timber trestle ramp and the relocation of the existing walkway float. On completion of Phase 1 it would allow boat launches from the new single lane ramp and Phase 2 would commence with the demolition of the existing timber trestle. The other components of Phase 2 would include the construction of the other side of the side of the ramp to provide a ramp with an overall width of 34 m.

As shown on the drawings, the main features of the facility are described as follows:

- A three lane ramp with access lane and parking area with total dimensions of approximately 180 m long and 34 m wide. Supported on steel piles, the superstructure would be made of precast concrete beam with a decking slab for speed of assembly and installation. The slab surface would also have a grooved pattern for improved traction on the ramp. The slope of the ramp would be 13% slightly steeper than the original timber trestle to provide a shorter ramp length and to create a larger area for the marina in front of the ramp; and
- A floating walkway to allow people access to their boats when launching and retrieving.

Expansion of the existing parking area is dependent on whether privately owned properties along Nelson Avenue will become available for use. However, increased parking space is possible with the relocation of the existing washroom building and the reconfiguration of the traffic pattern at the end of Nelson Avenue.

4.5.3 Options 3 & 4 – Rockfill ramp with all weather surface or concrete slab surface

The main features of the conceptual design for Options 3 and 4 are shown on Drawing Nos. 6537 - 404 and 6537-405 in Appendix A. The general concept for these options involves the demolition of the existing timber trestle ramp, and the construction of a rock filled ramp with either an all weather gravel surface (Option 3) or a concrete slab (Option 4). In these scenarios, there will be 3-4 month construction period during which the ramp will not be available for use. In these instances, the community will have to use the alternate boat launch ramp sites in the area.

As shown on the drawings, the main features of the facility are described as follows:

- A three lane ramp with access lane and parking area approximately 180 m long and 34 m wide. The core of the ramp will be constructed with general fill graded and sloped to 13% and the sides of ramp will be protected from erosion due to waves with armour rock. For Option 3 the ramp will have an all weather gravel surface, and for Option 4 the ramp surface will be a concrete slab with a grooved pattern for improved traction. The steeper slope of the ramp (13% versus 10% for the original timber ramp) provides a shorter ramp length and creates a larger area for the marina in front of the ramp; and,
- A floating walkway to allow people access to their boats when launching and retrieving.

Expansion of the existing parking area is dependent on whether privately owned properties along Nelson Avenue will be available for use. However, some minor improvements to enlargen the parking area are: the relocation of the existing washroom building and reconfiguration of the traffic pattern at the end of Nelson Avenue. A comparison of the existing boat launch ramp versus a photo-simulation of Option 4 is shown in Figures 4.1 and 4.2.

Figure 4.1 – Existing Timber Trestle Boat Launch Ramp

Figure 4.2 – Photo-simulation of Option 4 – Rock-filled Boat Launch Ramp

4.6 South Nakusp Site

The main features of the conceptual design of the boat launch ramp are shown on Drawing Nos. 6537 - 500 and 6537-501 in Appendix A.

As shown on the drawings, the main features of the facility are described as follows:

- A double lane ramp approximately 200 m long and 9.2 m wide with a turnaround area located midway along the length of the ramp. A future third lane, 4.6 m wide is also shown. The ramp surface will be made of concrete for resisting the damaging effects of wave action and for ease of maintenance. The slab surface will also have a grooved pattern for improved ramp traction. The slope of the ramp is 11.5% to match the existing ground levels;
- A floating walkway to allow people access to their boats when launching and retrieving;
- A parking area expansion approximately 65 m x 20 m to accommodate 24 -30 vehicles and trailers. The fill for the parking area will be retained by vertical retaining walls to minimise the footprint of the fill area; and,
- A floating breakwater to the south to shelter the launch ramp area from wind and wave attack.

5.0 Environmental Assessment Overview

5.1 General

M&N Team member Triton Environmental conducted a screening level environmental assessment of the sites. A summary of the assessment is provided below.

For the full Environmental Assessment report, please refer to Appendix C.

5.2 The North Nakusp Site

The Nakusp North site is not recommended based on the available fish habitat provided by the lakebed substrates in that area and the significant footprint that would occur as a result of the rock filled ramp.

5.3 The Public Beach Site

The Public Beach site is a potential option as it does not require a breakwater, the upland area is already disturbed and the lakebed substrates are predominantly fine silty sand which provide marginal fish habitat.

5.4 The Existing Nakusp Boat Launch Ramp Site

Given the environmental conditions at each of the four locations, it is recommended that Option 2 be selected at the existing Nakusp boat launch site. This site has an existing disturbance footprint and the conceptual design of Option 2 will possibly reduce the direct impact on the lakebed. However, given the high cost associated with Option 2, the Village of Nakusp is more likely to select Option 3 or 4 (rock filled berm)

5.5 The South Nakusp Site

The South Nakusp site contains viable fish habitat and significant wildlife habitat potential which is limited within the village boundaries. However, the conceptual boat ramp location proposed on private land does not have any potential environmental sensitivity.

All options were brought forth at the public meeting; however, based on the results of the discussion held after the feasibility study presentation to members of the Village Council, and feedback from the public consultation meeting, the existing Nakusp boat launch ramp Option 4 was preferred.

6.0 Archaeological Assessment Overview

6.1 General

M&N Team member, Golder Associates Ltd. (Golder), conducted an archaeological overview assessment (AOA) for one existing and three proposed boat launch ramp locations at Nakusp on the east side of Arrow Lakes Reservoir. The AOA consisted of a combination of background research and preliminary field reconnaissance (PFR).

No previously documented archaeological sites were identified to be in direct conflict with the proposed ramp locations during the background research

In general, no archaeological material or features were observed on, or adjacent to, any of the existing or proposed boat launch ramp locations during the PFR.

A summary of the reconnaissance findings follows.

6.2 The North Nakusp Site

The area immediately to the south of the existing launch at the North Nakusp site has been subject to excavation activities that removed several meters of native sediment. These excavation activities created a deeper launch location, and the sediment was used to create the breakwater. As such, all native sediments that could contain archaeological materials in this area have been removed down to sterile glacial till.

The proposed North Nakusp site area immediately to the north of the existing launch and breakwater lacks evidence of native sediments with the potential to contain archaeological materials. Erosional processes associated with the inundation of the reservoir have removed native sediments down to glacial till, which is considered culturally sterile.

No known archaeological sites are recorded within 400 m of the proposed North Nakusp Site. No artifacts or traces of archaeological remains, or intact sediments that would contain archaeological deposits were identified during reconnaissance. The archaeological potential of the proposed North Nakusp Site is considered to be low.

It is recommended that no further archaeological work be conducted for the proposed North Nakusp site.

6.3 The Public Beach Site

The Nakusp Public Beach area is comprised of imported sand, and the public walkway shows heavily landscaped lawn and gardens. This general area has been heavily disturbed by industrial works associated with a poleyard, oil tank stations and the CPR Railway, as well as municipal infrastructure grading and stripping activities.

No known archaeological sites are recorded within 300 m of the proposed Nakusp Public Beach Site. No artifacts, archaeological features, or intact sediments that would contain archaeological deposits were identified during reconnaissance and the likelihood of identifying archaeological sites at this location is considered low. It is recommended that no further archaeological work be conducted for the proposed Nakusp Public Beach site.

6.4 The Existing Nakusp Boat Launch Ramp

The Existing Nakusp Boat Launch Ramp site has been subject to grading and stripping to create a public boat launch, parking lot and storm drain. The area to the west has been built up with large cobbles and is currently utilized as a storm drain. The area east of the launch is poorly drained and featureless. In addition, the area has been subject to similar disturbances as the Public Beach site, such as industrial development and stripping and grading activities.

All native sediments that could contain archaeological materials in this area have been removed down to sterile glacial till. No artefacts or traces of archaeological remains, or intact sediments that could contain archaeological deposits were identified during reconnaissance, and the likelihood of identifying an archaeological site is considered low within the reconnoitred area.

It is recommended that no further archaeological work be conducted for the proposed Existing Nakusp Boat Launch Ramp site in the reconnoitred area.

Archaeological site EbQk-5, the Skoda shipwreck, has been documented southeast of the marina breakwater by approximately 150 m. The remains of the wreck were not observed during the field reconnaissance. If upgrading is approved for the Existing Nakusp Boat Launch Ramp Site, the location of EbQk-5 would need to be confirmed to determine if a conflict exists with development activities. If unavoidable conflict exists, additional archaeological work would be warranted under a Section 12 Heritage Conservation Act Site Alteration Permit.

6.5 The South Nakusp Site

Surface reconnaissance of the South Nakusp site did not result in the identification of archaeological materials.

The portion of the South Nakusp site located to the south of the private wharf is considered to have a low likelihood of containing archaeological sites due to the removal of several metres of sediment to construct a breakwater. All native sediments that could contain archaeological materials in this area have been removed to sterile glacial till. Provided that the proposed construction footprint is not changed, no native sediments with the potential to contain archaeological materials will be impacted in the area to the south of the private wharf.

The portion of the South Nakusp site located to the north of the private wharf, directly adjacent to an un-named creek, is considered to have a high likelihood of containing archaeological materials. This is due to the presence of native, intact sediments in close proximity to both Arrow Lake and the un-named creek. Should this portion of the South Nakusp Site area be chosen for development, an Archaeological Impact Assessment under a Section 14 Heritage Conservation Act Inspection Permit would be warranted.

Archaeological site EbQk-5, the Skoda shipwreck, is located offshore and within approximately 150 m northwest of the South Nakusp Site. The remains of the shipwreck were not identified during the PFR, but they are reported to lie between the marina and the commercial wharf associated with the South Nakusp site. If the South Nakusp Site is approved, the location of EbQk-5 would need to be confirmed to determine if a conflict exists with development activities. If unavoidable conflict exists, additional archaeological work would be warranted under a Section 12 Heritage Conservation Act Site Alteration Permit.

6.6 Recommendations

In the event development activities proceed at either the Existing Nakusp Boat Launch Ramp site or the South Nakusp site, the Skoda shipwreck EbQk-5 should be relocated. This can likely be accomplished during a PFR at low water or utilizing an underwater archaeologist. If a conflict exists with EbQk-5, it is recommended that the wreck be avoided. In the event that site avoidance is not feasible, a Section 12 Site Alteration Permit from the Archaeology Branch would be required, at minimum.

The portion of the South Nakusp Site located to the north of the private wharf, directly adjacent to the un-named creek, is considered to have high archaeological potential. Should this option be chosen, an Archaeological Impact Assessment under a Section 14 Inspection Permit from the Archaeology Branch is warranted in this area prior to any development activities.

7.0 Cost Benefit Analysis

While assessing the capital and maintenance costs of the proposed ramp improvements is relatively straight forward, assessing the benefits in this case is much more difficult, at least in quantitative terms. BCH or the Village of Nakusp does not currently charge a fee for using the boat ramps, so there are no actual revenues associated with these facilities. Apart from meeting BCH's goals and commitments under the Columbia River Water Use Planning Process, there does not appear to be any direct financial benefit to offset against the capital costs. There are also no usage statistics to indicate how many boaters take advantage of the Arrow Lakes Reservoir amenities, nor the seasonal distribution of that use. It is therefore impossible to quantify the non-financial societal benefits based on industry averages or other "rules of thumb".

To develop quantitative cost/benefit ratios or internal rates of return, it would first be necessary to conduct a number of socio-economic studies which are outside the scope of this assignment, such as collecting seasonal usage statistics, conducting market surveys, estimating population growth projections and demographic shifts over time, and so forth.

On a qualitative basis, some of the societal benefits which may accrue from the ramp improvements include:

- Improved access for area residents to recreational activities (e.g. fishing, boating);
- Short-term economic spin-off in the region from the construction program (employment wages, taxes, materials purchases, meals and accommodations during construction): and,
- Long-term economic spin-off from increased usage, tourism, and local resident day-trips to the area.

Since it is not possible to establish a "dollar value equivalent" for these societal benefits, it is necessary to make a value judgement on the viability of each project on its own merits.

The boat launch ramp concepts reviewed by the WUP CC were less sophisticated; for example, gravel surfacing for the ramps, no floating walkways, and no turnarounds. These concepts are in line with the community needs and expectations. It is quite likely that costs were based on the work being done during early spring when there is construction equipment is available at reduced rates.

The estimated costs of making the improvements noted on the drawings are summarized in the tables below. Cost estimates are considered upper bound, order-of-magnitude estimates based on providing the maximum possible benefit. In each case, the proposed improvements could be scaled back to provide less benefit at a correspondingly reduced cost.

7.1 The North Nakusp Site

Table 7.1 provides the estimated construction cost for a new 9.2 m wide boat launch ramp with a turnaround, parking area and rubble mound breakwaters at the North Nakusp site.

Table 7.2 shows the estimated annual maintenance cost for the boat launch ramp. The removal of sand debris on the ramp is based on an assumed 150 mm thick build-up on the ramp. The other items in Table 7.2 are provisional sums.

Table 7.1: North Nakusp Site – Estimated Construction Cost

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Excavation incl. grading for ramp and turnaround bases	m^3	550	$ 33	$ 18,150
2	Fill for ramp and parking areas	m^3	150	$ 33	$ 4,950
3	Concrete slab for ramp and turnaround	m^3	280	$ 292	$ 81,670
4	Scour Protection for edges of ramp and turn-around	m^3	300	$ 30	$ 9,000
5	Asphalt pavement for parking areas	m^3	2400	$ 47	$ 112,800
6	Rubble mound breakwater – core fill	m^3	8700	$ 33	$ 287,100
7	Rubble mound breakwater – armour protection	m^3	2900	$ 78	$ 226,200
8	Walkway Floats	m^2	200	$ 409	$ 81,800
9	Steel pile supports for floats	m	900	$ 509	$ 458,100
				Sub-Total	$ 1,279,860
				Mobilization / Demobilization (5% of Total)	$ 64,000
				Contingencies (25 %)	$ 319,965
				Total	**$ 1,663,825**

Table 7.2: North Nakusp – Estimated Annual Maintenance Cost

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Remove sand build-up on ramp	m^3	280	$ 19	$ 5,600
2	Repair floats	Sum	-	-	$ 3,200
3	Repair scour protection	Sum	-	-	$ 3,200
4	Repair breakwater	Sum	-	-	$ 3,200
5	Repair car park pavement	Sum	-	-	$ 3,200
				Total	**$ 18,400**

7.2 Nakusp Public Beach Site

Table 7.3 provides the estimated construction cost for a new 9.2m wide boat launch ramp with a turnaround, parking area and floating breakwater at the Nakusp Public Beach site.

Table 7.4 provides the estimated annual maintenance cost for removing silt build-up at the end of the ramp and allowances for repairs to the appurtenances of the ramp.

Table 7.3: Nakusp Public Beach Site - Estimated Construction Cost

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Fill incl. grading for ramp and parking bases	m^3	26,650	$ 33	$ 879,450
2	Concrete slab for ramp and turnaround	m^3	350	$ 292	$ 102,200
3	Scour protection for edges of ramp and turn-around	m^3	300	$ 30	$ 9,000
4	Asphalt pavement for parking areas	m^3	2,400	$ 47	$ 112,800
5	Retaining wall for parking area	m^2	2,100	$ 390	$ 819,000
6	Floating breakwater	m	90	$ 500	$ 45,000
7	Walkway Floats	m^2	360	$ 409	$147,240
8	Steel pile supports for floats	m	900	$ 509	$ 458,100
				Sub-Total	$ 2,572,790
				Mobilization / Demobilization (5% of Total)	$ 128,640
				Contingencies (25 %)	$ 643,198
				Total	**$ 3,344,627**

Table 7.5: Public Beach Site – Estimated Annual Maintenance Cost

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Remove sand build-up on ramp	m^3	280	$ 19	$ 5,600
2	Repair floats	Sum	-	-	$ 3,200
3	Repair scour protection	Sum	-	-	$ 3,200
4	Repair breakwater	Sum	-	-	$ 3,200
5	Repair car park pavement	Sum	-	-	$ 3,200
				Total	**$ 18,400**

7.3 Existing Nakusp Boat Launch Ramp – Option 1

Table 7.6 below, provides the estimated cost for the addition of a turnaround to the existing timber trestle ramp. Table 7.7 provides the estimated annual maintenance cost for removing silt build-up the end of the ramp and allowances for repairs to the appurtenances of the ramp.

Table 7.6: Existing Nakusp Boat Launch Ramp – Option 1

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Turnaround – Steel pile supported reinforced concrete slab including concrete, reinforcement and formwork	m^2	500	$ 1200	$ 600,000
2	Install new fender piles & relocate mooring float	Sum			$ 50,000
				Sub-Total	$ 650,000
				Mobilization / Demobilization (5% of Total)	$ 32,500
				Contingencies (25 %)	$ 162,500
				Total	**$ 845,000**

Table 7.7: Existing Nakusp Boat Launch Ramp – Option 1 - Annual Maintenance

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Remove sand built-up on ramp	m^3	260	$ 18	$ 4,680
2	Repairs to floats	Sum	-	-	$ 3,000
3	Repairs to chain anchorages	Sum	-	-	$ 3,000
				Total	**$ 10,680**

7.4 Existing Nakusp Boat Launch Ramp – Option 2

Table 7.8 below, provides the estimated cost for the replacement of the existing timber trestle ramp with a new 34 metre wide steel pile supported precast concrete deck boat launch ramp. Table 7.9 provides the estimated annual maintenance costs for removing silt build-up at the end of the ramp and allowances for repairs to the appurtenances of the ramp.

Table 7.8: Existing Nakusp Boat Launch Ramp – Option 2

Item no.	Item Description	Unit	Quantity	Rate	Total
1	Demolish existing timber trestle ramp	m^2	1824	$ 180	$ 328,320
2	Steel pile supported precast concrete deck	m^2	5950	$ 1200	$ 7,140,000
				Sub-Total	$ 7,468,320
				Mobilization / Demobilization (5% of Total)	$ 373,416
				Contingencies (25 %)	$ 1,867,080
				Total	**$ 9,708,816**

Table 7.9: Existing Boat Launch Ramp – Option 2 – Estimated Annual Maintenance

Item No.	Item Description	Unit	Quantity	Rate	Total

1	Remove sand built-up on ramp	m^3	893	$ 18	$ 16,074
2	Repair floats	Sum	-	-	$ 3,000
3	Repair scour protection	Sum	-	-	$ 3,000
				Total	**$ 22,074**

7.5 Existing Nakusp Boat Launch Ramp – Option 3

Table 7.10 below, provides the estimated cost for demolition of the existing timber trestle ramp, and the construction of a rock filled ramp with an all weather gravel surface,. Table 7.11 provides the estimated annual maintenance costs for removing silt build-up the end of the ramp and allowances for repairs to the appurtenances of the ramp.

Table 7.10: Existing Nakusp Boat Launch Ramp – Option 3

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Demolish existing timber trestle ramp	m^2	1824	$ 180	$ 328,320
2	Fill for ramp base	m^3	11,332	$ 33	$ 373,956
3	Armour rock protection for side slopes	m^3	875	$ 30	$ 26,250
				Sub-Total	$ 728,526
				Mobilization / Demobilization (5% of Total)	$ 36,426
				Contingencies (25 %)	$ 182,132
				Total	**$ 947,084**

Table 7.11: Existing Nakusp Boat Launch Ramp – Option 3 – Estimated Annual Maintenance

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Remove sand built-up on ramp	m^3	893	$ 18	$ 16,074
2	Repair floats	Sum	-	-	$ 3,000
3	Repair scour protection	Sum	-	-	$ 4,000
				Total	**$ 23,074**

7.6 Existing Nakusp Boat Launch Ramp – Option 4

Table 7.12 below, provides the estimated cost for demolition of the existing timber trestle ramp, and the construction of a rock filled ramp with a concrete slab surface .. Table 7.13 provides the estimated annual maintenance costs for removing silt build-up the end of the ramp and allowances for repairs to the appurtenances of the ramp.

Table 7.12: Existing Nakusp Boat Launch Ramp – Option 4

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Demolish existing timber trestle ramp	m^2	1824	$ 180	$ 328,320
2	Fill for ramp base	m^3	11,332	$ 33	$ 373,956
3	Armour rock protection for side slopes	m^2	875	$ 30	$ 26,250
4	Concrete slab	m	892	$ 292	$ 260,464
				Sub-Total	$ 988,990
				Mobilization / Demobilization (5% of Total)	$ 49,450
				Contingencies (25 %)	$ 247,248
				Total	**$ 1,282,688**

Table 7.13: Existing Nakusp Boat Launch Ramp – Option 4 – Estimated Annual Maintenance

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Remove sand built-up on ramp	m^3	893	$ 18	$ 16,074
2	Repair floats	Sum	-	-	$ 3,000
3	Repair scour protection	Sum	-	-	$ 4,000
				Total	**$ 23,074**

7.7 South Nakusp Boat Launch Ramp

Table 7.14 below, provides the estimated cost for. Table 7.15 provides the estimated annual maintenance costs for removing silt build-up the end of the ramp and allowances for repairs to the appurtenances of the ramp.

Table 7.14: South Nakusp Boat Launch Ramp

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Fill incl. grading for ramp and parking bases	m^3	633	$ 33	$ 20,889
2	Concrete slab for ramp and turnaround	m^3	350	$ 292	$ 102,200
3	Scour Protection for edges of ramp and turn-around	m^3	263	$ 30	$ 7,890
4	Asphalt pavement for parking areas	m^3	1,088	$ 47	$ 51,136
6	Floating breakwater	m	90	$ 500	$ 45,000
7	Walkway Floats	m^2	360	$ 409	$147,240
8	Steel pile supports for floats	m	900	$ 509	$ 458,100
				Sub-Total	$ 832,455
				Mobilization / Demobilization (5% of Total)	$ 41,622

Contingencies (25 %)	$ 208,113
Total	**$ 1,082,190**

Table 7.15: South Nakusp Boat Launch Ramp – Estimated Annual Maintenance

Item No.	Item Description	Unit	Quantity	Rate	Total
1	Remove sand build-up on ramp	m^3	280	$ 19	$ 5,600
2	Repair floats	Sum	-	-	$ 3,200
3	Repair scour protection	Sum	-	-	$ 3,200
4	Repair breakwater	Sum	-	-	$ 3,200
5	Repair car park pavement	Sum	-	-	$ 3,200
				Total	**$ 18,400**

In reviewing the above cost estimates, it is important to note the following:

- The estimates are concept level only and are not intended to be used to establish a project budget. The estimates are intended to provide an indication of the probable costs to determine which boat launch ramp facility alternative(s) warrant further consideration.
- The estimates are based on Moffatt & Nichol's in-house experience and data for projects of a similar nature.
- The estimates are based upon mid-2006 to early 2007 price levels in Canadian dollars, and escalated by 6% for mid -2008 prices.
- The estimated costs for supplying the walkway floats are based on a quotation from Blue Water Systems Limited for a steel float and frame chassis with timber decking.
- The estimates exclude any archaeological investigation assessment, additional habitat compensation programmes, removal and remediation of contaminated materials and other hazardous waste.
- A contingency allowance of 10% was included in the cost estimates to cover unforeseen construction costs at the feasibility stage of this project.
- The estimates exclude the GST.

Table 7.16 below summaries the capital cost estimate and annual maintenance costs rounded to the nearest thousand for the various locations

Table 7.16: Summary of Estimates for Capital and Annual Maintenance Costs

Location	Capital Costs	Annual Maintenance Cost
Nakusp North	**$ 1,664,000**	**$ 18,000**
Nakusp Public Beach	**$ 3,345,000**	**$ 18,000**
Existing Nakusp – Option 1	**$ 845,000**	**$ 11,000**
Existing Nakusp – Option 2	**$ 9,709,000**	**$ 23,000**
Existing Nakusp – Option 3	**$ 974,000**	**$23,000**
Existing Nakusp – Option 4	**$ 1, 283,000**	**$ 23,000**
South Nakusp	**$ 1,082,000**	**$ 18,000**

8.0 Conclusions and Recommendations

The project team presented the conceptual layouts for the four sites to the council members of the Village of Nakusp on June 11, 2008, and also at a public consultation meeting at the Seniors Hall in Nakusp on June 25, 2008.

At the June 25, 2008 public consultation meeting, the community had indicated a preference for Option 4 of the existing boat launch ramp site.

Our general conclusions and recommendations about the various sites are as follows:

8.1 North Nakusp Site

The North Nakusp site has adequate land space for a boat ramp facility as well as the water depths for year round boat access to the lake, and no archaeological impact. However, the site was not considered feasible because of its exposure to wind and wave, dust storms, and potential negative environmental impact to fish habitat.

8.2 Public Beach Site

The Public Beach site has deep water depths suitable for year round boat access to the lake, less potential negative environmental impact to fish habitat, and no archaeological impact. However, this location was not considered feasible as any potential development would entail the loss of beach area, increased traffic congestion, and conflicts with vehicle traffic with the pedestrian use of the beach and park facilities.

8.3 Existing Nakusp Boat Launch Ramp Site

Option 1 only satisfied the improved manoeuvrability on the ramp but would not address parking and replacement concerns of the aging timber trestle ramp.

While Option 2 is the most environmentally sensitive concept, it was the most costly option of the concepts presented and was not considered feasible from that reason.

Option 3 was considered feasible; however an all weather gravel surface would require more effort and cost to maintain than a concrete surface ramp.

Option 4 was considered the most favourable because it satisfied the requirements for a low maintenance structure, improved access to the lake, provided some additional parking at lower water levels and created more water area for the marina with the potential for expansion.

8.4 South Nakusp Site

The South Nakusp site was considered feasible, however, due to the uncertainties of the availability of the private property to be used for a boat ramp, this option was also discounted.

9.0 Closure

This report has been prepared for the sole benefit of BC Hydro and its agents, and may not be used by any third party without the expressed written consent of Moffatt & Nichol and BC Hydro. Any use of this document by a third party is at the sole risk of such third party. The statements and conclusions presented herein are valid as of the date of publication. Future changes in the conditions affecting the underlying assumptions of this report may alter its findings and the conclusions. Moffatt & Nichol does not undertake to revise and update this report should future events reflect changed conditions.

We trust that this report meets BC Hydro's requirements at this time. Should you have any questions, or if we can be of further assistance, please contact the undersigned at any time.

Prepared by:

MOFFATT & NICHOL

P.F. HOO
29380
2013-07-11
PROFESSIONAL ENGINEER

Paul Hoo, P.Eng.
Project Manager

Reviewed by:

MOFFATT & NICHOL

Ron Byres, P.Eng.
Senior Project Manager

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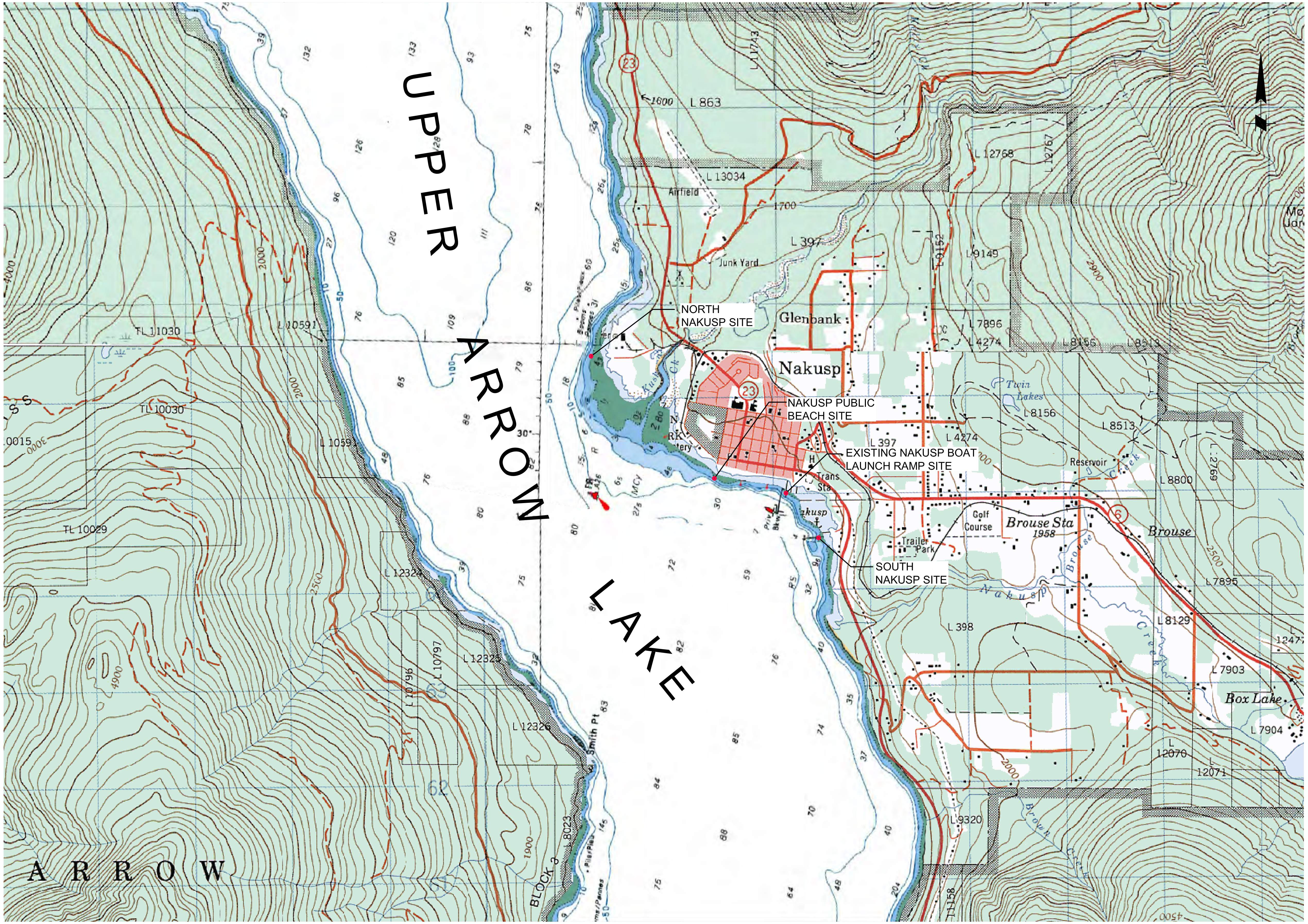
Appendix A:
Drawings



NOTES:

1. TOPOGRAPHIC PLAN EXTRACTED FROM DIGITAL MAPS PROVIDED BY THE SURVEYS AND MAPPING BRANCH DEPARTMENT OF ENERGY, MINES, AND RESOURCES. INFORMATION CURRENT AS OF 1977. PARTS OF MAPS 82K04 AND 82K05 EDITION 2 UTM ZONE 11 WERE USED FOR THIS DRAWING.
2. TOPOGRAPHIC CONTOURS ARE IN FEET ABOVE MEAN SEA LEVEL, NAD27.
3. HYDROGRAPHIC PLAN EXTRACTED FROM DIGITAL MAPS PROVIDED BY THE CANADIAN HYDROGRAPHIC SERVICE. PART OF CHART 3057 DATED JUNE 21, 1991 WAS USED TO PRODUCE THIS DRAWING.
4. DEPTHS ARE IN METRES AND ARE REDUCED TO A DATUM WHICH AT NAKUSP IS 434.0m ABOVE GEODETIC DATUM (GD).

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

400m 0m 400m 800m
SCALE: 1 : 20000

No.	Date	DESCRIPTION	Dr'n	Ch'd
C	AUG8/08	ISSUED FOR DRAFT REPORT	JL	PH
B	JUN18/08	ISSUED FOR CLIENT REVIEW	JL	PH
A	JUN5/08	ISSUED FOR REVIEW BY PROJECT TEAM	JL	PH

CLIENT: BChydro

IN ASSOCIATION WITH: Atek HYDROGRAPHIC SURVEYS LTD. 4740 Joyce Avenue Powell River, BC, V8A 3B6 ph: 604 485 0205 fax: 604 485 0200; TRITON ENVIRONMENTAL CONSULTANTS LTD.; Golder Associates

MOFFATT & NICHOL
777 WEST BROADWAY, SUITE 301
VANCOUVER, BC, CANADA, V5Z 4J7
604-707-9004

DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: APR10/08 — DRAWING NUMBER: 6537-100

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

LOCATION PLAN

SCALE: AS SHOWN

C

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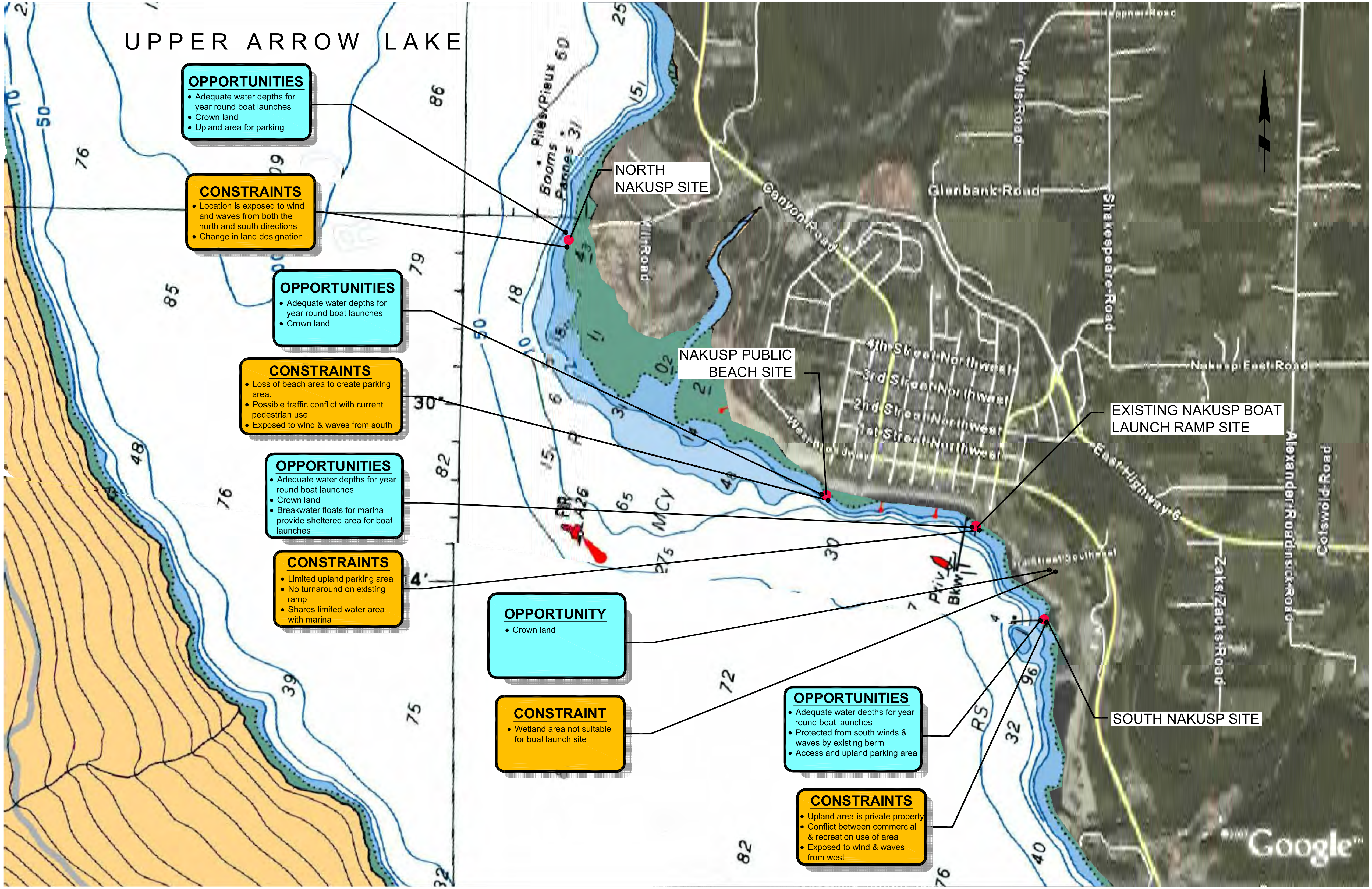

UPPER ARROW LAKE
OPPORTUNITIES
• Adequate water depths for year round boat launches
• Crown land
• Upland area for parking
CONSTRAINTS
• Location is exposed to wind and waves from both the north and south directions
• Change in land designation
OPPORTUNITIES
• Adequate water depths for year round boat launches
• Crown land
CONSTRAINTS
• Loss of beach area to create parking area.
• Possible traffic conflict with current pedestrian use
• Exposed to wind & waves from south
OPPORTUNITIES
• Adequate water depths for year round boat launches
• Crown land
• Breakwater floats for marina provide sheltered area for boat launches
CONSTRAINTS
• Limited upland parking area
• No turnaround on existing ramp
• Shares limited water area with marina
OPPORTUNITY
• Crown land
CONSTRAINT
• Wetland area not suitable for boat launch site
OPPORTUNITIES
• Adequate water depths for year round boat launches
• Protected from south winds & waves by existing berm
• Access and upland parking area
CONSTRAINTS
• Upland area is private property
• Conflict between commercial & recreation use of area
• Exposed to wind & waves from west
NORTH NAKUSP SITE
NAKUSP PUBLIC BEACH SITE
EXISTING NAKUSP BOAT LAUNCH RAMP SITE
SOUTH NAKUSP SITE
Canyon Road
Glenbank Road
Wells Road
Shakespeare Road
Nakusp East Road
4th Street Northwest
3rd Street Northwest
2nd Street Northwest
1st Street Northwest
East Highway 6
Alexander Road
Cotswold Road
Zaks/Zacks Road
Google

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

200m 0m 200m 400m
SCALE: 1 : 10000

No.	Date	DESCRIPTION	Dr'n	Ch'd
C	AUG8/08	ISSUED FOR DRAFT REPORT	JL	PH
B	JUN18/08	ISSUED FOR CLIENT REVIEW	JL	PH
A	JUNE5/08	ISSUED FOR REVIEW BY PROJECT TEAM	JL	PH

CLIENT: BC hydro

IN ASSOCIATION WITH: Atek Hydrographic Surveys Ltd. — TRITON Environmental Consultants Ltd. — Golder Associates

MOFFATT & NICHOL
777 WEST BROADWAY, SUITE 301
VANCOUVER, BC, CANADA, V5Z 4J7
604-707-9004

DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08
DRAWING NUMBER: 6537-101

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

OPPORTUNITIES AND CONSTRAINTS MAP

SCALE: AS SHOWN

C

DATE: 2008/08/08 - 2:34pm
PATH: P:\6537 Feasibility Study for Boat Launch Ramps at Nakusp\CADD\Submittal\\6537-101.dwg

PROPOSED RUBBLE MOUND BREAKWATER (EL.419–444m)

FUTURE BOAT LAUNCH RAMP LANE

PROPOSED TURNAROUND

PROPOSED PARKING AREA EXPANSION 60mx40m (EL.441–442m)

CONTROL LINE

9.2m

4.6m

2.0m

PROPOSED FLOATING WALKWAY

PROPOSED PARKING AREA 60mx40m (24 TO 30 VEHICLES AND TRAILERS) (EL.441–442m)

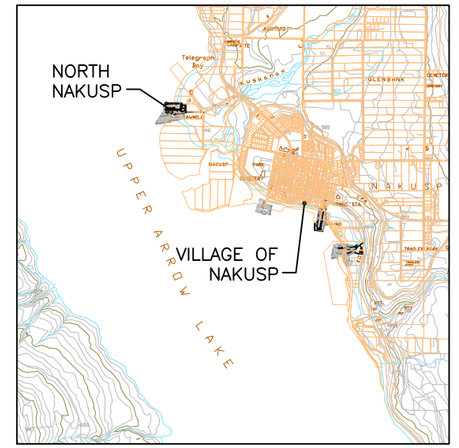
PROPOSED DOUBLE LANE BOAT LAUNCH RAMP

KUSKANAX ROAD

EXTEND EXISTING RUBBLE MOUND BREAKWATER

EXISTING RUBBLE MOUND BREAKWATER

EXISTING LAUNCH



KEY PLAN
NTS

NOTES:

1. CONTOURS ARE IN METERS TO GEODETIC DATUM AND ARE BASED ON A HYDROGRAPHIC AND TOPOGRAPHIC SURVEY CONDUCTED BY ATEK HYDROGRAPHIC SURVEYS LTD. ON MAY 3–10, 2008.

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

PLAN

10m 0m 10m 20m
SCALE: 1 : 500

No.	Date	DESCRIPTION	Dr'n	Ch'd
C	AUG8/08	ISSUED FOR DRAFT REPORT	JL	PH
B	JUN18/08	ISSUED FOR CLIENT REVIEW	JL	PH
A	JUNE5/08	ISSUED FOR REVIEW BY PROJECT TEAM	JL	PH

CLIENT: BC hydro

IN ASSOCIATION WITH:

Atek HYDROGRAPHIC SURVEYS LTD.
4740 Joyce Avenue
Powell River, BC, V8A 3B6
phe 604 485 0205 faxe 604 485 0200

TRITON ENVIRONMENTAL CONSULTANTS LTD.
Richmond 604-279-2063 Prince George 250-562-8155 Terrace 250-635-1464
WWW.TRITON-ENV.COM

Golder Associates

MOFFATT & NICHOL
777 WEST BROADWAY, SUITE 301
VANCOUVER, BC, CANADA, V5Z 4J7
604–707–9004

DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08
DRAWING NUMBER: 6537–200

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

NORTH NAKUSP
PROPOSED BOAT LAUNCH RAMP PLAN

SCALE: AS SHOWN

C

DATE: 2008/08/08 – 2:33pm
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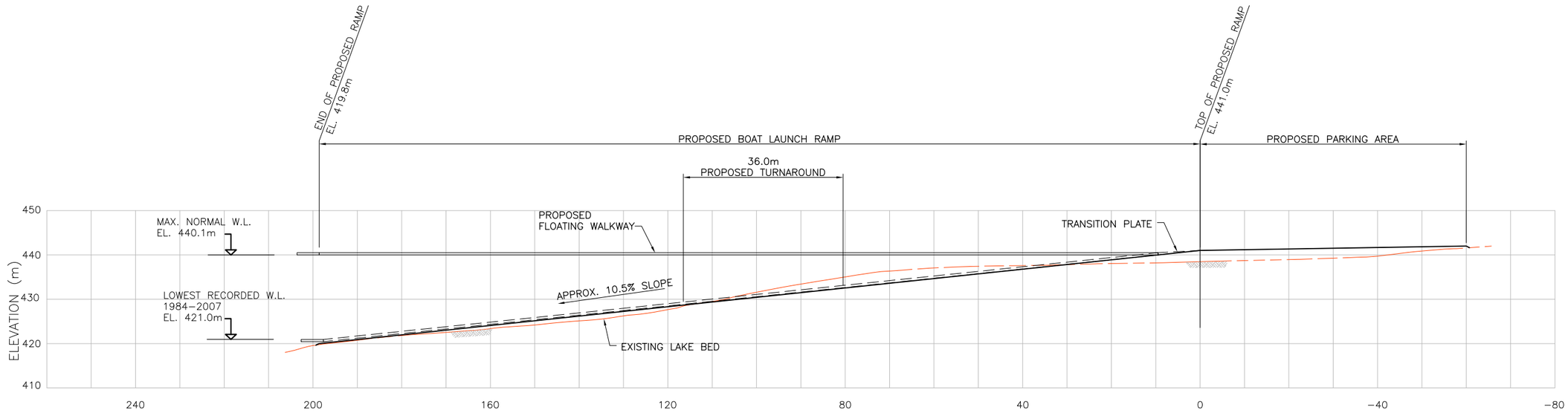

PROFILE ALONG CONTROL LINE

NOTE:

1. SEE REFERENCE DRAWING 6537–200
2. GUIDE PILE SUPPORTS FOR FLOATING WALKWAY NOT SHOWN FOR CLARITY

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

10m 0m 10m 20m
SCALE: 1 : 500

No.	Date	DESCRIPTION	Dr'n	Ch'd
C	AUG8/08	ISSUED FOR DRAFT REPORT	JL	PH
B	JUN18/08	ISSUED FOR CLIENT REVIEW	JL	PH
A	JUNE5/08	ISSUED FOR REVIEW BY PROJECT TEAM	JL	PH

CLIENT: BC hydro

IN ASSOCIATION WITH:
Atek HYDROGRAPHIC SURVEYS LTD. 4746 Joyce Avenue Powell River, BC, V8A 3B6 ph: 604 485 0205 fax: 604 485 0200
TRITON ENVIRONMENTAL CONSULTANTS LTD. Richmond 604-279-2063 Prince George 250-962-8155 Terrace 250-635-1464 WWW.TRITON-ENV.COM
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VANCOUVER, BC, CANADA, V5Z 4J7
604–707–9004

DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08
DRAWING NUMBER: 6537–201

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

NORTH NAKUSP
PROPOSED BOAT LAUNCH RAMP PROFILE

SCALE: AS SHOWN

C

DATE: 2008/08/08 – 2:32pm
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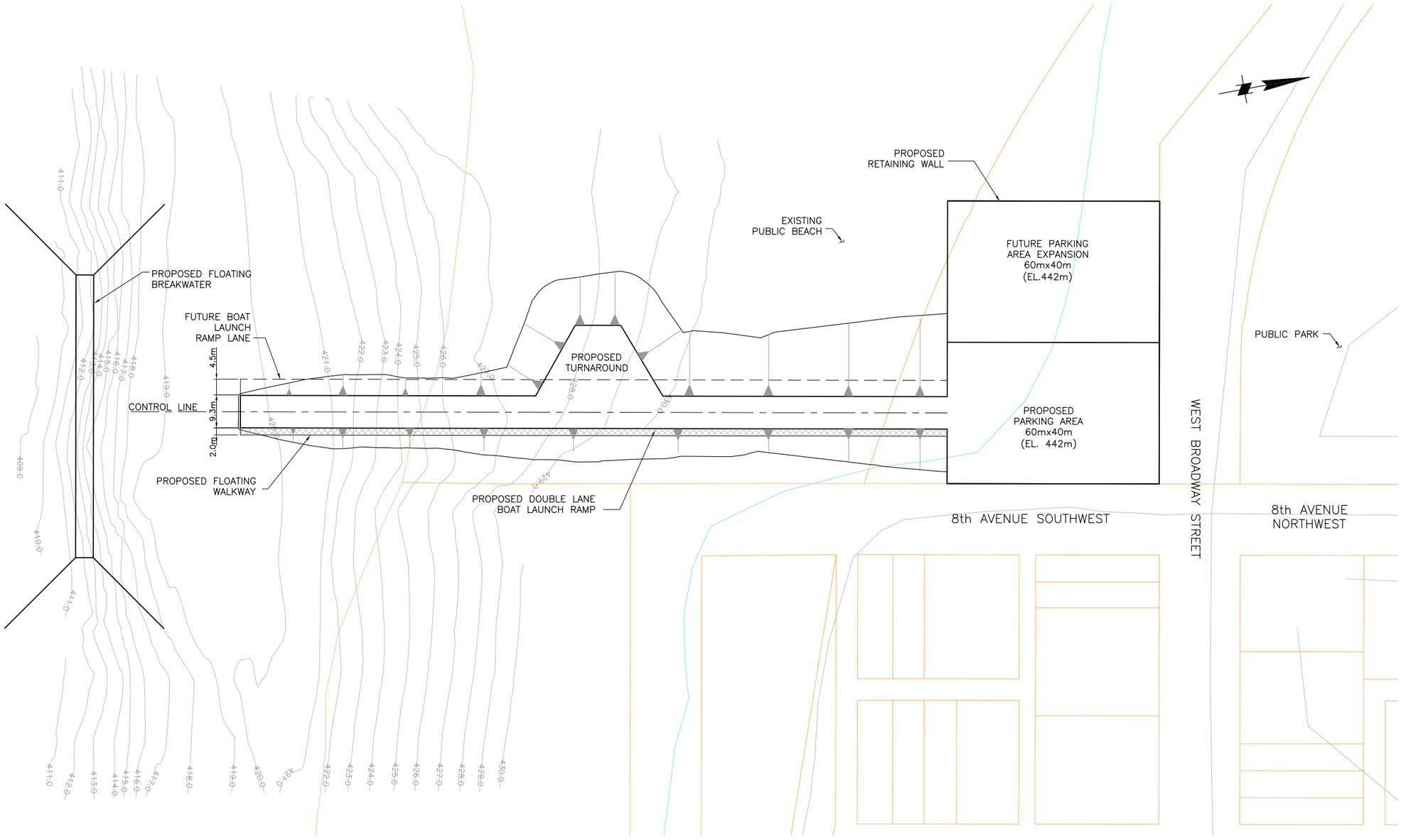
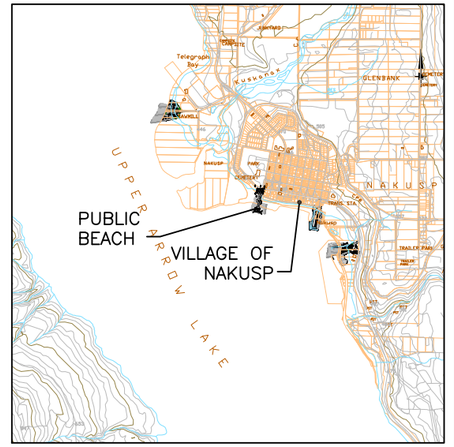


PLAN



KEY PLAN
NTS

NOTES:

1. CONTOURS ARE IN METERS TO GEODETIC DATUM AND ARE BASED ON A HYDROGRAPHIC AND TOPOGRAPHIC SURVEY CONDUCTED BY ATEK HYDROGRAPHIC SURVEYS LTD. ON MAY 3–10, 2008.

PRELIMINARY
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SCALE: 1 : 600

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DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08 DRAWING NUMBER: 6537–300

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

NAKUSP PUBLIC BEACH SITE
PROPOSED BOAT LAUNCH RAMPS PLAN

SCALE: AS SHOWN

C

DATE: 2008/08/08 – 2:31pm
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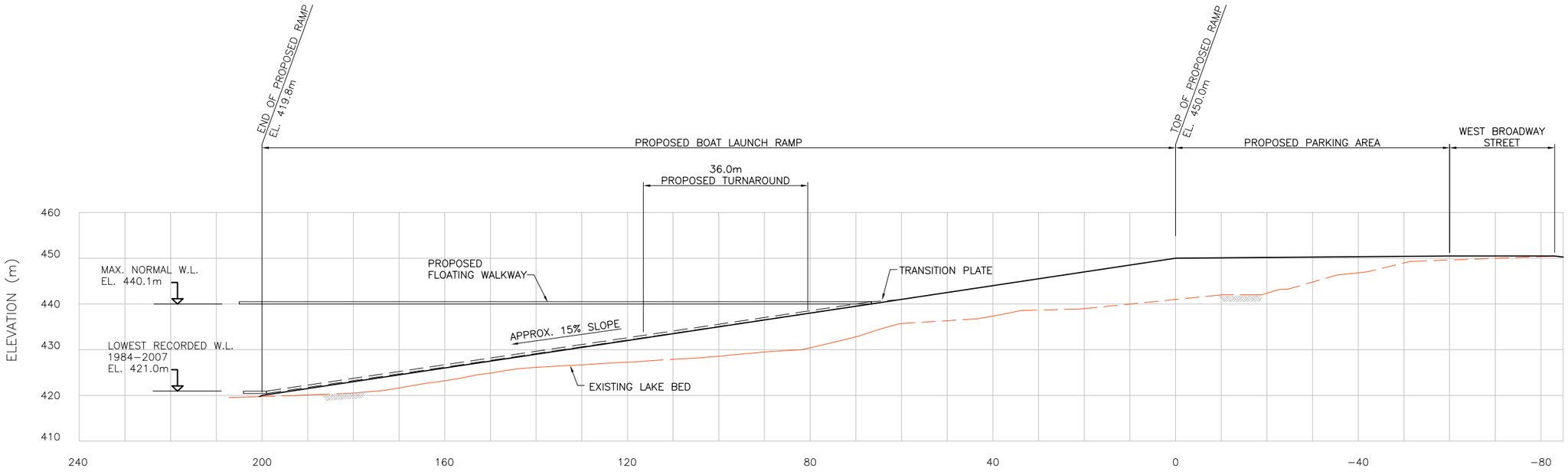

PROFILE ALONG CONTROL LINE

NOTE:

1. SEE REFERENCE DRAWING 6537–300
2. GUIDE PILE SUPPORRTS FOR FLOATING WALKWAY NOT SHOWN FOR CLARITY

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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CLIENT: BC hydro

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DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08
DRAWING NUMBER: 6537–301

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

NAKUSP PUBLIC BEACH SITE
PROPOSED BOAT LAUNCH RAMP PROFILE

SCALE: AS SHOWN

C

EXISTING FLOATING BREAKWATERS

EXISTING WALKWAY FLOATS

EXISTING MARINA

RELOCATE EXISTING FLOATS

CONTROL LINE

EXISTING FLOATS

PROPOSED TURNAROUND

EXISTING TIMBER TRESTLE BOAT LAUNCH RAMP

EXISTING WALKWAY

EXISTING WASHROOM BUILDING

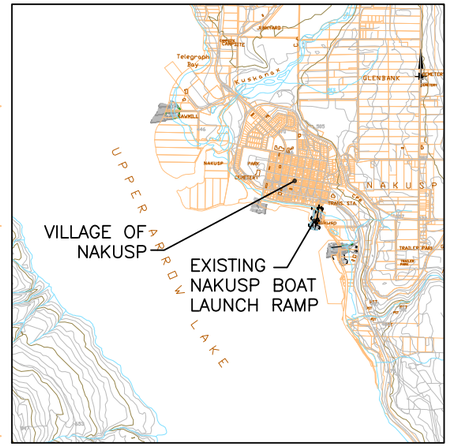
EXISTING STORMWATER DRAIN

NELSON AVENUE

EXISTING PARKING AREA

EXISTING FENCE LINE

PROPERTY BOUNDARY EXTRACTED FROM BC LAND, TITLE AND SURVEY DRAWING



KEY PLAN
NTS

NOTES:

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PLAN

PRELIMINARY
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10m 0m 10m 20m
SCALE: 1 : 500

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DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08
DRAWING NUMBER: 6537–400

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

EXISTING NAKUSP BOAT LAUNCH RAMPS OPTION 1 – PROPOSED TURNAROUND PLAN

SCALE: AS SHOWN

C

DATE: 2008/08/08 – 2:29pm
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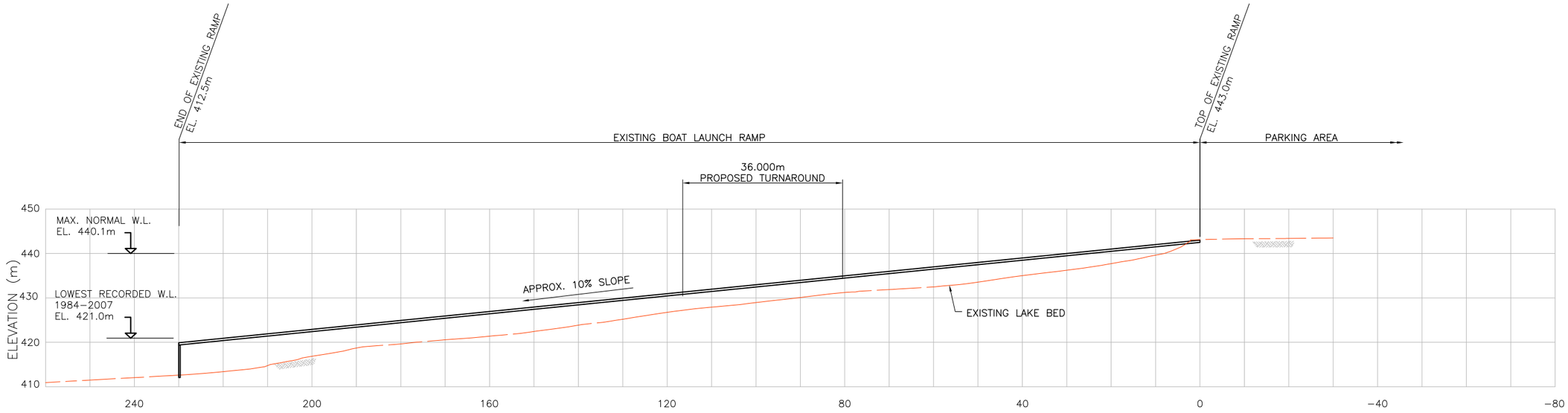

PROFILE ALONG CONTROL LINE

NOTE:

1. SEE REFERENCE DRAWING 6537–400
2. EXISTING TIMBER PILES NOT SHOWN FOR CLARITY

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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SCALE: 1 : 500

No.	Date	DESCRIPTION	Dr'n	Ch'd
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B	JUN18/08	ISSUED FOR CLIENT REVIEW	JL	PH
A	JUNE5/08	ISSUED FOR REVIEW BY PROJECT TEAM	JL	PH

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DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08
DRAWING NUMBER: 6537–401

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

EXISTING NAKUSP BOAT LAUNCH RAMPS
OPTION 1 – PROPOSED TURNAROUND PROFILE

SCALE: AS SHOWN

C

DATE: 2008/08/08 – 2:29pm
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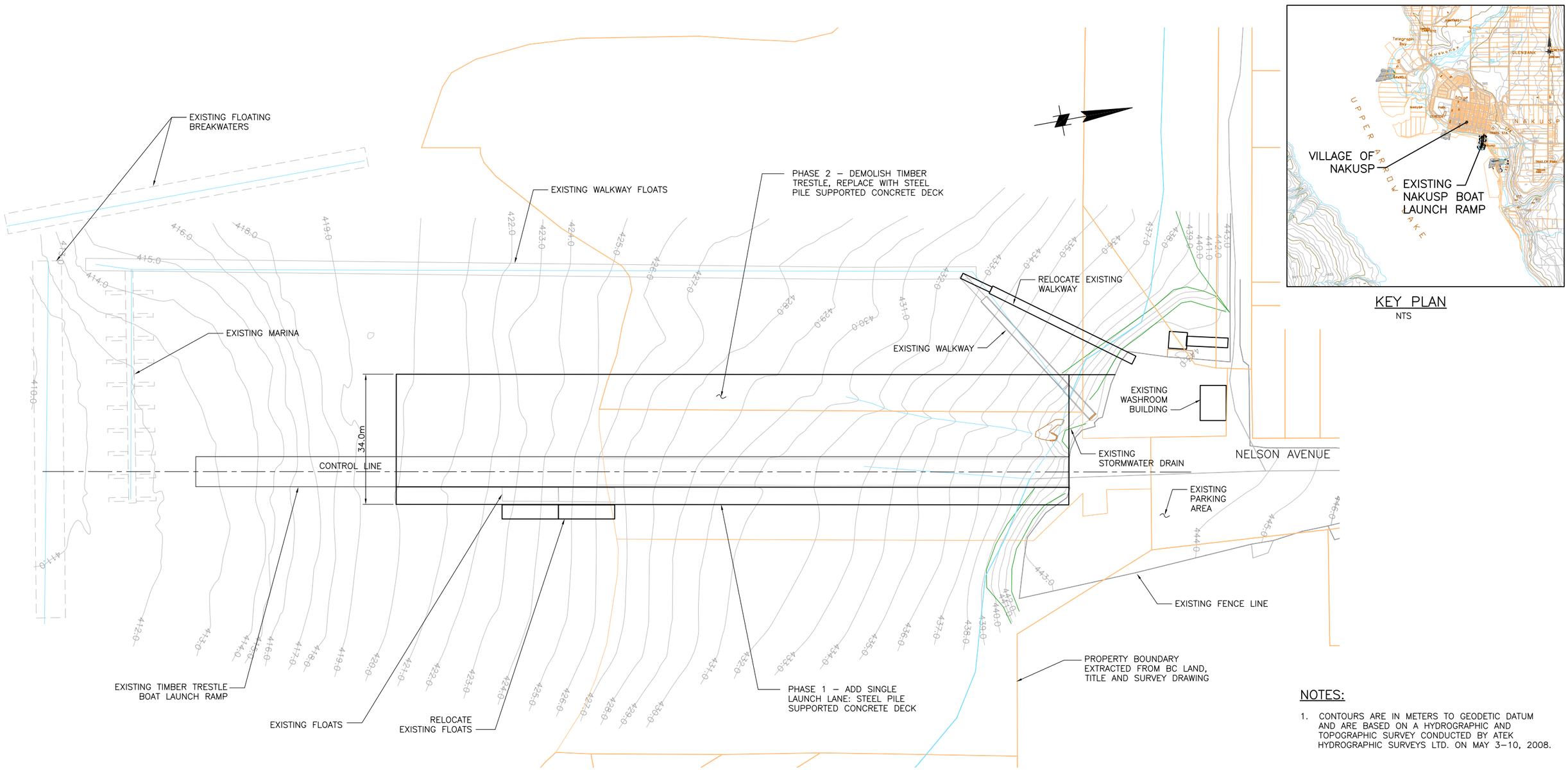

KEY PLAN
NTS

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PRELIMINARY
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10m 0m 10m 20m
SCALE: 1 : 500

PLAN

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DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08
DRAWING NUMBER: 6537–402

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

EXISTING NAKUSP BOAT LAUNCH RAMPS OPTION 2 – STEEL PILE SUPPORTED DECK

SCALE: AS SHOWN
C

DATE: 2008/08/08 – 2:28pm
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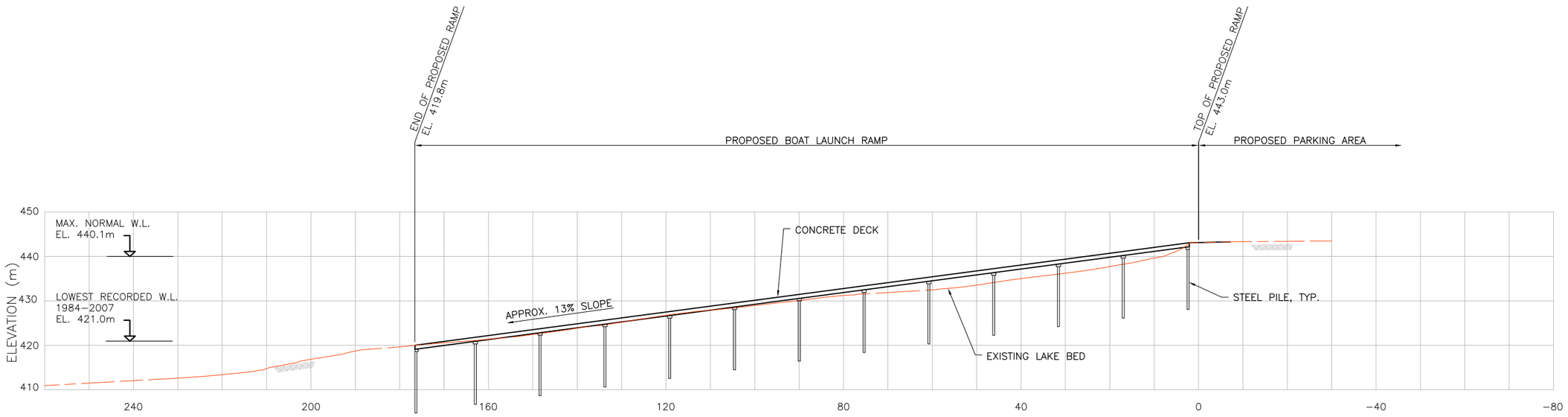

PROFILE ALONG CONTROL LINE

NOTE:

1. SEE REFERENCE DRAWING 6537–402
2. FLOATING WALKWAY AND GUIDE PILE SUPPORTS NOT SHOWN FOR CLARITY

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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SCALE: 1 : 500

No.	Date	DESCRIPTION	Dr'n	Ch'd
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B	JUN18/08	ISSUED FOR CLIENT REVIEW	JL	PH
A	JUNE5/08	ISSUED FOR REVIEW BY PROJECT TEAM	JL	PH

CLIENT: BC hydro

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DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

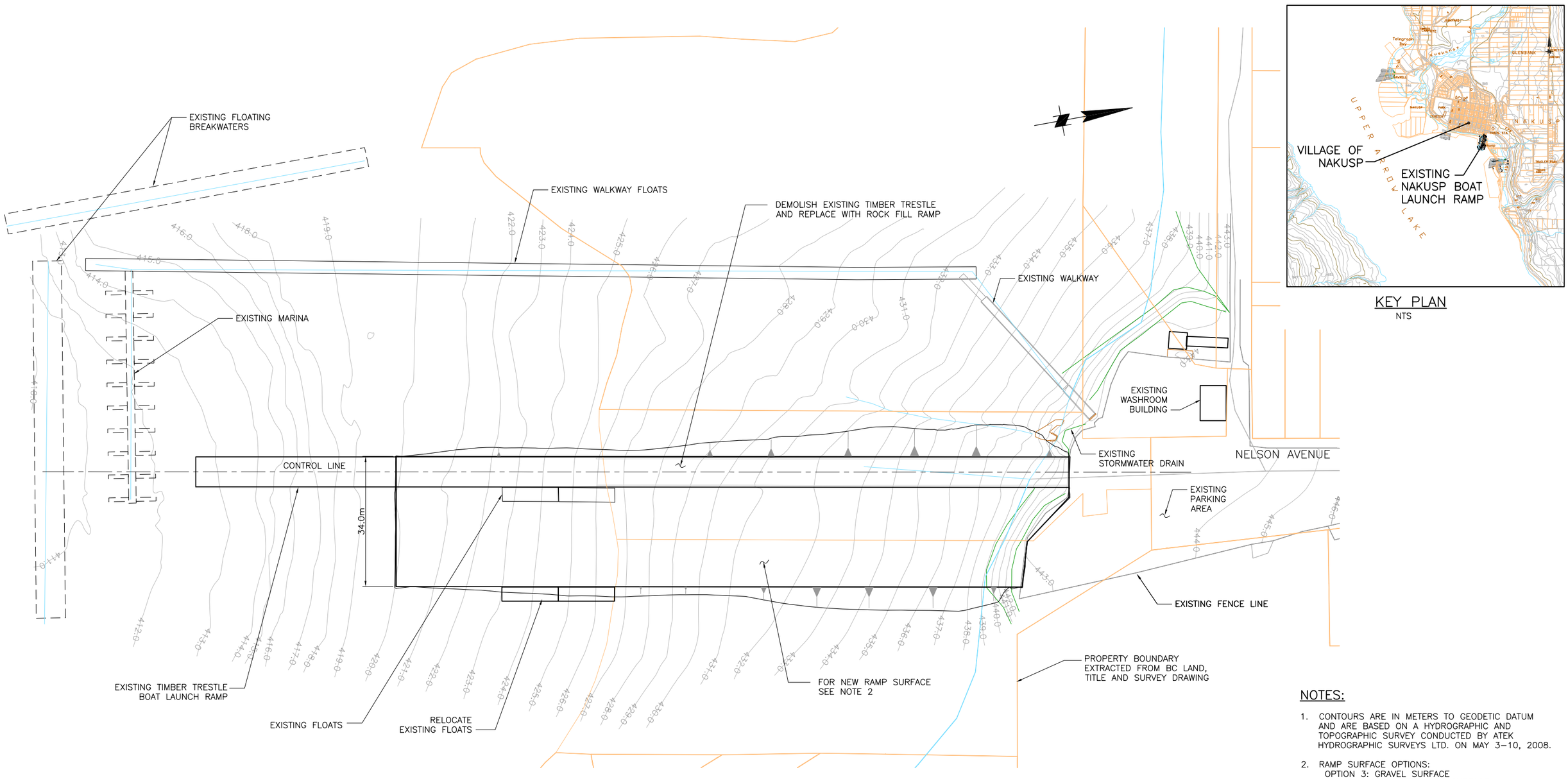
DATE: MAY28/08
DRAWING NUMBER: 6537–403

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

EXISTING NAKUSP BOAT LAUNCH RAMPS
OPTION 2 – STEEL PILE SUPPORTED DECK PROFILE

SCALE: AS SHOWN

C



KEY PLAN
NTS

PLAN

NOTES:

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2. RAMP SURFACE OPTIONS:
   OPTION 3: GRAVEL SURFACE
   OPTION 4: CONCRETE SLAB SURFACE

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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SCALE: 1 : 500

No.	Date	DESCRIPTION	Dr'n	Ch'd
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CLIENT: BC hydro

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DESIGN PH | DRAWN JL | CHK'D RB | APP'D
DATE MAY28/08 | DRAWING NUMBER 6537–404

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

EXISTING NAKUSP BOAT LAUNCH RAMPS OPTION 3/4 – ROCK FILL RAMP PLAN

SCALE AS SHOWN

C

DATE: 2008/08/08 – 2:26pm
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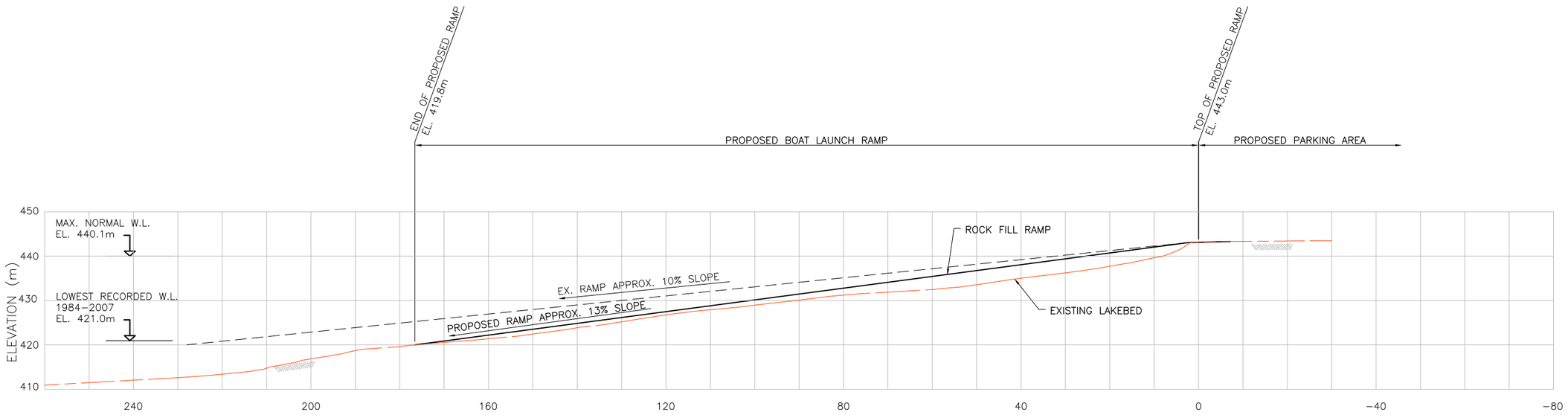

PROFILE ALONG CONTROL LINE

NOTE:

1. SEE REFERENCE DRAWING 6537–404
2. FLOATING WALKWAY AND GUIDE PILE SUPPORTS NOT SHOWN FOR CLARITY

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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CLIENT: BC hydro

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DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08
DRAWING NUMBER: 6537–405

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

EXISTING NAKUSP BOAT LAUNCH RAMPS OPTION 3/4 – ROCK FILL RAMP PROFILE

SCALE: AS SHOWN

C

PROPOSED FLOATING BREAKWATER

DEMOLISH DERELICT WALKWAY FLOATS & PILES

FUTURE ADDITIONAL BOAT LAUNCH RAMP LINE

PROPOSED TURNAROUND

PROPOSED DOUBLE LANE BOAT LAUNCH RAMP

PROPOSED PARKING AREA EXTENSION (EL.443m)

ROAD TO HIGHWAY

MAINTENANCE

4.6m

9.2m

CONTROL LINE

2.0m

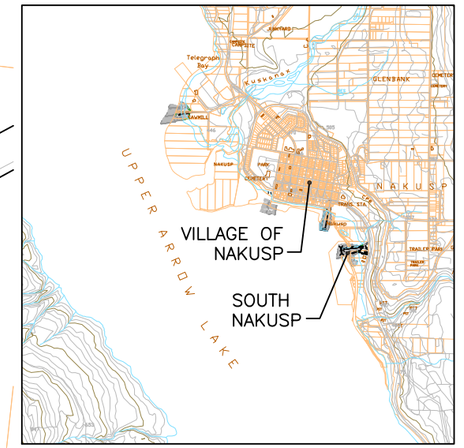
PROPOSED FLOATING WALKWAY

REMOVE EXISTING RAILS

EXISTING ASPHALT YARD

EXISTING LAUNCH

OFFICES



KEY PLAN
NTS

NOTES:

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PLAN

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08
DRAWING NUMBER: 6537–500

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY
SOUTH NAKUSP
PROPOSED BOAT LAUNCH RAMP PLAN

SCALE: AS SHOWN

C

DATE: 2008/08/08 - 2:25pm
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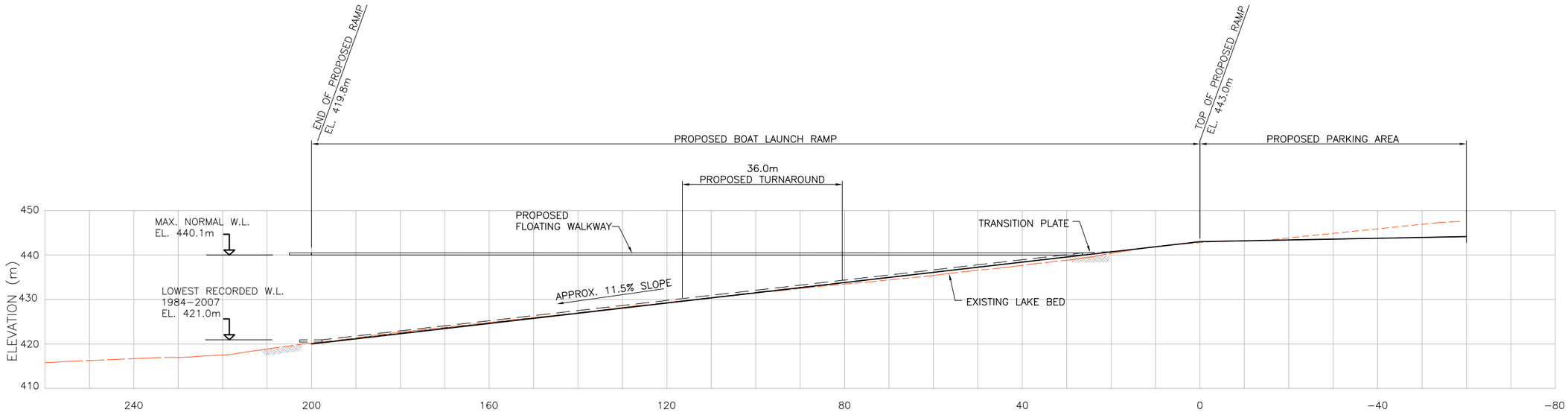

PROFILE ALONG CONTROL LINE

NOTE:

1. SEE REFERENCE DRAWING 6537–500
2. GUIDE PILES FOR FLOATING WALKWAY NOT SHOWN FOR CLARITY

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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DATE: 2008/08/08 – 2:24pm
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DESIGN	DRAWN	CHK'D	APP'D
PH	JL	RB	

DATE: MAY28/08
DRAWING NUMBER: 6537–501

UPPER ARROW LAKES NAKUSP BOAT RAMPS FEASIBILITY STUDY

SOUTH NAKUSP
PROPOSED BOAT LAUNCH RAMP PROFILE

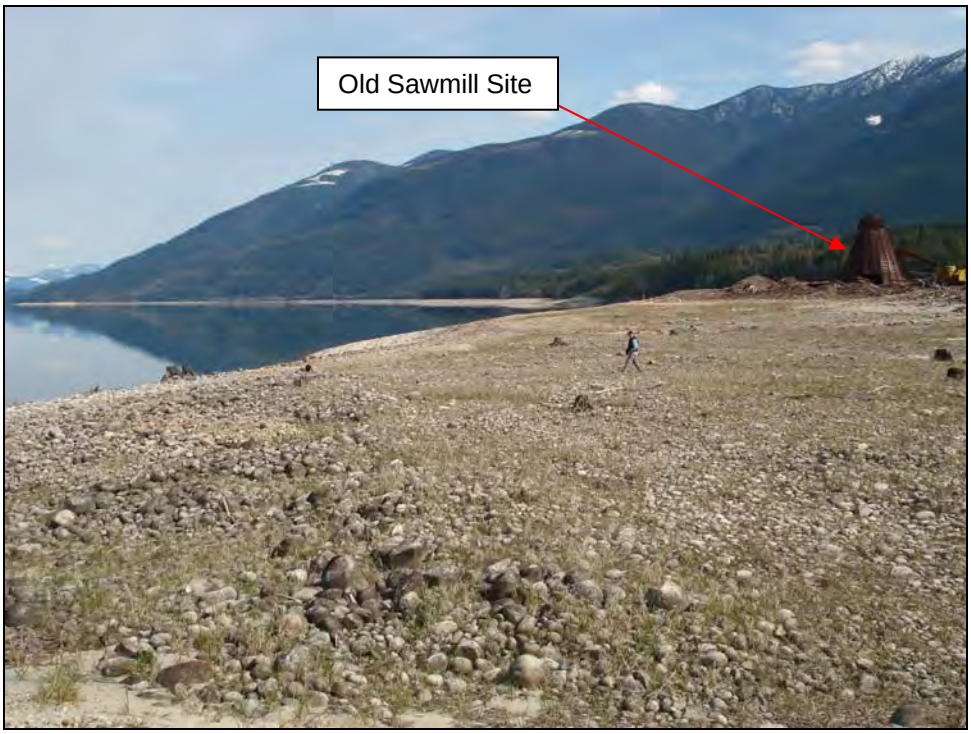
SCALE: AS SHOWN

C

Appendix B:
Photographs Taken during Site Visit
May 1 to 3, 2008

North Nakusp Site

Photograph No.1: View of north fetch from the top of the northern berm at the end of Kuskanax Road.



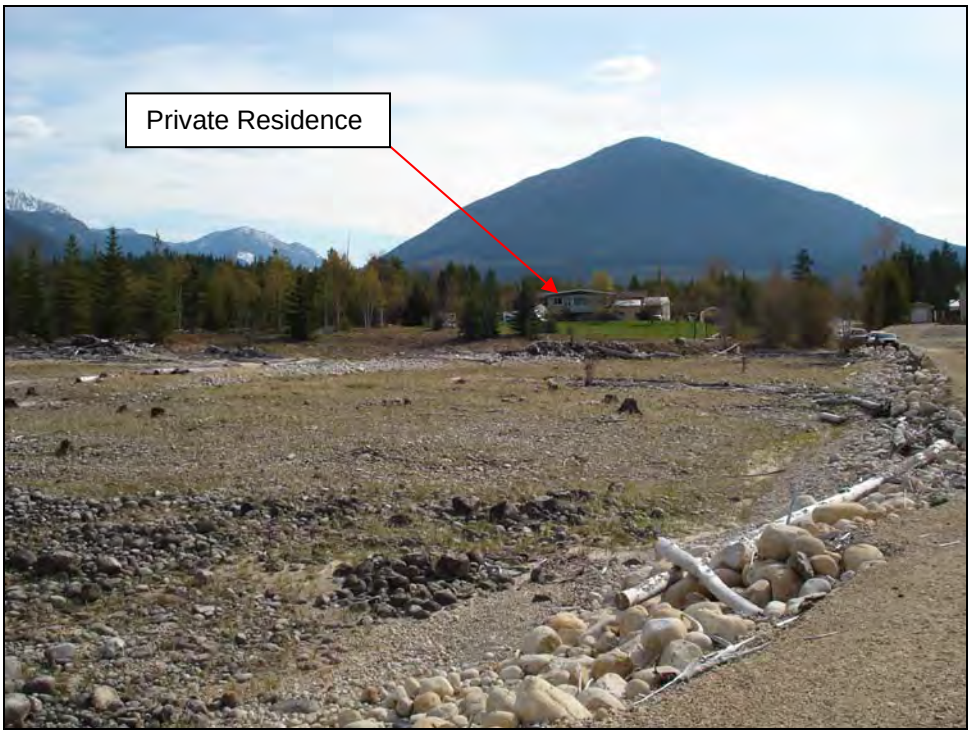
Photograph No. 2: View looking north from the northern berm at the end of Kuskanax.

Photograph No. 3: View along northern berm.

Photograph No. 4: View of northern bay between berms.

Photograph No. 5: View of south fetch.

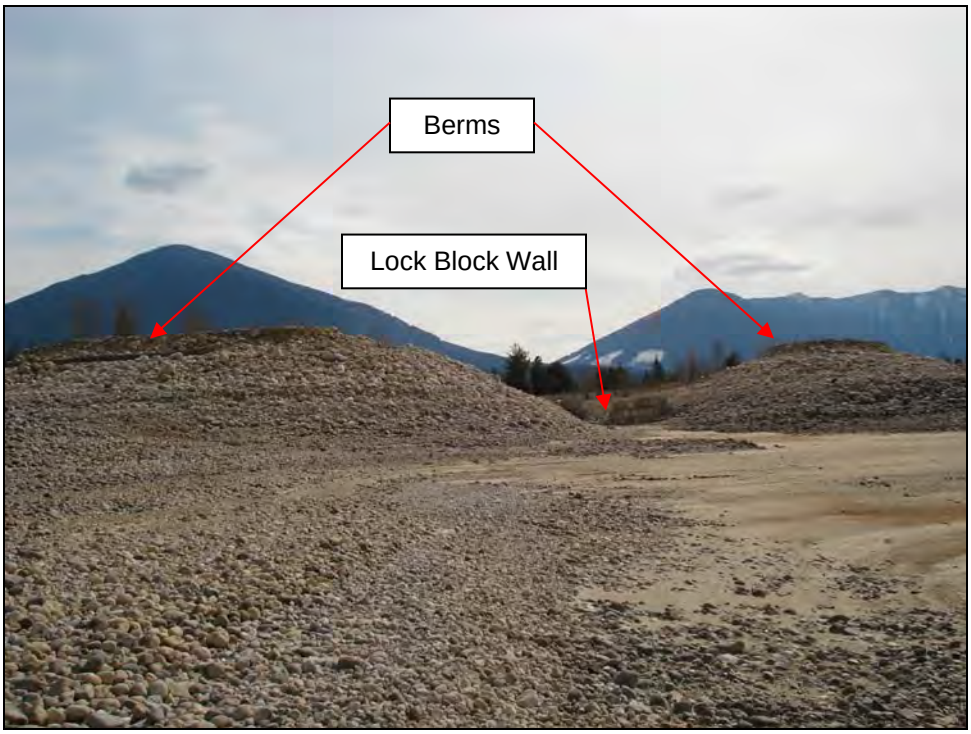
Photograph No. 6: View of southern berm.



Photograph No. 7: View of upland area on the northwest side of Kuskanax Road.

Photograph No. 8: View along top of northern berm towards upland area.

Photograph No. 9: View of Kuskanax Road looking east.

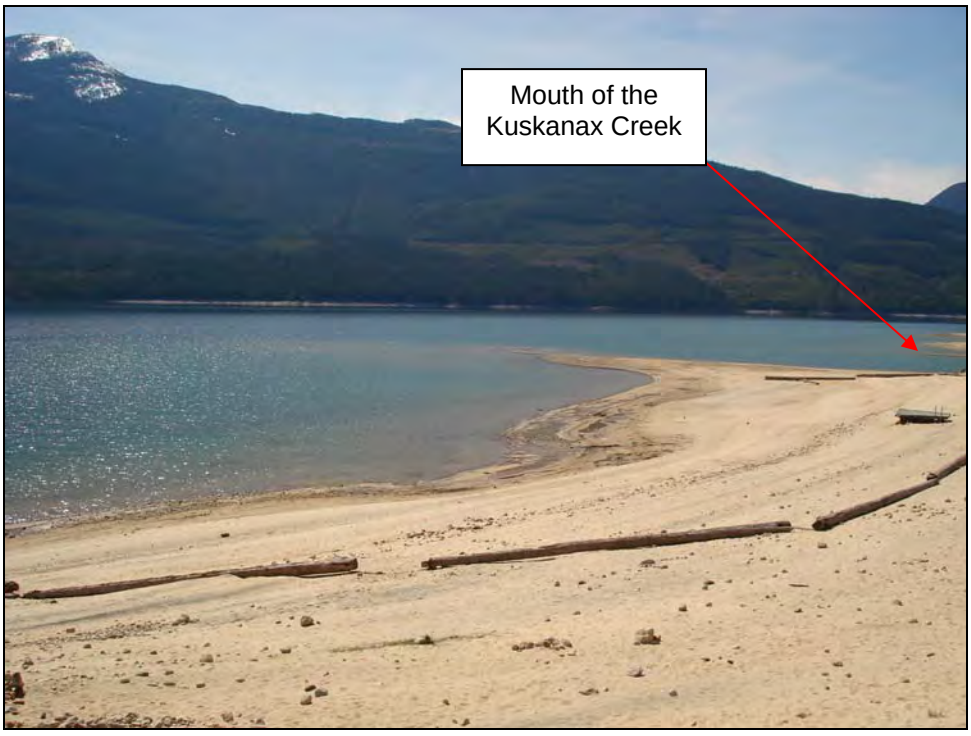


Photograph No. 10: View of adjacent southern bay near Kuskanax Road.

Photograph No. 11: View of north fetch from the southern bay.

Photograph No. 12: View of south fetch from southern site location.

Nakusp Public Beach Site



Photograph No. 13: View of north fetch at Nakusp Public Beach Site.

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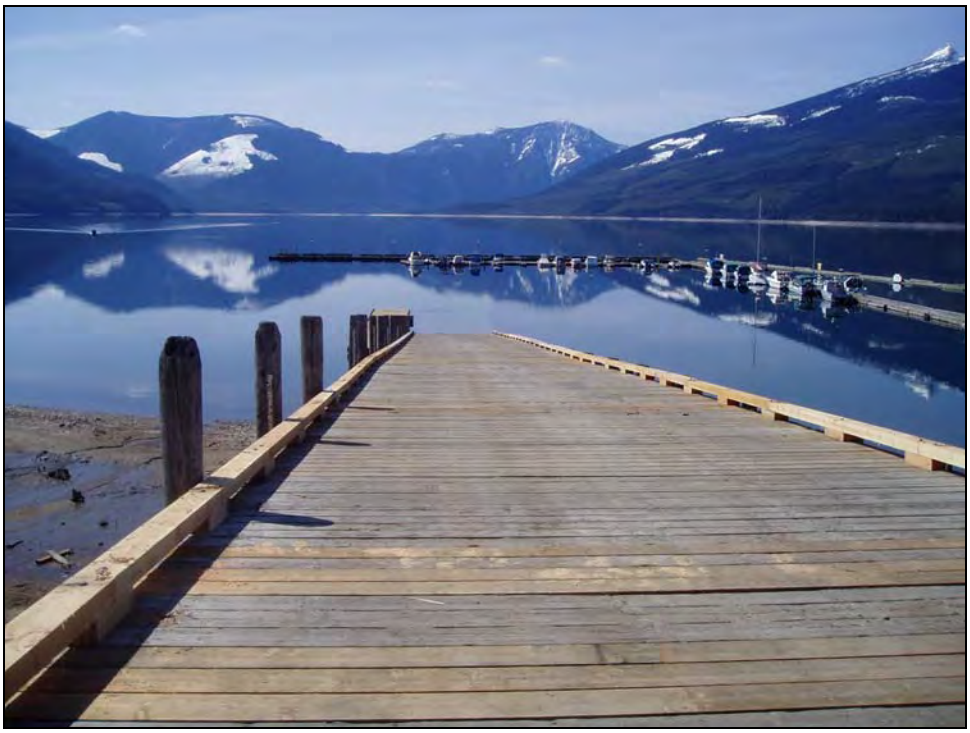

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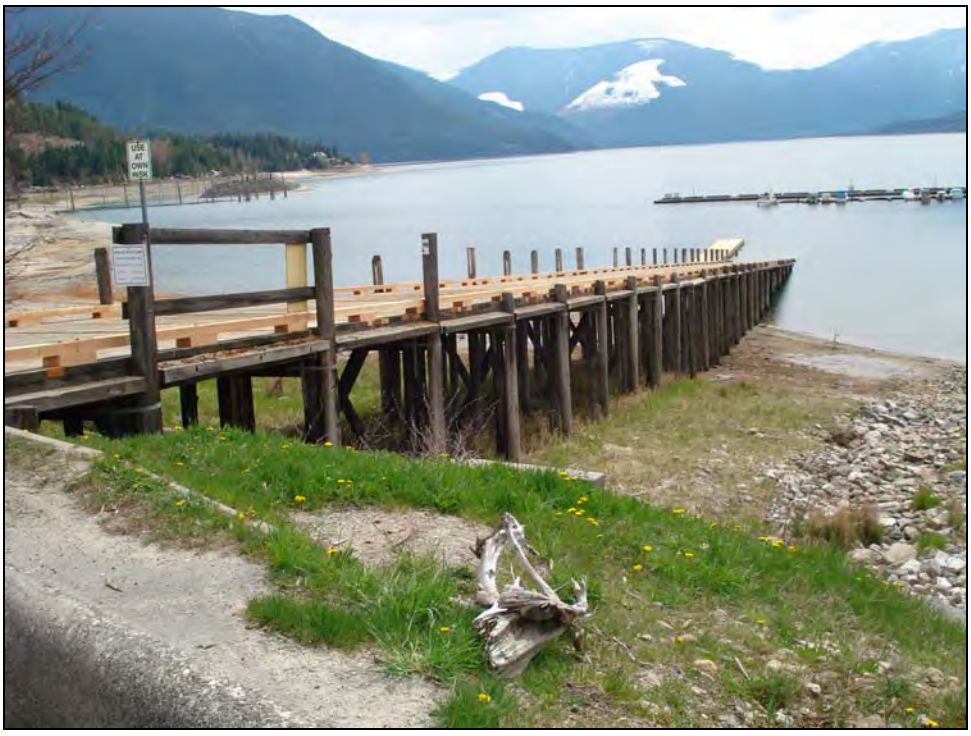

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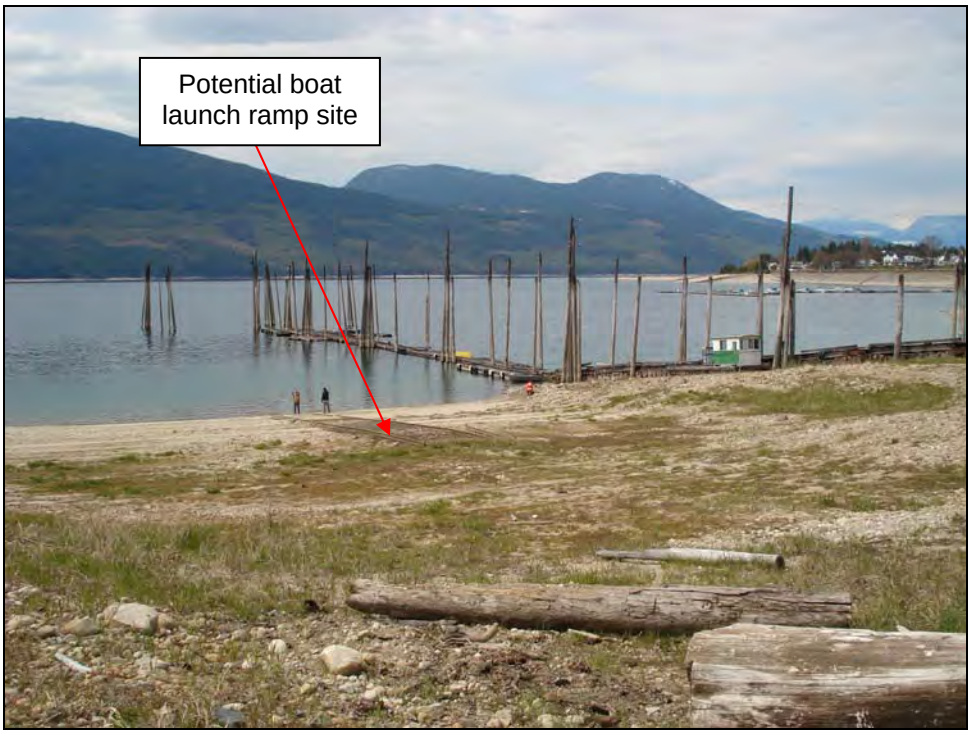

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Appendix C:
Environmental Report

3933/WP#P-1801

Nakusp Boat Ramp Feasibility Study – Environmental Component

Prepared for:

Moffat & Nichol
777 W. Broadway, Suite 201
Vancouver, BC V5Z 4J7

Prepared by:

TRITON
ENVIRONMENTAL CONSULTANTS LTD.

Suite 201 - 1157 5th Avenue
Prince George, BC, V2L 3L1
Tel: (250) 562-9155 Fax: (250) 562-9135

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1.0 INTRODUCTION

1.1 Purpose of Document

The purpose of this document is to identify the environmental sensitivities at the existing and proposed boat ramp locations in the vicinity of Nakusp, BC. This report is prepared in response to the BC Hydro Columbia River Water Use Plan Feasibility of Boat Ramps Study Terms of Reference. This report will be submitted in conjunction with the associated Engineering Technical and Archaeological Feasibility reports completed by Moffatt & Nichol (M&N) and Golder Associates (Golder).

This report has been prepared to:

- Provide a description of the environmental setting;
- Document baseline environmental conditions based on existing information, field data and observations;
- Identify valued ecosystem components (VEC) at or near each of the proposed sites;
- Provide an assessment of potential impacts of development on the VEC's at each site;
- Provide an Environmental Management Plan (EMP) for each site;
- Identify regulatory permitting and approval requirements necessary to proceed with construction at each site; and
- Identify if any additional environmental investigations may be required.

1.2 Environmental Setting

The four potential boat ramp sites are located along the Lower Arrow Lake Reservoir surrounding the Village of Nakusp (Figure 1). Access to the area is by Highway 6, which is located between Vernon and Nelson or by Highway 23 from Revelstoke.

The project is within the Selkirk Foothills Ecosection along the valley bottom between the Monashee mountain range in the west and the Selkirk range in the east. The Interior Cedar Hemlock biogeoclimatic zone (ICH) is characteristic of the lower elevations of this region, with cedar, hemlock, Douglas fir and Western larch predominating (Braumandl and Curran 1992). The climate and vegetation communities of project area are described by the Columbia-Shuswap moist warm (mw2) subzone of the ICH zone. The ICHmw2 occurs at elevations ranging from 500 to 1450 m in the northern part of its range and between 1200 and 1450 m when it is located upslope of the Dry Warm subzone (ICHdw1).

The climate of the area is represented by moist, hot summers and mild winters with moderate snowfall. The mean annual temperature for this area is 7.6º C with daily maximums averaging 12.5º C and daily minimums averaging 2.6º C (Environment Canada 2007). Precipitation is slightly higher in the ICHmw2 than that of the Dry Warm subzone (dw1), with a mean annual precipitation of 840 mm compared to 740 mm in the ICHdw1. The average yearly precipitation recorded at Nakusp between 1971 – 2000 is 842 mm (Environment Canada 2008).

Within this subzone, the dominant tree species include western red cedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*) with varying amounts of Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), and paper birch (*Betula papyrifera*). Late seral and climax stands are limited due to disturbances such as fire and harvesting. Shrub species include falsebox (*Paxistima myrsinites*), Douglas maple (*Acer glabrum*), and baldhip rose (*Rosa gymnocarpa*). Herbaceous species include prince's pine (*Chimaphila umbellata*), queen's cup (*Clintonia uniflora*) and twinflower (*Linnaea borealis*).

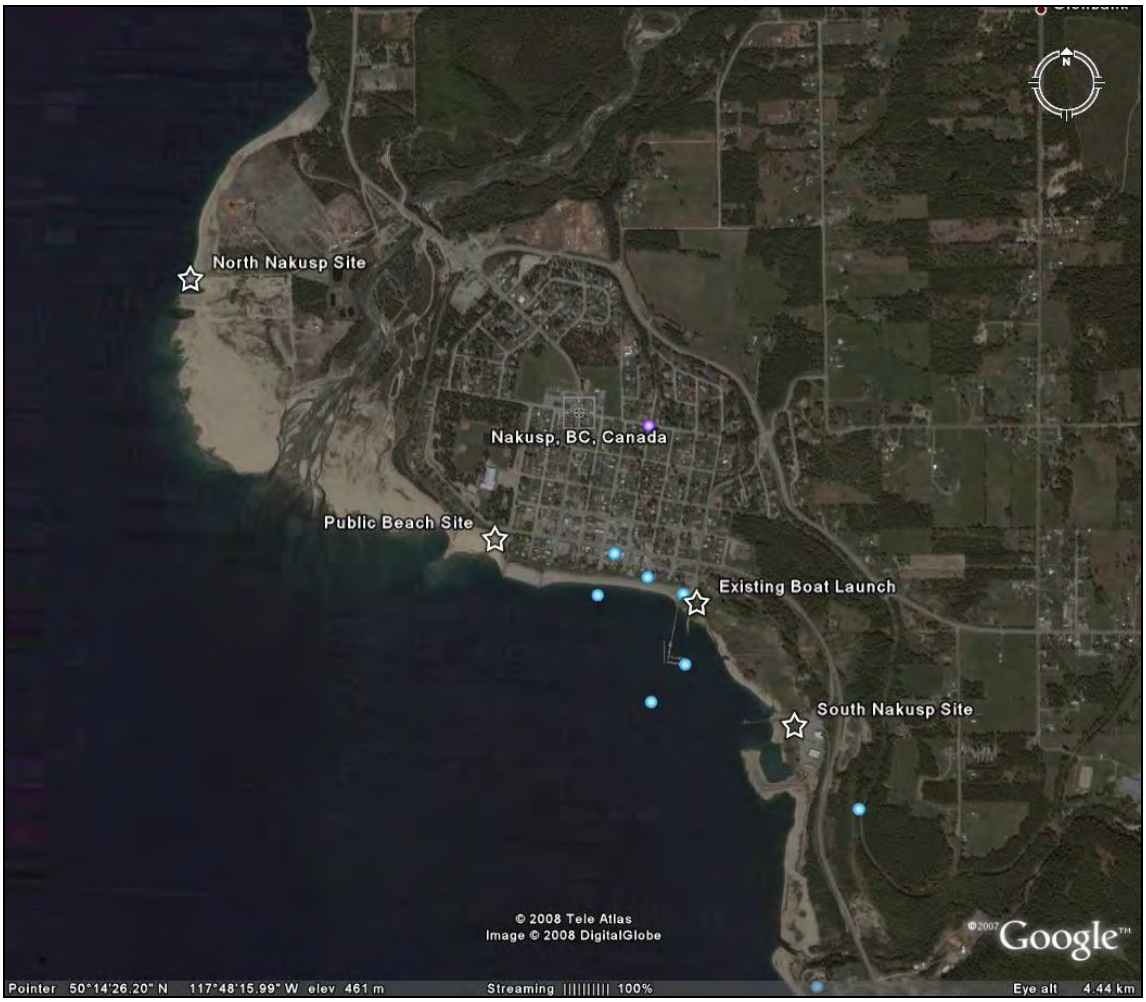

Figure 1. Nakusp Boat Ramp Site Locations.

2.0 METHODOLOGY

Spring field surveys were conducted in conjunction with the engineering and archaeological surveys to document existing conditions in aquatic and terrestrial habitats surrounding the existing and proposed boat ramp locations.

2.1 Fish and Fish Habitat

Aquatic habitats were assessed in terms of substrate, gradients (% slope), and drawdown zone vegetation. No fish sampling was conducted but data on the potential fish species within the project area was reviewed along with the associated habitat requirements of those species for all life stages. Habitat observed at each boat ramp site was described in terms of its suitability to provide habitat for the identified species.

2.2 Wildlife and Wildlife Habitat

In order to determine the local, regional and provincial significance of habitats within the study area, it is necessary to consider the full range of wildlife species known, or with significant potential to occur in the vicinity of each boat ramp. Key references that were utilized to achieve this include:

- Stevens *et a*l. (1994) provide a breakdown of wildlife species by biogeoclimatic zones and subzones with some habitat cross referencing, and habitat preferences;
- The Mammals of British Columbia (Eder and Pattie, 2001);
- The Birds of British Columbia Vol 1, Vol 2, Vol 3, Vol 4 (Campbell *et al*. 1990);
- A field guide to site identification and interpretation for the Nelson Forest Region (Braumandl and Curran 1992);
- A Field Guide for Identification and Interpretation of Ecosystems of the Rocky Mountain Trench, Prince George Forest Region (Meidinger *et al* 1998; 2007);
- BC Conservation Data Centre tracking lists (BC CDC 2007a);
- Bats of British Columbia (Nagorsen and Brigham 1993); and
- The Amphibians and Reptiles of British Columbia (Matsuda *et al.* 2006).

2.2.1 Wildlife Species of Management Concern

The primary warehouse of information on the status of flora and fauna in the province is the BC Conservation Data Centre (CDC). The CDC provides tracking lists for flora, fauna, and plant communities for each Forest District in the province. The District lists identify species that can be expected to occur within the District boundaries, which is often coincident with watershed divides. These areas can include the bulk of some wildlife sub-populations. These status lists use a colour-coding system to rank the status

and management priorities for species at risk. Following is a breakdown and brief description of the status and ranking criteria used in developing these lists:

Red-listed Species:

- candidates for legal designation as threatened or endangered under Federal legislation;
- include threatened species - any indigenous species of fauna or flora that is likely to become endangered in British Columbia if the factors affecting its vulnerability do not become reversed; and
- include endangered species - any indigenous species of fauna or flora that is threatened with imminent extinction or extirpation throughout all or a significant portion of its British Columbia range.

Blue-listed Species:

- considered to be vulnerable or sensitive and are candidates for upgrade to the red-list or downgrade to yellow; and
- include vulnerable species - any indigenous species of fauna or flora that is particularly at risk in British Columbia because of low or declining populations.

Yellow-listed Species

- the yellow-listed species are those considered not at risk in British Columbia and are considered for management emphasis for various reasons including recent declines in population numbers, restricted distribution, losses of habitat, public interest, species that are maintained by ecosystem management and species for which the Province has a global responsibility.

In addition to red, blue, and yellow-listed species, numerous other species are of management concern within the province due to:

- populations that are actively managed;
- species that are of commercial value;
- species with specific habitat requirements (e.g. nest cavities);
- species found at low densities; and
- colony nesters.

In order to identify species of management concern that potentially occur in the study area, the full list of wildlife species known to occur, or with significant potential to occur within the ICHmw2 were considered. Based on sub-regional wildlife distribution, abundance, and species sensitivities the CDC has developed tracking lists for individual forest districts. The CDC red, blue and yellow lists for rare vertebrate species within the Arrow Boundary Forest District were acquired. In addition, the Federal Species at Risk Act Registry (SARA) was also reviewed for the potential of any Schedule 1 listed species to be present within the project area (Appendix 2).

The comprehensive list can be reduced based on known regional distributions, specialized habitat requirements, and extreme rarity to a subset of species that is more reasonable to

expect within the project area. This was done using the descriptions of terrestrial habitat observed at each boat ramp site to determine its suitability to provide habitat for identified wildlife species. Seven SARA species may be found within the vicinity of the project areas (Table 1).

Table 1. SARA species which may occur on the landscape surrounding the project area.

Scientific name	Common Name	SARA Category
Taxidea taxus	Badger	Endangered
Megascops kennicottii macfarlanei	Western Screech Owl	Endangered
Cottus confuses	Shorthead Sculpin	Threatened
Eumeces skiltonianus	Western Skink	Special Concern
Rangifer tarandus caribou	Woodland Caribou (Southern Mountain population)	Threatened
Plethodon idahoensis	Couer d'Alene salamander	Special Concern
Bufo boreas	Western Toad	Special Concern

2.3 Vegetation

There are two useful land classification schemes that capture the variation in plant and animal communities at a sub-regional scale. Ecosections (Regional Ecosystem Classification) are contiguous areas with similar climate and physiography, which are large enough to sustain a variety of plant and wildlife communities. Biogeoclimatic subzones and subzone variants (Biogeoclimatic Ecosystem Classification, BEC) are characterized by a particular combination of dominant plant species. Subzones and subzone variants are dispersed within sub-regional areas and often occur within a relatively narrow elevational range and/or in relation to aspect.

The Province has protected representative natural examples of both ecosections and subzones/variants at the landscape level. Site associations or site series units are the fine units of the biogeoclimatic classification system that capture plant community variation at the stand or operational level and these are the ecosystems that are tracked by the Conservation Data Centre (CDC). The CDC red and blue-lists identify ecosystems that are considered rare or at risk. The biogeoclimatic site series unit is also routinely used by forest and wildlife resource managers, and provides an appropriate means to assess the local, regional and provincial significance of potential effects of habitat alteration in the study area. The ecosystems of the study area have been described at the biogeoclimatic site series level.

A review of Species at Risk and the CDC red and blue-lists were completed prior to the field assessments. Plant species that were located in areas that may be impacted by construction relating to the boat ramps were identified. A review of potentially occurring species, their habitat requirements and the likelihood of any being present in the project area was also conducted as a risk assessment rather than an actual inventory.

2.4 Potential Impacts

Valued Ecosystem Components (VECs) are elements of the biophysical and socio-economic environment that are valued by society and of particular relevance in completing the project scoping. They may be landscape level features (ecosystems), or individual fish, wildlife or plant species that are recognized as rare, sensitive or vulnerable to human activity. VEC's were identified by reviewing the fish and fish habitats, wildlife and wildlife habitat and vegetation at each site and assigning an Environmental Sensitivity Rating (ESA) of either low, moderate or high, based on how sensitive that habitat feature would be to the proposed boat ramp construction at each site.

3.0 ENVIRONMENTAL OVERVIEW ASSESSMENT

3.1 Fish and Fish Habitat

The Arrow Lake Reservoir (ALR) provides habitat for a variety of fish species include several fish species of management concern within the Arrow Boundary Forest District (Table 2). Burbot has just recently been added as a red-listed species within the Kootenay Region and is not yet included on the CDC website (BC CDC 2008).

Table 2. Fish Species of Management Concern within the Arrow Lake Reservoir.

Scientific Name	Common Name
Acrocheilus alutaceus	Chiselmouth
Acipenser transmontanus pop. 2	White sturgeon (Columbia River population)
Cottus hubbsi	Columbia sculpin
Cottus confusus	Shorthead sculpin
Lota lota	Burbot
Oncorhynchus clarkii lewisi	Westslope cutthroat trout
Rhinichthys umatilla	Umatilla dace
Salvelinus confluentus	Bull trout

Chiselmouth has not been identified within the ALR but is suspected to be present. Chiselmouth prefers warmer sections of streams and lakes and is primarily an algae feeder. It can be found within the littoral zones of some lakes but because it is an algae specialist, it requires rocks or large woody debris covered with algae as forage habitat. They spawn in tributary streams during June or July when water temperatures reach 17^{o}C and in gravel/cobble substrates (Cannings and Ptolemy 1998). Since the substrate is not covered with algae, it is unlikely that they will be in the vicinity of the project area.

Literature reviews for the habitat requirements of the Umatilla dace, Columbia and shorthead sculpin, Westslope cutthroat trout, also remove them from the species of concern for these boat ramp areas. For example, the Umatilla dace is primarily a riverine species (Ford *et al.* 1993) and no occurrences of Westslope cutthroat trout were found in stream data records for the tributary streams closest to the boat ramp locations. FISS data does not identify the Columbia sculpin as present in the ALR but occurrences of the shorthead sculpin in the Columbia River system have been noted. Shorthead sculpin is usually found in fast riffles in colder streams with gravel and cobble substrates. Occurrences have been limited to tributaries of the lower Columbia and Slocan Rivers (Troffe 1999).

Prickly sculpin as shown some affinity to the shallow muddy inlets and bays within the ALR while the torrent sculpin prefers areas more exposed to the current (which does exist in the ALR) (Northcote undated). Therefore, some of the project area may provide some habitat for prickly sculpin.

Adult Burbot are usually found in waters deeper than 16 m. Burbot are winter spawners preferring water depths between 1 and 10 m and sand or gravel substrates (McPhail 2007). A potentially area for Burbot spawning in the ALR is near Mosquito Creek, south of Nakusp (Arndt and Baxter 2006).

White sturgeon within the ALR have been found to congregate near Burton where the mouth of Burton and Caribou Creeks provide suitable spawning grounds for Kokanee, a prey species for White sturgeon (Westslope 2004). Spawning occurs in early spring and has been documented in the Mid-Columbia near Revelstoke. Overall the water depths experienced along the Nakusp shoreline at high reservoir levels are not likely to provide habitat for adult white sturgeon.

Adult bull trout found within the ALR spawn between August and October in several large tributaries to the ALR, including Kuskunax Creek (FISS 2008). They are usually found in the upper reaches of these tributaries and are associated with steeper, colder waters, with cobble and gravel substrates (. Adults within the ALR are usually found in deeper water and associated with some form of cover. When juveniles return to the lake, they are also usually found in deep water (McPhail 2007).

3.2 Wildlife and Wildlife Habitat

The CDC red, blue and yellow list for rare species (excluding fish) within the ICH subzone of the Arrow Boundary Forest District was acquired and a total of 11 red-listed, 23 blue-listed, and one yellow-listed species were identified (Table 3). Nine bird species, 13 invertebrates, 8 mammal and 4 amphibians/reptile species were identified. Thirteen species have formal COSEWIC designations (4 endangered 7 special concern, 1 threatened/special concern, and 1 not at risk), 10 species are Identified Wildlife, and 11 species are listed under the Species at Risk Act.

Table 3. Red and blue-listed species in the ICH zone of the Arrow Boundary Forest District.

Species	COSEWIC	BC Status	Identified Wildlife	SARA	Occurrence in Project Area	Potential Effects
Tiger Salamander	E (Nov 2001)	Red	Y (May 2004)	1	Unlikely given habitats present.	None anticipated.
Banded Tigersnail	No	Blue	No		Unlikely given habitats present.	None anticipated.
Winged Floater	No	Blue	No		**Potential along lakeshore**.	None anticipated.
Great Blue heron, *herodias* subspecies	No	Blue	Y (Jun 2006)		**Potential occurrence along Arrow Lakes.**	None anticipated.
Vivid Dancer	No	Red	No		Unlikely given habitats present.	None anticipated.
Short-eared Owl	SC (Mar 2008)	Blue	Y (May 2004)	3	Unlikely given habitats present.	None anticipated.
American Bittern	No	Blue	No		Unlikely given habitats present.	None anticipated.
Western Painted Turtle - Intermountain - Rocky Mountain Population	SC (Apr 2006)	Blue	No	1	**Potential occurrence along Arrow Lakes.**	None anticipated.

Species	COSEWIC	BC Status	Identified Wildlife	SARA	Occurrence in Project Area	Potential Effects
Townsend's Big-eared Bat	No	Blue	No		Unlikely given habitats present	None anticipated.
Coeur d'Alene Oregonian	No	Blue	No		Unlikely given habitats present	None anticipated.
Bobolink	No	Blue	No		Unlikely given habitats present.	None anticipated.
Western Skink	SC (May 2002)	Blue	No	1	Unlikely given habitats present	None anticipated.
Shortface Lanx	No	Red	No		Unlikely given habitats present	None anticipated.
Ashy Pebblesnail	No	Red	No		Unlikely given habitats present	None anticipated.
Attenuate Fossaria	No	Blue	No		Unlikely given habitats present	None anticipated.
Wolverine, *luscus* subspecies	SC (May 2003)	Blue	Y (May 2004)		Unlikely given habitats present.	None anticipated.
Pale Jumping-slug	No	Blue	No		Unlikely given habitats present	None anticipated
Barn Swallow	No	Blue	No		**Potential in Nakusp area**.	None anticipated
Yellow-breasted Chat	E (Nov 2000)	Red	Y (May 2004)	1	Unlikely given habitats present.	None anticipated
Pygmy Slug	No	Red	No		Unlikely given habitats present	None anticipated
Magnum Mantleslug	No	Blue	No		Unlikely given habitats present	None anticipated
Fisher	No	Blue	Y (Jun 2006)		Unlikely given habitats present.	None anticipated
Western Screech-Owl, *macfarlanei* subspecies	E (May 2002)	Red	Y (May 2004)	1	Unlikely given habitats present	None anticipated
Lewis's Woodpecker	SC (Nov 2001)	Red	Y (May 2004)	1	Unlikely given habitats present	None anticipated
Fringed Myotis	DD (May 2004)	Blue	Y (May 2004)	3	**Potential occasional visitor**	None anticipated
Red-tailed Chipmunk, *simulans* subspecies	No	Blue	No		Unlikely given habitats present	None anticipated
Rocky Mountain snail	No	Blue	No		Unlikely given habitats present	None anticipated
Subalpine Mountainsnail	No	Blue	No		Unlikely given habitats present.	None anticipated
Bighorn Sheep	No	Blue	Y (Jun 2006)		Unlikely given habitats present.	None anticipated
Rotund Physa	No	Red	No		Unlikely given habitats present	None anticipated
Coeur d'Alene Salamander	SC (Nov 2001)	Yellow	Y (May 2004)	1	Unlikely given habitats present	None anticipated
Purple Martin	No	Blue	No		Unlikely given habitats present	None anticipated
Caribou (southern population)	T (May 2000)	Red	Y (May 2004)	1	Unlikely given habitats present.	None anticipated
Badger	E (May 2000)	Red	Y (May 2004)	1	Unlikely given habitats present.	None anticipated
Grizzly Bear	SC (May 2002)	Blue	Y (May 2004)		Unlikely given habitats present.	None anticipated

The comprehensive list can be reduced based on known regional distributions, specialized habitat requirements, and extreme rarity to a subset of species that is more reasonable to expect may occur within the project area. In general, the area surrounding the Village of Nakusp can provide habitat for black bear, ungulates, songbirds, and some amphibians and reptiles. The available habitats and plant species that were documented within the project area are common and not limiting on the landscape. Therefore, it is unlikely that they are important for several of the listed species, which are more likely to be associated with larger areas of more contiguous preferred habitats.

Of the listed species, five have potential to occur with the assessed area including: winged floater, great blue heron, western painted turtle, barn swallow, and the fringed myotis.

3.3 Vegetation

3.3.1 Rare Plant Communities

The CDC Rare Natural Plant Community Tracking List for the Arrow Boundary Forest District identifies one blue-listed and eight yellow-listed plant communities (site series unit) in the ICHmw2 biogeoclimatic subzone (Table 4). Where there is poor representation of mature natural examples of SBS subzones in protected areas and there has been substantial modification of existing areas, most or all site series units in a subzone often appear on the CDC lists. There are no occurrences of red-listed communities in this subzone which are typically rare on the landscape and are often sensitive to disturbance.

Table 4. Listed plant communities in the ICHmw2.

Scientific Name	English Name	BC Status	Site Series
Calamagrostis canadensis / Aulacomnium palustre	bluejoint reedgrass / glow moss	Yellow	ICHmw2/08
Calamagrostis canadensis - Carex spp.	bluejoint reedgrass - sedges	Yellow	ICHmw2/09
Pseudotsuga menziesii - Thuja plicata / Paxistima myrsinites	Douglas-fir - western redcedar / falsebox	Yellow	ICHmw2/03
Thuja plicata / Lonicera utahensis / Gymnocarpium dryopteris	western redcedar / Utah honeysuckle / oak fern	Yellow	ICHmw2/05
Thuja plicata / Oplopanax horridus / Athyrium filix-femina	western redcedar / devil's club / lady fern	Yellow	ICHmw2/06
Thuja plicata - Picea engelmannii x *glauca / Lysichiton americanus*	western redcedar - hybrid white spruce / skunk cabbage	Yellow	ICHmw2/08
Thuja plicata - Tsuga heterophylla / Equisetum arvense	western redcedar - western hemlock / common horsetail	Blue	ICHmw2/07
Tsuga heterophylla / Paxistima myrsinites	western hemlock / falsebox	Yellow	ICHmw2/04
Tsuga heterophylla - Thuja plicata / Paxistima myrsinites / Pleurozium schreberi	western hemlock - western redcedar / falsebox / red-stemmed feathermoss	Yellow	ICHmw2/01

Other vegetation communities of particular importance and sensitivity include riparian communities, which are not described in the site identification field guide, but typically have high wildlife values and are sensitive to disturbance.

3.3.2 Rare Plant Species

Plant species can be identified using several keys. Generally the nomenclature follows Hitchcock *et al.* (1973), however The Vascular Plants of British Columbia (Ministry of Forests 1989, 1990, 1991 & 1994) was used where there were discrepancies in the species names used. There are 28 plant species that appear on the CDC red-list and 37 that occur on the blue-list of rare vascular plant species within the ICH subzone of the Arrow Forest District (BC CDC 2008, Appendix 3).

This list was further examined to determine if the listed plant species have the potential to occur within the ICHmw2 subzone. The examination revealed that none of the listed species or genera of the listed species have significant potential to occur within the study area, based on their distribution and habitat requirements.

3.3.3 First Nations Traditional Plant Use

A variety of plants have been identified as providing value to First Nations people. Indigenous peoples throughout BC have used plants for food, medicine, tools, transportation, and shelter (Davis 1993). Foods such as berries, roots, fruits, bark, shoots, leaves and lichens have been included in their diets for centuries. Plants also provide forage for the animals on which they hunted and relied on for meat. Table 5 outlines those species of importance that were observed or are likely to occur in the upland areas of these sites.

Table 5. Plant species found within the project area with traditional uses.

Common Name	Scientific Name	Use
Douglas-fir	*Pseudotsuga menziesii*	Medicinal tea, gum.
Saskatoon	*Amelanchier alnifolia*	Berries.
Paper birch	*Betlua papyrifera*	Sap used for medicine, bark used for baskets, cradles and canoes.
Trembling aspen	*Populus tremuloides*	Tent poles, deodorizer, absorbent material.
Hazelnut	*Corylus cornuta*	Food source - nuts.
Black cottonwood	*Populus balsamifira*	Canoes and fire sets.
Hookers thistles	*Cirsium hookerianum*	Vegetable.
Oregon grape	*Mahonia aquifolium*	Berries, flavour, jelly, beneficial to blood.
Red osier dogwood	*Cornus sericea*	Smoked for lung disease
False solomons seal	*Smilacina racemosa*	Berries, sweetener or flavouring.
High bush cranberry	*Viburnum edule*	Berries.
Wild raspberry	*Rubus idaeus*	Popular berry.
Soapberry	*Sherperdia canadensis*	Confection, ailments, trade item.

Wild strawberry	*Fragaria virginiana*	Berries.
Thimbleberry	*Rubus parviflorus*	Berries.
Chokecherry	*Prunus virginiana*	Berries.
Common juniper	*Juniperus communis*	Medicinal tea, cleaner, deodorizer.

4.0 NORTH NAKUSP SITE

4.1 Fish and Fish Habitat

Located 0.6 km to the south of the proposed boat ramp location is Kukunax Creek which is known to support populations of Kokanee, rainbow trout and bull trout (FISS 2007). Given the location of this proposed ramp, the fish habitat provided by Kuskunax Creek and its fan will not be impacted. No other unnamed or unnmaped drainages were observed in the vicinity of this location.

The lakebed substrates in the area of the proposed boat ramp extension were observed to be primarily composed of cobbles and gravels with areas of fines (Appendix 1; Plate 2). The fine substrates do not provide adequate rearing or spawning habitat for most species in the lake. The cobbles and gravels may provide some interstitial space and potential spawning substrate as they did not appear to be highly compacted (Appendix 1; Plate 4. There was little aquatic vegetation but some LWD was found north of the berm. The deeper water depth does provide cover for fish species in the area.

The area that is proposed for the ramp construction is not likely to provide habitat for prickly sculpin as they have shown some affinity for shallow muddy inlets and bays (Northcote undated). The substrates may provide habitat for burbot, rainbow trout, bull trout and Kokanee although they are usually found in deeper cooler waters and more closely associated with some form of cover.

4.2 Wildlife and Wildlife Habitat

During the field assessment, a few deer tracks were observed in the fine substrates near the high water mark. Killdeer, Canada geese, tree swallows, and kinglets were observed around the upland area where there are some suitable nesting sites provided by the vegetation bordering the old mill site (Appendix 1; Plate 5). Waterfowl were observed along the shorelines just south of the existing berm. Although not observed, it is likely that other songbirds, small mammals, amphibians, and reptiles, and ungulates utilize this area.

The construction of a boat ramp in this location would not affect the already developed upland area. Minimal clearing would be necessary to facilitate the construction of the ramp and associated parking areas as per the conceptual design drawings (Moffat & Nichol Drawing No. 6537-200). The noise of construction may temporarily displace wildlife from this area and therefore, critical periods such as nesting should be avoided. If clearing is to occur, critical periods such as nesting (May 1 to July 31st) are to be avoided. A nest survey may be conducted prior to construction and if no nests are found, then clearing could proceed outside of this window.

While this area may be used by a variety of species, the habitat is not deemed critical and is not limited upon the landscape. A further review of these listed wildlife species and their habitat requirements are not required. Of the SARA species listed in Table 1, none of them are likely to be affected if boat ramp construction occurs at this location. In addition, critical habitat for winged floater, great blue heron, western painted turtle, barn swallow, and the fringed myotis were not found at this project site.

4.3 Vegetation

Plant species observed at this location included: trembling aspen, ponderosa pine, paper birch, willow (sp), soopolallie, silky lupine, red-clover, kinnikinnick. Some horsetails were observed along the high water mark. The upland area had a westerly aspect (280 degrees) and the soils were shallow over bedrock. The vegetation in this area has been burned on different occasion from wildfires hence, the lack of mature trees and the present of a burned snag (Warren 2008). Given the disturbed nature of this area and plant species present, it does not represent a particular site series of the ICHmk2 subzone.

Minimal clearing of the vegetated upland area would be required for construction of a boat ramp in this location. Given the vegetation observed, no rare plant or plant communities or plants used by First Nations people would be impacted.

4.4 Potential Environmental Effects

The wildlife habitat and terrestrial habitat existing at this site are not deemed critical habitats and are not limited upon the landscape. Based on the proposed construction, these ecosystem components have been previously disturbed and are assigned an ESA rating of low.

The fish habitat present is assigned a Moderate ESA rating given that the substrate is suitable for rearing of juvenile trout and burbot. The proposed boat ramp is a double lane gravel filled berm (190 m long) with either a gravel or concrete slab surface with one turnaround area. In addition, the existing rubble mound breakwater will be extended by 90 m and another 200 m long breakwater will be required north of the ramp. The associated parking area required for this ramp would be 2400 m^2, with room to expand to twice that area.

Given the size of the ramp and breakwater required, the overall disturbance footprint below the high water mark is expected to be approximately 10,050 m^2. While the riprap berm and rubble mound breakwater will provide some interstitial space and cover for fish, it will also displace natural lakebed substrate. Given the size of the footprint, DFO will likely consider this a HADD and the project will need to be Authorized. If so, compensation may be required and further investigation into compensations options will be prepared and incorporated into the final design. Options may include the placement of LWD features into the riprap berm during construction to provide cover habitat at

varying water levels. Overall, this site is not preferred for construction given the design footprint.

This design and corresponding environmental information has been provided to DFO to provide comment but due to various constraints, the DFO is not reviewing conceptual projects solely for the purpose of providing advice or comments.

5.0 NAKUSP PUBLIC BEACH SITE

5.1 Fish and Fish Habitat

No streams or drainages were observed in close proximity to this site. The mouth of Kuskunax Creek is located 0.8 km to the northwest of the site and as such fish habitat in that stream would not be affect by construction at this site. The lakebed substrates in the area of the proposed boat ramp were observed to be primarily composed of silt and sands with a smaller component of cobbles and gravels (Appendix 1; Plate 8). Sand substrates in the beach area had been imported (Warren 2008). The fine substrates do not provide adequate rearing or spawning habitat for most species in the lake. No large boulders or LWD were visible that would provide cover habitat.

5.2 Wildlife and Wildlife Habitat

During the field assessment, little wildlife was observed. Songbirds were evident within the upland shrubs and although not observed, it is possible that other songbirds, small mammals, amphibians, and reptiles utilize this area. This area is frequently used by humans and as such its usage by wildlife may be sporadic.

While this area may be used by a variety of species, the habitat is not deemed critical and is not limited upon the landscape. A further review of these listed wildlife species and their habitat requirements are not required. Of the SARA species listed in Table 1, none of them are likely to be affected if boat ramp construction occurs at this location. In addition, critical habitat for winged floater, great blue heron, western painted turtle, barn swallow, and the fringed myotis were not found at this project site.

Construction may temporarily displace wildlife from this area and therefore, critical periods such as nesting should be avoided.

5.3 Vegetation

The vegetated upland areas surrounding this location have been highly disturbed (Appendix 1; Plate 9). Landscaping has been completed and thus no natural representatives of the ecosystems found in the ICHmk2 are found here. No rare plant or plant communities or plants used by First Nations people would be impacted if construction was to occur at this site.

5.4 Potential Environmental Effects

While fish habitat, wildlife habitat and terrestrial habitat do exist within the vicinity of the boat launch, no critical habitats are present and the habitat present is not limited upon the landscape. Thus these habitats are assigned a low ESA rating.

The conceptual plans for the proposed construction of a new ramp at this location are similar to those proposed at the North Site. However, no rubble mound breakwaters will be required, therefore reducing the overall footprint. The overall footprint for this option is 4800 m^2. The lakebed substrate is predominantly fines and the increase of larger boulders into this area may provide more suitable fish habitat in the immediately area. Given the disturbance footprint, DFO will likely need to authorize this project and may require compensation. If so, compensation may be required and further investigation into compensations options will be prepared and incorporated into the final design. Options may include the placement of LWD features into the riprap berm during construction to provide cover habitat at varying water levels. Overall, construction at this site is feasible given that there should be no significant unmitigable impacts to fish habitat.

This design and corresponding environmental information has been provided to DFO to provide comment but due to various constraints, the DFO is not reviewing conceptual projects solely for the purpose of providing advice or comments. It is anticipated that, based on conceptual design, that no significant unmitigable affects would occur as a result of the construction of this boat ramp. An appropriate Environmental Management Plan would be required for submission to the agencies prior to construction.

6.0 EXISTING NAKUSP BOAT LAUNCH RAMP SITE

6.1 Fish and Fish Habitat

No mapped or named streams are located in the vicinity of the existing ramp. During the pre-field review, a small mapped drainage was observed just to the north of the existing ramp however, the mouth of the stream was not shown. This drainage may flow into the Village and be divert and piped as storm water. A culvert was observed immediately east of the ramp with a riprap channel downslope of the outlet. This drainage did not have flow at the time of the assessment. The riprap channel does provide fish habitat during higher reservoir levels (Appendix 1; Plate 13). In addition, a smaller seepage was observed east of the ramp and a larger drainage was observed 30 m east of the ramp.

The lakebed substrates in the area of the existing ramp were observed to be primarily composed of silt and sands with a smaller component of cobbles and gravels (Appendix 1; Plates 16 and 17). The fine substrates do not provide adequate rearing or spawning habitat for most species in the lake. There was little aquatic vegetation and LWD found surrounding the boat launch, therefore little shelter or forage opportunities are available to fish. There are more cobbles and gravels and vegetation present closer to the high water mark.

The area that will be used for the ramp extension may provide some habitat for prickly sculpin as they have shown some affinity for shallow muddy inlets and bays (Northcote undated). Burbot are not usually found where the bottom substrate is predominantly sand or silt and rainbow trout, bull trout and Kokanee would be found in deeper cooler waters and more closely associated with some form of cover. The fine substrate likely provides habitat for a variety of aquatic invertebrates.

The existing ramp is 73 m long and 7.33 m wide. It is supported by approximately 154 timber piles that are 40 cm in diameter covering approximately 14 m^2 of lakebed. The inner piles are treated but the outer most timber piles are non-treated.

6.2 Wildlife and Wildlife Habitat

During the field assessment, several songbirds and waterfowl were observed near the existing boat launch. American coots, a horned grebe, tree swallows, Canada geese, chickadees and robins were noted (Appendix 1; Plate 15). In addition, several garter snakes were observed amongst the riprap along the drainage channel by other members of the assessment team. Although not observed, it is likely that other songbirds, small mammals, amphibians, and reptiles utilize this area or are occasionally visitors within the habitat provided.

Neither of the three options considered for this location would affect the already developed upland area. Some minor clearing of shrubs immediately east of the existing

ramp may be cleared if the rock filled ramp option is selected. If clearing is to occur, critical periods such as nesting (May 1 to July 31st) are to be avoided. A nest survey may be conducted prior to construction and if no nests are found, then clearing could proceed outside of this window.

While this area may be used by a variety of species, the habitat is not deemed critical and is not limited upon the landscape. A further review of these listed wildlife species and their habitat requirements are not required. In addition, of the SARA species listed in Table 1, none of them are likely to be affected by the construction.

6.3 Vegetation

The upland vegetation at this location was limited. Willows, hawthorn, alder, and grasses were observed. Since this area has been very disturbed and is susceptible to fluctuations in water levels in the reservoir, it can not be described by any natural plant community found within the ICHmw2. Due to the limited vegetation present and lake of naturally occurring ecosystems, no rare plant or plant communities would be impacted if construction was to occur at this site. While these species have been identified as being used by First Nations, it is unlikely that these are utilized today.

Overall, some disturbance to the shrubs immediately east of the existing ramp may occur if the rock filled ramp option is selected (Appendix 1; Plate 11 and 14). The riparian vegetation along the drainage adjacent to the boat ramp is non-existent, therefore, will not be affected during construction.

6.4 Potential Environmental Effects

While fish habitat, wildlife habitat and terrestrial habitat do exist within the vicinity of the boat launch, no critical habitats are present and the habitat present is not limited upon the landscape. Thus these habitats are assigned a low ESA rating.

Three potential ramp options have been proposed for this location. Option 1 is to retained the existing timber structure but add a turnaround midway down the ramp. Option 2 is to remove existing structure and replace with a 3-lane ramp comprised of steel piles and concrete decking. Option 3 is to remove existing structure and replace it with a 3-lane large rock fill ramp with concrete slabs on the surface. Of these, Option 2 would provide the is the preferred option.

Option 1 is viable as little lakebed area would be required to install the piles necessary for the turnaround. However, given that the original structure contains treated piles that will require replacement at some time and that only one lane would be provided for users, this option may not be selected.

Option 3 requires the greatest disturbance footprint. In total, the rock fill ramp would displace 6400 m^2 of lakebed habitat. While the riprap used along the outer edge may

provide more suitable cover from interstitial space, it would also fill in the vegetation located near the high reservoir level immediately east of the existing ramp. This vegetation can provide habitat for reptiles and other wildlife at lower water levels.

Option 2 is the preferred method as it provides a compromise between providing the Village with a suitably sized structure and a disturbance footprint similar to the existing conditions. This option will remove all of the timber piles which currently occupy 14 m^2 of lakebed. The new steel piles would occupy approximately 11 m^2 of lakebed. Also, this option would require minimal vegetation clearing and would not impact the riprap associated with the drainage channel. This option would however cover this area that is known to provide habitat for reptiles which may sun themselves on the rocky surface.

Given the disturbance footprint of Option 2, DFO may not need to authorize this project. However, if Option 3 is selected, they may choose to authorize it. If so, compensation may be required and further investigation into compensations options will be prepared and incorporated into the final design. Options may include the placement of LWD features into the riprap berm during construction to provide cover habitat at varying water levels.

This design and corresponding environmental information has been provided to DFO to provide comment but due to various constraints, the DFO is not reviewing conceptual projects solely for the purpose of providing advice or comments.

7.0 SOUTH NAKUSP SITE

7.1 Fish and Fish Habitat

A small stream was observed at this site location. No historical fish information for this stream was found, however, mapping indicates that it is a second order, 1 km long stream (NRIC 2008). Several culverts are known to occur on this stream however, the stream section below Highway 6 is considered fish bearing as no barriers to upstream migration were observed. The average channel width was 1.5 m and channel substrates primarily fines with occasional gravels and cobbles. Riparian vegetation was limited to grasses within the drawdown zone. The stream creates a small wetland area between the road and the high water mark which contained abundant cattails and was surrounding by willows, alders, and skunk cabbage (Appendix 1; Plate 21). Fish species which may utilize this stream include largescale sucker and rainbow trout. Historically, both of these species were sampled in Nakusp Creek (WSC: 300-706100) which is located 980 m south of this site.

The lakebed substrates in the area of the proposed boat ramp location were observed to be primarily composed of silt and sands with a smaller component of cobbles and gravels (Appendix 1; Plate 27). The fine substrates do not provide adequate rearing or spawning habitat for most species in the lake and limited cover was observed. Some cover would be provided at higher water levels by the small stumps of smaller trees observed upslope of the existing water level.

7.2 Wildlife and Wildlife Habitat

During the field assessment, abundant deer tracks, American coot, tree swallow, white crowed sparrow, house wren, hummingbird (sp?), red-breasted nuthatch, pine siskin, Canada geese, black-capped chickadee, western garter snake and American robin were observed (Appendix 1; Plates 23 and 25). It is likely that other songbirds, small mammals, amphibians, reptiles, and ungulates also utilize this area.

The island designated as a wildlife refuge was not an “island” at the time of the assessment. Due to the reservoir levels, the upland vegetation and island were connected and areas inundated by water during the summer months were now available as nesting and foraging areas for several species. Significant clearing of upland vegetation and conversion of the grass land area would be required to facilitate a boat ramp at this location.

Given that this area provides a small area of contiguous habitat at lower reservoir levels, which are limited within the Village boundaries. It has the potential to be utilized by great blue heron, western painted turtle, and the fringed myotis. While these species were not observed during the assessed, the habitat is similar to those required by these species. The potential of this area to be utilized cannot be ruled out.

7.3 Vegetation

The vegetated areas are fairly moist and as such the vegetation included Western cedar, young Douglas fir, trembling aspen, black cottonwood, paper birch, skunk cabbage, abundant willow, alder, nootka rose, and cattails. Scotch broom was also observed on the island, which is considered an invasive species in this region but is often introduced into natural ecosystems from ornamental plantings (Cranston *et al*. 2002).

The vegetation present can be found within several of the site series present within the ICHmw2. It is difficult to determine the plant community that best represents this area given that portions of the area are inundated by reservoir levels during the summer. However, given that skunk cabbage is present and the soils are hygric, it may be the western redcedar - hybrid white spruce / skunk cabbage (ICHmw2/08) site series which is yellow-listed. Yellow-listed communities can occur when there is poor representation of mature natural examples of subzones in protected areas and there has been substantial modification of existing areas. Having a yellow-listed plant community in this area does not mean that development cannot occur in this area; however, attempts should be made to avoid its disturbance.

Other vegetation communities of particular importance and sensitivity include riparian communities, which are not described in the site identification field guide, but typically have high wildlife values and are sensitive to disturbance. The riparian vegetation along the drainage is important for maintaining water quality and quantity within the stream and a 15 m wide riparian buffer would be proposed.

7.4 Potential Environmental Effects

Fish and wildlife habitat are more readily available at this site compared to the other three locations. The upland area provides not only wetland habitat for a variety of species, it also provide water storage to assist with water quality entering the lake from upslope. While the habitat may not be critical for any listed species, it does provide habitat within the Village boundary which has not yet been disturbed and therefore these habitats are assigned a high ESA rating.

Given both the archeological and environmental constraints found at this location, a ramp was not proposed at this location. However, a proposed boat launch ramp design was provided on the basis that the private property located immediately south of the surveyed crown land may become available for use.

The upland area on the private property is already developed. A few scattered cottonwoods and shrubs were observed but otherwise the remaining area is paved. The lakebed substrate where the proposed ramp is located is primarily fines and sands which would not provide suitable habitat for many species in the Arrow Lakes. The rock filled berm with riprap along the edges would actually provide cover for fish in the immediate area. Given that approximately 2580 m^2 of lakebed habitat would be covered by the

ramp, DFO may need to authorize this project as a HADD would occur. If so, compensation may be required and further investigation into compensations options will be prepared and incorporated into the final design. Options may include the placement of LWD features into the riprap berm during construction to provide cover habitat at varying water levels.

This design and corresponding environmental information has been provided to DFO to provide comment but due to various constraints, the DFO is not reviewing conceptual projects solely for the purpose of providing advice or comments. It is anticipated that, based on conceptual design, that no significant unmitigable affects would occur as a result of the construction of this boat ramp.

8.0 MITIGATIVE MEASURES, GUIDELINES AND RECOMMENDATIONS

The purpose of an Environmental Management Plan (EMP) is to identify the components of a project with may impact identified ecosystem components (see previous sections). It shall be used as a guide by all parties associated with the construction process to ensure best management practices are followed and negative impacts to the environment are nil. A specific EMP was not required at this time as no work is scheduled to occur until a decision has been made as to the design option most feasibility to the Village of Nakusp. However, general measures have been provided to guide future EMP development.

Potential impacts from the extension of an existing boat ramp or the construction of a new ramp are expected to be minimal and should be easily avoided and/or mitigated. The primary potential impact is the introduction and/or mobilization of deleterious substances into the lake habitat during construction. This may include the following:

- sediment mobilization during excavation of the lakebed in preparation for the installation of the concrete slab;
- oil/fuel spills to occur both on the soils surrounding the work area and into the water;
- disturbance to fish during pile driving operations;
- leaching of grouting materials, waste water or concrete slurry into the water if concrete poured on site; and
- erosion of exposed soils and transport into waterways.

The intent of any EMP is to limit the suspended sediment discharged from the site to within 25 mg/l under normal conditions and 75 mg/l during storm events, which is consistent with the recommendations in the *Land Development Guidelines for the Protection of Aquatic Habitat* (Chilibeck 1993). The general approach to meet the criteria will be to ensure construction works occur in the dry, isolate any sediment-laden water from the lake, minimize surface erosion, and minimize the size of disturbed areas.

8.1 Mitigative Measures

General mitigative measures that are recommended during the course of construction at any boat ramp location include the following:

1. Construction should be completed within the lowest reservoir water levels, which usually occur between late-April and early May. The lowest water levels in the Mid-Columbia reach also occur in early May but the operators at the Revelstoke Dam may be contacted to determine the best time for construction. This will help ensure that the work is completed in the "dry". If water levels begin to increase during the construction, an isolation fence or berm must be constructed to keep water out of the work site.

2. Isolation fences can be installed using a variety of materials. Concrete lock blocks can be placed and will provide a level of isolation. Also, a section of filter fabric with a sheet of heavy gauge polyethylene plastic, as a liner would be laid on the lakebed, the sandbags placed on top, and the fabric wrapped over the sandbags to create an impermeable barrier. Other materials such as rebar, hay bales and silt fencing can be combined to create an isolation fence. The availability of materials, site conditions, and access to the site will determine the type of fence constructed. Disturbed sediment within the construction site will be allowed to settle out prior to removal of the enclosure.

3. With most isolation features, some degree of seepage should be expected. If this does occur, any sediment-laden water that is created should be retained in the isolation area. If necessary, the turbid water can be pumped out of the area by a vacuum truck. If water is present within the work area, a fish salvage using an electrofisher should be completed prior to the beginning of works to prevent potential injury to fish.

4. Pre-cast concrete slabs are to be used in remote areas and in areas near the water. If a cast-in place concrete slabs are to be used, it is very important that no concrete or grouts enter the water as the leachate is toxic and is considered a deleterious substance. To prevent this, the work area should be isolated from the water with a waterproof barrier such as polyethylene sheets or sealed coffer dams. These should remain in place during the curing period (at least 72 hours) (MOT 2004). Monitoring of the pH frequently in the watercourse immediately downstream of the isolated worksite will be required until completion of the works. Emergency measures will be implemented if downstream pH has changed more than 1.0 pH unit from the background level, or is below 6.0 or above 9.0 pH units (MWLAP 2004). Keep a carbon dioxide (CO_2) tank with regulator, hose and gas diffuser readily available during concrete work as it can be used to neutralize pH levels if a spill occurs.

5. Pile driving may be required depending on option selected. Pile driving does not usually cause enough disturbance to the stream/lake bed to cause the mobilization of any significant amount of sediment. It is recommended that pre-cast concrete or steel piles are used instead of treated wooden pilings. Untreated wooden piling may also be used however, they will require more maintenance than steel piles (MOE 2006). Steel piles should be used instead of treated timber piles as DFO does not recommended the used of treated lumber due to the potential for leaching of contaminants into the water (DFO 2007).

6. It is recommended that pile driving be completed using a drop hammer or at a minimum, a bio-fueled diesel hammer. While pile driving may have as some impact on the fish in the immediate vicinity, a 3000 lb drop hammer will not produce a large concussive force, therefore the effects will be localized. A 10 m^2 zone around each pier can be isolated by seine nets to reduce any potential

impacts to fish within the zone of influence. It is unlikely that fish will be present within the pile driving area as this should be completed in the dry.

7. If there is surface flow at the time of construction, it will be necessary to dewater the work area. To facilitate pumping, a sump would need to be excavated in the drainage upstream of the work area as there is no well defined channel to dam, and the flow pumped out of the sump and into the bush for natural filtration. Once the water in the sump has clarified, the flows should be pumped around the work area and discharged directly back into the lake.

8. As heavy equipment activity will occur in close proximity to the lakeshore or other streams, the equipment should be inspected to ensure it is clean, in good working order and free of any fluid leaks or excess grease. Equipment that uses synthetic biodegradable hydraulic fluid oil would be preferred. The environmental monitor should inspect the equipment for leaks and the operator should be asked to comment on the condition of the hydraulic lines. A spill kit should be present on any machinery working on this project.

9. Excavated material should be placed on level ground, away from any concentrated flows. Stockpiled materials can be covered with polyethylene tarps, or silt fences may be placed around the perimeter of the pile if excessive erosion occurs that results in sediment laden water being transported off the site.

10. In order to minimize tracking dirt onto the access roads, gravel pads should be maintained at access points. If necessary these pads can be modified to function as active (pressure wash) or passive (wet trench) wash stations. This may only apply to the Centennial Park site to prevent the tracking of dirt onto the City's streets.

Other general mitigative measures may include but not be limited to:

- Flagging or otherwise delineating the limits of disturbance prior to initiating construction;
- A daily tailgate meeting to review environmental objectives and procedures with the construction supervisor and crew;
- If rocks, stumps or logs need to be moved from the lakebed to build the ramp, they should be relocated to an area of similar depth and not removed from the site;
- Ensuring that a spill kit is present on-site;
- Ensuring there are no fuel or fluid leaks from equipment;
- Prohibiting refueling or fuel storage within 20 m of waterbodies;
- Minimize unnecessary clearing; and
- Avoid working during heavy or prolonged rains

8.2 Monitoring Requirements

A suitably qualified professional should be retained as an environmental monitor during the construction process. The monitor should be on site prior to the start of the project to ensure all parties are aware and familiar with the EMP, during all phases of the construction that are in the wetted area, during significant weather events, and at completion to ensure site is left stable and environmentally sound.

Activities with associated environmental monitoring responsibilities can include:

- Installation of isolation structures at site to prevent mobilization of any sediment-laden water;
- Thoroughly monitoring machinery before and during works to ensure no hydraulic fluid leaks;
- Fish salvage within isolation area;
- Monitoring of water quality to ensure no sediment is mobilized during construction;
- Ensuring no concrete leachate or slurry enters the water and monitoring of water pH levels;
- Construction and decommissioning of any isolation structures; and
- Mitigation activities (*e.g*. erosion and sediment control measures).

Additional monitoring requirements may be outlined in the Letter of Advice or Authorization issued by DFO. The monitor will complete daily environmental monitoring reports which will accurately document the daily activities and any problems/solutions that were managed on site. A post-construction monitoring will be completed and submitted to both BC Hydro and the appropriate agencies.

8.3 Timing Windows

In addition to the low water levels required, the timing of construction is also potentially limited by the Periods of Least Risk for Instream Works (MOE 2007c). Based on the presence of bull trout, rainbow trout, Kokanee, and burbot in the ALR, the instream work window is July 15 to August 15th. Since this timeframe corresponds with higher water levels not suitable for construction, a variance must be obtained from MOE prior to construction (Section 4.1.2).

It is advised that if clearing of the upland area is required, operations such as brushing and mowing, should not be conducted in the spring or early summer when birds are nesting. Work areas should be thoroughly inspected for occupied bird nests, eggs or nests of species protected under the Wildlife Act and Migratory Bird Convention Act (MOT 2004).

8.4 Permitting Requirements

If during construction, an isolation fence is required, a fish salvage should be conducted. A fish collection permit for fish salvage must be obtained from MOE.

Since all construction must occur during low water levels, the timing of these works will be outside of the instream work window and a variance from MOE will be required. In order to satisfy MOE requirements for granting a variance, the basic requirements include:

1. Justification for why the works need to be conducted outside of the default instream work window;
2. Demonstration that fish passage will be maintained to accommodate fish migration to or from spawning areas; and
3. A sediment management plan that minimizes the potential for sediment release.

This feasibility study and a site specific EMP should provide MOE with the required information to grant a variance.

Depending on whether the boat launch ramp is a newly constructed feature or if it is an extension/upgrade of an existing, a Water Act *Notification* or *Approval* form is required for submission to the Ministry of Environment. This feasibility study along with the *Approval* or *Notification* form should also be forwarded to the local DFO office (Nelson, BC) for their review prior to construction. Normally the conversion of lakebed habitat to a hard surface (*i.e.* concrete) would constitute a Harmful Alteration, Disruption or Disturbance (HADD) under section 35(2) of the Federal Fisheries Act. DFO will determine if the project can proceed under a Letter of Advice (which approves the project without legal requirements for reporting or monitoring) or an Authorization (which may require legal compensation, post-construction monitoring, and reporting requirements).

Also, depending on which option is selected, Transport Canada will also require notification. If the project is an alteration of an existing boat ramp, Transport Canada does not usually require further regulatory interest in the project and it can proceed as necessary (Mackie 2007).

9.0 SUMMARY

Given the environmental conditions at each of the four locations, it is recommended that Option 2 be selected at the existing Nakusp boat launch site. This site has an existing disturbance footprint and the conceptual design of Option 2 will possibly reduce the direct impact on the lakebed. However, given the high cost associated with Option 2, the Village of Nakusp is more likely to select Option 3 or 4 (rock filled berm).

The Nakusp North site is not recommended based on the available fish habitat provide by the lakebed substrates in that area and the significant footprint that would occur as a result of the rock filled ramp. The Public Beach site is a potential option as it does not require a breakwater, the upland area is already disturbed and the lakebed substrates are predominately fines which provide marginal fish habitat. The Nakusp South site contains viable fish habitat and significant wildlife habitat potential which is limited within the Village boundaries. However, the conceptual boat ramp location proposed on private land does not have any environmental sensitivies.

All options will be brought forth at the upcoming public meeting. However, based on the results of the discussion held after the feasibility study presentation to members of the Village Council, it is likely that Options 3 or 4 at the existing site will be selected.

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APPENDIX 1

REPORT PHOTOGRAPHS

Nakusp North Site

Plate 1. Looking west along berm created at Nakusp North site.

Plate 2. Looking west towards end of berm. Substrate here is larger and provides fish habitat.

Plate 3. South side of berm and likely excavated area.

Plate 4. Example of substrate located on shoreline north of existing berm.

Plate 5. Wildlife tree observed in upland area.

Plate 6. View of upland area. Heavily disturbed from development.

Public Beach Site

Plate 7. Looking southwest from public beach to Arrow Lake.

Plate 8. View of substrate at public beach site. Note shallow water depths extending from shoreline.

Plate 9. Upland view at public beach. Majority of vegetation is landscape and no critical wildlife habitat is provided.

Existing Boat Launch Site

Plate 10. Looking south down existing boat ramp at Nakusp.

Plate 11. Looking north at existing boat ramp at Nakusp.

Plate 12. Treated timber piles used on inside of bridge but outside edge piles are untreated.

Plate 13. View of the storm drain outlet at existing Nakusp boat ramp.

Plate 14. Looking northwest along old road bed towards existing ramp.

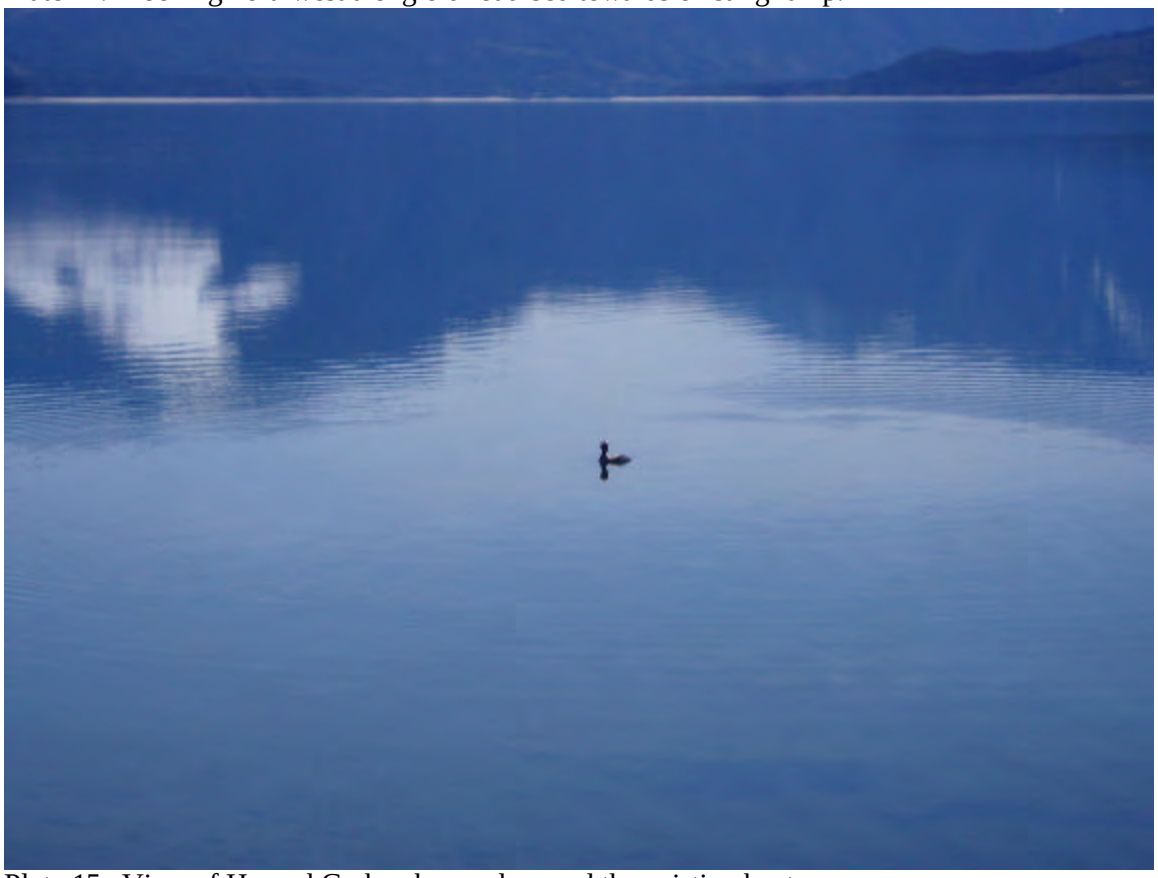

Plate 15. View of Horned Grebe observed around the existing boat ramp.

Plate 16. View of the substrate along shoreline adjacent to the existing ramp.

Plate 17. View of the lakebed at the existing boat ramp site in Nakusp.

Nakusp South Site

Plate 18. Looking west towards the informal boat ramp south of Nakusp (private property).

Plate 19. View of the potential boat launch area at Nakusp South site (private property).

Plate 20. Looking east towards upland area north of unnamed stream.

Plate 21. Upstream view of the unnamed stream north of Pope and Talbot office.

Plate 22. Looking downstream along unnamed stream located north of Pope and Talbot office.

Plate 23. White crowned sparrow observed in Wildlife Refuge area.

Plate 24. Downslope view of existing walkway floats and piles.

Plate 25. Garter snake observed in upland area above potential launch site at Nakusp South site.

Plate 26. View of disturbed upland area at Nakusp South site.

Plate 27. Lakebed substrates at proposed site location.

APPENDIX 2

SARA SPECIES LIST
(not including marine species)

Table 6. Schedule 1 species listed as extirpated, previously known to occur within British Columbia, and their accepted range within British Columbia.

Species	Category	Historical range within British Columbia[1]	Potential for habitat to occur in vicinity of project
Sage grouse (BC population)	Bird	Occurred in Okanagan and Similkameen valleys.	No
Pacific gopher snake	Reptile	Two historical (over 50 years ago) sightings in grasslands (southern BC).	No
Pygmy short-horned lizard (BC population)	Reptile	Two historical records from Okanagan Valley.	No
Pacific pond turtle	Reptile	Common in ponds and lakes of southern BC and Vancouver Island in the mid-1800s (no sightings Canada since 1959).	No
Island marble	Arthropod	Historically found on Gabriola and Vancouver islands.	No
Puget Oregonian snail	Molluscs	Extreme southwestern BC. Most recent record in Canada from 1905.	No

[1] Species range taken from Environment Canada (2007), except where otherwise noted.

Table 7. Schedule 1 species listed as endangered that are known to occur within British Columbia, and their accepted range within British Columbia.

Species	Category	Range within British Columbia[1]	Potential for species to occur in vicinity of project
American badger (*jeffersonii* subspecies)	Mammal	Southeastern BC (south of Quesnel).	**YES**
Vancouver Island marmot	Mammal	Vancouver Island.	No
Townsend's mole	Mammal	Restricted to about 20 km^2 in the central Fraser Valley.	No
Horned Lark	Bird	Coastal BC and lower Fraser Valley	No
Williamson's Sapsucker	Bird	Lytton, Cache Creek area south to Manning Park.	No
Yellow breasted chat (*auricollis* subspecies)	Bird	Okanagan.	No
Western Screech Owl	Bird	Coastal BC and Okanagan Valley.	**YES**
Spotted owl (*caurina* subspecies)	Bird	Southwestern British Columbia.	No
Burrowing owl	Bird	A few in south-central BC. Requires treeless plains.	No
Sage thrasher	Bird	Extreme south-central BC.	No
White-headed woodpecker	Bird	Extreme south-central BC.	No
Nightsnake	Reptile	Extreme south-central BC.	No
Sharp-tailed snake	Reptile	Gulf Islands and southeastern Vancouver Island.	No
Oregon spotted frog	Amphibian	Lower Fraser River Valley[2]	No
Northern leopard frog (southern mountain population)	Amphibian	Extreme southeastern BC.	No
Tiger salamander	Amphibian	Extreme south-central BC.	No
Rocky Mountain tailed frog (southern mountain population)	Amphibian	East Kootenays of extreme southern British Columbia.	No
Nooksack dace	Fish	4 small streams tributary to the Nooksack River in the Abbotsford, Aldergrove and Clearbrook areas of the lower Fraser Valley.	No
Morrison Creek lamprey	Fish	Morrison Creek watershed (Vancouver Island).	No
White Sturgeon	Fish	Nechako River Population	No
Stickleback (Enos and Paxton Lakes, and Vananda Creek populations)	Fish	Vancouver Island (Enos Lake), Texada Island (Paxton Lake and Vananda Creek).	No
Salish sucker	Fish	Nine populations in four creek drainages in the lower Fraser Valley.	No
Island blue	Arthropod	Vancouver Island.	No
Taylor's checkerspot	Arthropod	Vancouver Island.	No
Sand verbera moth	Arthropod	Coastal areas – Strait of Georgia.	No
Mormon metalmark (southern mountain	Arthropod	Okanagan.	No

Species	Category	Range within British Columbia[1]	Potential for species to occur in vicinity of project
population)			
Oregon forestsnail	Mollusc	Extreme southwestern BC.	No
Hotwater physa	Mollusc	Liard River hotsprings.	No
Scarlet ammannia	Vascular Plant	Osoyoos Lake area of south-central BC.	No
Spadling's campion	Vascular Plant	Southeastern BC.	No
Slender collomia	Vascular Plant	Single site near Princeton BC.	No
Deltoid balsamroot	Vascular Plant	Vancouver Island.	No
Tall bugbane	Vascular Plant	Chilliwack River Valley.	No
Water-plantain buttercup	Vascular Plant	Vancouver Island.	No
Coastal Scouler's catchfly	Vascular Plant	Limited to three small islands close to Victoria on Vancouver Island.	No
Southern maidenhair fern	Vascular Plant	Fairmont Hot Springs (southeastern British Columbia).	No
Small-flowered lipocarpha	Vascular Plant	BC southern border is the northern limit.	No
Seaside birds-foot lotus	Vascular Plant	Southern tip of Vancouver Island.	No
Prairie lupine	Vascular Plant	Southern tip of Vancouver Island.	No
Streambank lupine	Vascular Plant	Southwestern corner of BC (lower Fraser Valley and Vancouver Island).	No
Bearded owl-clover	Vascular Plant	Southern tip of Vancouver Island.	No
Golden paintbrush	Vascular Plant	Southern tip of Vancouver Island.	No
Kellogg's rush	Vascular Plant	Southeastern Vancouver Island.	No
Bear's-foot sanicle	Vascular Plant	Southern tip of Vancouver Island.	No
Toothcup	Vascular Plant	Along Kamloops and Osoyoos lakes.	No
Howell's triteleia	Vascular Plant	Southeastern Vancouver Island.	No
Tall woolly-heads	Vascular Plant	Southern Vancouver Island.	No
Margined streamside moss	Moss	Kootenay region, along southern border.	No
Poor pocket moss	Moss	North Vancouver.	No
Rigid apple moss	Moss	Eastern Vancouver Island and on some of the adjacent Gulf Islands.	No
Rusty cord moss	Moss	Four sites- closest is North-east of Kamloops. Alkaline wetlands.	No
Silver hair moss	Moss	Sumas Mountain (east of Abbotsford).	No
Seaside centipede	Lichen	Two locations on the west coast of Vancouver Island (Ucluth Peninsula and Schooner Cove).	No

[1] Species range taken from Environment Canada (2007), except where otherwise noted.

[2] Species range taken from Matsuda *et al.* (2006)

Table 8. Schedule 1 species listed as threatened that are known to occur within British Columbia, and their accepted range within British Columbia.

Species	Category	Range within British Columbia[1]	Potential for species to occur in vicinity of project
Pallid bat	Mammal	Okanagan Valley.	No
Wood bison	Mammal	Northeastern BC.	No
Woodland caribou (boreal population)	Mammal	Northeastern BC.	No
Woodland Caribou (Southern Mountain population)	Mammal	CENTRAL BC.	**YES**
Ermine (*haidarum* subspecies)	Mammal	Queen Charlotte Islands	No
Pacific water shrew	Mammal	Lower Mainland of southwestern BC.	No
Peregrine falcon (*anatum* subspecies)	Bird	Southwestern and west-central BC.	No
Northern goshawk (*laingi* subspecies)	Bird	Queen Charlotte Islands	No
Marbled murrelet	Bird	Coastal BC (up to 75 km inland).	No
Great Basin gophersnake	Reptile	Southern BC. Okanagan primarily.	No
Western rattlesnake	Reptile	Southern BC, north to Cache Creek.	No
Coastal giant salamander	Amphibian	Chilliwack River Valley.	No
Great Basin spadefoot	Amphibian	Dry valleys of southern interior BC (especially the Okanagan Valley).	No
Vancouver Lamprey	Fish	Southern Vancouver Island.[2]	No
Cultus pygmy sculpin	Fish	Cultus Lake (Lower Mainland)	No
Shorthead sculpin	Fish	Southeast BC (Columbia River Basin).	**YES**
Behr's hairstreak	Arthropod	Southern Okanagan Valley.	No
Dun skipper	Arthropod	Southwestern BC including Vancouver Island.	No
Dromedary jumping-slug	Molluscs	Southern and western Vancouver Island.	No
White-top aster	Vascular Plant	Southern Vancouver Island.	No
Scouler's corydalis	Vascular Plant	Western Vancouver Island.	No
Lemmon's holly fern	Vascular Plant	Eastern side of the Okanagan Valley.	No
Lyall's mariposa lily	Vascular Plant	Between the Similkameen River and the Okanagan Valley (limited to a single height of land adjacent to the U.S. border).	No
Mexican mosquito-fern	Vascular Plant	South central BC.	No
Macoun's meadowfoam	Vascular Plant	Vancouver Island, not on mainland of BC.	No
Showy phlox	Vascular Plant	Most northern occurrence in BC is Summerland.	No
Cliff paintbrush	Vascular Plant	Southwest BC around Chilliwack and Skagit Rivers.	No

Species	Category	Range within British Columbia[1]	Potential for species to occur in vicinity of project
Phantom orchid	Vascular Plant	Extreme southwest of BC.	No
Purple sanicle	Vascular Plant	Southeastern Vancouver Island and the adjacent Gulf Islands.	No
Yellow montane violet	Vascular Plant	East coast of Vancouver Island and on Saltspring Island.	No
Alkaline wing-nerved moss	Moss	Southwest of Williams Lake, wet alkaline areas.	No
Haller's apple moss	Moss	East central BC (close proximity to Alberta border).	No

[1] Species range taken from Environment Canada (2007), except where otherwise noted.

[2] Species range taken from Froese and Pauly (2005).

Table 9. Schedule 1 species listed as special concern that are known to occur within British Columbia, and their accepted range within British Columbia.

Species	Category	Range within British Columbia[1]	Potential for species to occur in vicinity of project
Mountain beaver	Mammal	Extreme southwestern BC.	No
Woodland caribou (Northern Mountain population)	Mammal	Northern BC (north of Mackenzie).	No
Spotted Bat	Mammal	Okanagan, Chilcotin River and Williams Lake.	No
Long-billed curlew	Bird	South central British Columbia, but extending range into McBride, Prince George, and known to breed in the vicinity of Vanderhoof.[2]	No
Ancient murrelet	Bird	Coastal areas only.	No
Peregrine falcon (*pealei* subspecies)	Bird	Queen Charlotte Islands, northern Vancouver Island.	No
Barn owl	Bird	Extreme southern BC and west coast of southern Vancouver Island.	No
Flammulated owl	Bird	South central BC (south of Quesnel).	No
Yellow rail	Bird	Eastern BC.	No
Western screech owl (*kennicotti* subspecies)	Bird	Coast of BC, including Vancouver Island but excluding Queen Charlotte Islands.	No
Lewis's woodpecker	Bird	Most common in the Okanagan Valley and Thompson Basin areas.	No
Rubber boa	Reptile	Patchy distribution through major river basins in southern third of BC.	No
Western yellow-belly racer	Reptile	Hot and dry areas of the Okanagan and Similkameen.	No
Western skink	Reptile	Extreme southern portion of mainland BC.	**YES**
Coast tailed frog	Amphibian	Coastal mountain ranges in BC.	No

Red-legged frog	Amphibian	Vancouver Island, the Gulf Islands, the mainland adjacent to the Strait of Georgia, and through the Fraser Valley to Hope.	No
Couer d'Alene salamander	Amphibian	Southeastern edge of Kootenay Lake in Creston Valley, the Moyie River drainage and in the Columbia River drainage	**YES**
Western toad	Amphibian	Widespread across BC.[3]	**YES**
Columbia mottled sculpin	Fish	Columbia, Flathead, Similkameen and Kettle rivers.	No
Monarch	Arthropod	Southern BC.	No
Rocky Mountain ridged mussel	Arthropod	Southern BC, Columbia River System.	No
Warty jumping-slug	Mollusc	Southern Vancouver Island.	No
Vancouver Island beggarticks	Vascular Plant	Lower Fraser Valley and on southern Vancouver Island, with one additional record on the mainland coast of BC just north of Vancouver Island	No
Coastal wood fern	Vascular Plant	Southeastern Vancouver Island.	No
Columbia carpet moss	Moss	Bunchgrass BioGeozone of narrow valley in south-central part of BC.	No
Twisted oak moss	Moss	Coastal BC, Vancouver Island.	No
Banded cord moss	Moss	Southwestern coastal BC.	No

[1] Species range taken from Environment Canada (2007), except where otherwise noted.

[2] Species range taken from De Smet (1992). [3] Species range taken from Wind and Dupuis (2002).

APPENDIX 3

RARE PLANT SPECIES LIST

Scientific Name	English Name	BC Status	Biogeoclimatic zone
Agastache urticifolia	nettle-leaved giant-hyssop	Blue	BGxh;ESSFdc;ICHdw;ICHmk;ICHmw;IDFdm;IDFxh;MSxk;PPdh;PPxh
Agoseris lackschewitzii	pink agoseris	Blue	AT;ESSFmw;ESSFwc;ESSFwcp;ESSFxc;ICHmw;ICHwk;IDFdk;MSdm
Apocynum x *floribundum*	western dogbane	Blue	BGxh;BWBSdk;CWHdm;CWHxm;ICHmc;ICHmk;IDFdm;IDFww;IDFxh;IDFxm;PPxh;SBSwk
Arnica longifolia	seep-spring arnica	Blue	ICHvk
Aster ascendens	long-leaved aster	Red	ICHdw;IDFdm;SBSmc
Astragalus microcystis	least bladdery milk-vetch	Red	ICHdw
Astragalus vexilliflexus var. *vexilliflexus*	bent-flowered milk-vetch	Blue	BAFA;ESSFdk;ESSFdkp;ESSFmv;ICHmw;IMA
Bidens vulgata	tall beggarticks	Red	BGxh;ICHxw
Botrychium simplex	least moonwort	Blue	BWBSmw;CDFmm;CWHds;CWHxm;ICHmw;IDFxh;MSdk;SBPSxc
Carex adusta	lesser brown sedge	Red	ICHxw
Carex amplifolia	bigleaf sedge	Blue	CWHdm;ICHdw;ICHmw;ICHwk;IDFmw;IDFxh
Carex lenticularis var. *lenticularis*	lakeshore sedge	Red	CWHms;ESSFdk;ICHmk;ICHmw;IDFmw
Carex pedunculata	peduncled sedge	Blue	ICHmw;IDFmw;PPdh
Carex scoparia	pointed broom sedge	Blue	BWBSmw;CDFmm;CWHdm;CWHvh;CWHxm;ICHdw;ICHwk;ICHxw;SBSvk
Carex vulpinoidea	fox sedge	Blue	BGxh;CWHdm;CWHxm;ICHmw;ICHxw;IDFmw;IDFxh
Castilleja tenuis	hairy owl-clover	Red	ICHdw
Chenopodium atrovirens	dark lamb's-quarters	Red	ICHmk;IDFdm;IDFxh;IDFxw;MSxk;SBSdw
Clarkia rhomboidea	common clarkia	Red	ICHxw
Coreopsis tinctoria var. *atkinsoniana*	Atkinson's coreopsis	Red	BGxh;ICHdw
Crepis occidentalis ssp. *pumila*	western hawksbeard	Red	BGxh;ESSFmw;ICHdw;ICHmw
Cryptantha ambigua	obscure cryptantha	Blue	BGxh;BGxw;ICHmk;IDFdk;IDFdm;MSdk;MSxk;PPdh
Dicentra uniflora	steer's head	Blue	ESSFmw;ESSFwc;ICHdw;ICHmk;IDFdm;IDFww;IDFxh
Dryopteris cristata	crested wood fern	Blue	ICHdw;ICHmc;ICHmw;ICHvk;ICHwk;ICHxw;IDFmw;IDFxh;SBSmk
Eleocharis elliptica	Slender spike-rush	Blue	BAFA;ESSFdk;ESSFwc;ICHmw;ICHvk;ICHwk;IDFmw;IMA
Epilobium glaberrimum ssp. *fastigiatum*	smooth willowherb	Blue	AT;CWHds;CWHvh;ESSFmw;ICHdw;ICHmw;IDFun;IDFww;MSxk
Epilobium leptocarpum	small-fruited willowherb	Blue	AT;CWHdm;CWHds;CWHvm;CWHwh;CWHxm;ESSFmw;ESSFwc;ESSFwk;ESSFxv;ICHmc;ICHmw;ICHwk;MSdk;SBSwk;SWBmk
Epipactis gigantea	giant helleborine	Blue	BGxh;CWHdm;ICHdw;ICHmw;ICHxw;IDFdm;IDFmw;IDFxh;PPxh
Erysimum asperum	prairie rocket	Red	ICHdw
Floerkea proserpinacoides	false-mermaid	Blue	ICHdw;ICHmk;IDFmw;MSxk
Glycyrrhiza lepidota	wild licorice	Red	ICHdw;IDFdm;PPdh
Hesperochiron pumilus	dwarf hesperochiron	Red	ICHdw
Hesperostipa spartea	porcupinegrass	Red	BGxh;ICHdw;ICHmw;IDFmw;IDFxm
Heterocodon rariflorum	heterocodon	Blue	CDFmm;CWHmm;CWHxm;ICHdw;IDFdm;IDFxh
Hypericum scouleri ssp. *nortoniae*	western St. John's-wort	Blue	CWHvh;CWHvm;CWHxm;ESSFdk;ESSFwc;ESSFwcp;ESSFwm;ICHdw;IDFdm;IDFxh;PPdh
Idahoa scapigera	scalepod	Red	CDFmm;CWHxm;ICHxw;IDFww;PPxh
Impatiens ecalcarata	spurless touch-me-not	Blue	ICHdw;ICHxw;IDFdm
Isoetes minima	midget quillwort	Red	ICHdw
Juncus confusus	Colorado rush	Red	BGxh;ICHdw;ICHmk;IDFxh;MSdm
Lappula occidentalis var. *cupulata*	western stickseed	Red	BGxh;ICHmk
Lewisia triphylla	three-leaved lewisia	Blue	AT;ESSFdcp;ESSFwc;ICHdw;IDFdm
Linanthus septentrionalis	northern linanthus	Blue	BGxh;BGxw;ESSFdk;ICHdw;ICHmk;IDFdm;IDFxh;MSdk;PPdh
Lotus unifoliolatus var. *unifoliolatus*	Spanish-clover	Blue	CDFmm;CWHxm;ICHdw;ICHxw
Megalodonta beckii var. *beckii*	water marigold	Blue	CDFmm;ICHdw;ICHmw;ICHxw;IDFdm;IDFun;SBSmk
Melica smithii	Smith's melic	Blue	CDFmm;CWHdm;CWHxm;ESSFdk;ICHdw;ICHmw;ICHwk;IDFdm;IDFmw;IDFxh;SBSdk;SBSdw;SBSmk;SBSwk

APPENDIX A

Selected Photos

Photograph 1: Looking north along North Nakusp Site.

Photograph 2: Looking northwest to the proposed Nakusp Public Beach Site.

Photograph 3: Looking north to the Existing Nakusp Boat Launch Ramp Site. Note the storm drain and disturbed terrain west of the launch.

Photograph 4: Looking east to high potential area north of the wharf in the South of Nakusp Site.

SELECTED PHOTOGRAPHS

Golder Associates
Kamloops, BC

PROJECT No. 08-1430-0035			SCALE: None	REV. 0
DRAWN	KC	May 9, 2008	PHOTOPAGE 1	
CHECK	TP	May 9, 2008		
REVIEW	ARM	July 11, 2017		

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For more information, visit golder.com

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
Suite 200 - 2920 Virtual Way
Vancouver, BC, V5M 0C4
Canada
T: +1 (604) 296 4200

Golder Associates