(b) **Plans**

(i) The Permittee must provide the following plans to the Province for approval prior to any construction or camp establishment:

i. Environmental plan including wildlife management, vegetation management, waste management, invasive species prevention, sediment and erosion control plan, restoration and remediation plan, and archaeological plan.

ii. Construction and equipment plan including: fuel storage plan, spill prevention and response plan, safety and evacuation plan, and temporary camp plan. Temporary camp plan must include: managing wildlife attractants, managing greywater, installation of an electric fence around food preparation, eating, and greywater disposal areas, and no smoking or open burning of any kind.

These plans must be supported by necessary drawings, reports, maps, photos, permits, authorizations and specifications, prepared, where required by law or BC Parks, by registered professionals.

(c) **Guidelines**

(i) All works and monitoring shall be conducted as described in BC Standards and Best Practices for Instream Works (http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf) (Appendix A) and should be informed by the 1999 Impact Assessment for the proposed floating pump station at Chapman Lake (Whitehead 1999) (Appendix B) and Chapman Lake Water Supply Expansion (AECOM Nov 2106) (Appendix C) and shall comply with Park Use Permit Application (temporary amendment) – Sunshine Coast Regional District – Siphon at Chapman Lake Part 3 (Appendix D) and comply with the "Chapman Lake Siphon System Workplan and Timeline" (Appendix E) and the requirements listed in Special Provision 10(b) above.

(d) **Reporting**

(i) The Permittee will immediately report any spills or other incidents to the Area Supervisor.

(ii) After 24 hours, the Permittee will report to the Area Supervisor on the success of the first phase of installation and confirm the employment of the remaining three siphons.

(iii) The Permittee will provide to BC Parks environmental monitoring reports resulting from visits by the Environmental Monitor on a weekly basis.

(iv) Additional reporting as required under Water Sustainability Act, Section 10 application - 100220141 – Short Term Water Use on Chapman Lake – Use Approval 2005641 will also be provided to BC Parks on a weekly basis.

(v) The Permittee if approved by shíshálh Nation will provide to BC Parks a copy of the Preliminary Field Reconnaissance for archaeology report.

APPENDIX A – Standards and Practices for Instream Works (attached)

APPENDIX B – Impact Assessment Report – Whitehead 1999 (attached)

APPENDIX C - Chapman Lake Water Supply Expansion - AECOM Nov 2016 (attached)

APPENDIX D – Park Use Permit Application (temporary amendment) – Sunshine Coast Regional District – Siphon at Chapman Lake Part 3 (attached)

APPENDIX E – Chapman Lake Siphon System Workplan and Timeline (attached)

Attachment A for Park Use Permit #102714:

A. Proposed activities and pertinent information:
   a. The purpose of the land use permit is for drawing water and operating and maintaining current impoundment structures on Chapman and Edwards lake (conditional water license 50724 Chapman and 69966 Edwards)
   b. Details of:
      i. Existing uses:
         - Chapman and Edwards lake are currently used as water storage reservoirs for the SCRD's regional water system, which supplies water to approximately 90% of the residents on the Sunshine Coast (27,000 people)
      ii. Vegetation cover:
         - Tree species: Western hemlock, western red cedar, mountain hemlock, yellow cedar and Pacific Silver fir
         - Shrub species: blueberry, huckleberry, alpine rhododendron, spirea and kinnikinnick
      iii. Wildlife present:
         - The wildlife present includes species native to South Coast BC.
      iv. Water resources:
         - Chapman lake
         - Edwards lake
      v. Geology:
         - The Chapman Creek watershed is a steep-sided ice carved valley, underlain by bedrock made up of relatively erosion resistant quartz diorite and granodiorite, with bands of volcanic and sedimentary rock types also present in the headwater and southeastern portion of the watershed.
      vi. Historical and cultural significance of the proposed and adjacent area:
         - The area is designated as a conservation area under the Sechelt Indian Band's Strategic Land Use Plan
   c. Location and size of current and proposed improvements
      i. Current Improvements:
         - For Chapman Lake, the location of the existing infrastructure is at the outlet of the lake and includes a 3m impoundment structure. Currently, there is a 8'x8' helicopter pad at Chapman lake.
         - For Edwards Lake, the location of the existing infrastructure is at the Southeast end of the lake and includes a 3.5m impoundment structure.
      ii. Proposed Improvements:
         - 20' x 20' helicopter pad, in addition to the existing pad, to enhance safety for regular helicopter flights to Chapman Lake and to house emergency pumps and generators in the event that there is a prolonged

period of drought and low water supply. A separate park use permit application will be made for the use of emergency pumps.

d. Physical changes from the installation of the new landing pad will be minimal as the construction will be done by hand (refer to Figure 1).

e. The works will begin either fall of 2013 or spring/summer 2014. We are in the process of preparing plans that will be reviewed and approved by BC Parks.

f. Photo's

Figure 1: Proposed new landing pad area for Chapman Lake

Figure 2: Current impoundment structure and platform at Chapman lake

Figure 3: Current Impoundment structure at Edwards Lake

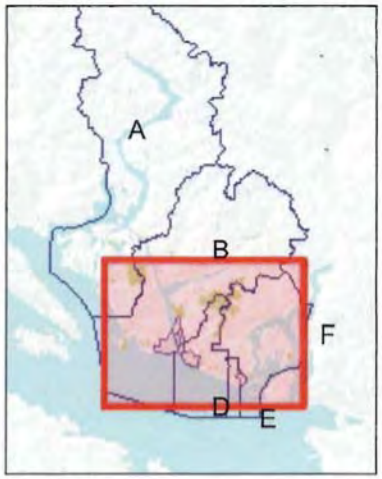
Figure 4: Existing 8'x8' helicopter landing pad

g. The proposed site is situated adjacent to the impoundment structure at Chapman Lake
h. Helicopter will be used to access Chapman and Edwards. The company used for helicopter transport has Aviation liability insurance.
i. The 5 year operational plan includes the following:
    i. Regular trips to Chapman and Edwards Lake during the spring/summer/fall seasons to operate and maintain the impoundment structures and draw water out of the reservoirs.
    ii. Annual reports will be provided to the Ministry of Forests Lands and Natural Resource Operations describing the activities undertaken as a result of the permit for the previous year.

B. Regarding experience, the Sunshine Coast Regional District has been operating the impoundment structures at Chapman and Edwards lakes since the early 1990's. Since the impoundment structures were installed, operation and management of the structures has improved immensely as we can now monitor and operate the release of water from Chapman Lake remotely, which allows us to better manage our supply and has lessened the number of visits typically made during the year.
C. The potential impacts to the park from this Park Use Permit will not significantly change from previous years. The only proposed change is the additional helicopter pad as described above. There will be minimal disturbance to vegetation to install the new pad. There is no impact to recreation, cultural values or park access for park visitors. The impacts to the main watercourse, Chapman Creek, is controlling water release from the lakes throughout the dry periods of the year. In addition to water for domestic distribution, fish values are also considered in the release of water from the lake.
D. Maps - Attached

Property Information and Mapping Services

Sunshine Coast Regional District



Legend

- Electoral Area Lines
- Ferry Routes
- Municipal Boundaries
- Parks
  - SCRD Park
  - Other Parks
  - Cemetery
- Band Lands

NAD_1983_UTM_Zone_10N

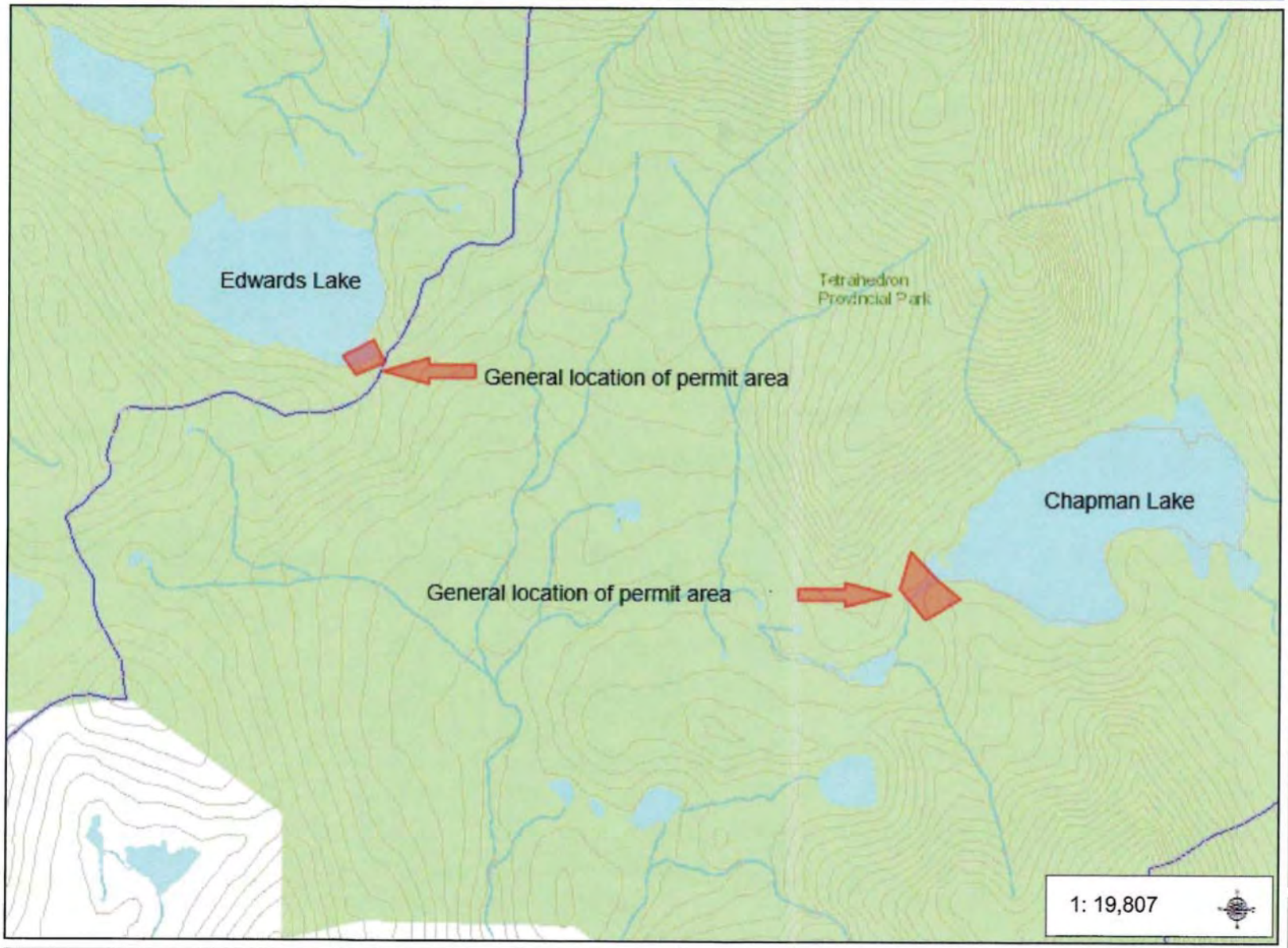
Sunshine Coast Regional District

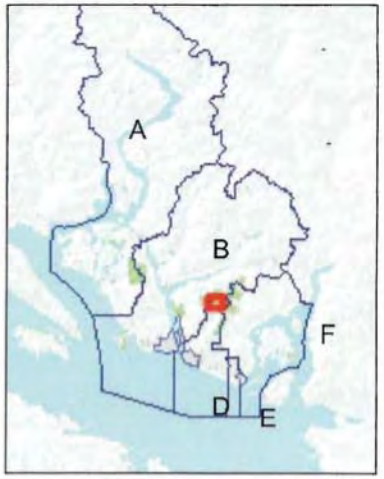
Notes

13,114.7 0 6,557.35 13,114.7 Meters

Property Information and Mapping Services

Sunshine Coast Regional District





Legend

- Contours - 20 m
- Electoral Area Lines
- Golf Courses
- Ferry Routes
- Municipal Boundaries
- Parks
  - SCRD Park
  - Other Parks
  - Cemetery
- Municipal Boundaries
- Band Lands

NAD_1983_UTM_Zone_10N

Sunshine Coast Regional District

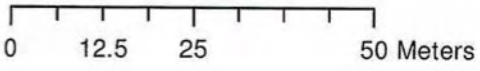
Notes

1,006.2 0 503.10 1,006.2 Meters

Detailed Site Map
Chapman Lake Proposed Improvements and Existing Infrastructure

This information has been compiled by the Sunshine Coast Regional District (SCRD) using data derived from a number of sources with varying levels of accuracy. The SCRD disclaims all responsibility for the accuracy or completeness of this information.

Date: 27/08/2013



BRITISH COLUMBIA | Ministry of Environment

Land Use / Occupancy Park Use Permit Application

Only applications that are considered by BC Parks to be compatible with the conservation and recreation objectives identified for the park(s), protected area(s), conservancy(ies) and recreation area(s) (collectively 'parks') involved in the proposal will be evaluated.

All applications must include completed application form, map, attachments (as indicated below) and non-refundable application fee (plus applicable taxes). Please make payment by VISA/MasterCard/American Express or by cheque, made payable to the Minister of Finance.

INFORMATION REGARDING APPLYING FOR A PARK USE PERMIT AVAILABLE AT:
www.env.gov.bc.ca/pasb

Application Type:

☐ New

☑ Renewal (Authorization #) 102714 Are you requesting changes to your authorization? ☐ Yes ☑ No

☐ Amendment (Authorization #) _____

If you are requesting changes to your authorization, please clearly indicate the changes under **Part 2: List of Proposed Changes**.

Requested Period of Use (inclusive): From 01/15/14 (mm/dd/yy) to 01/15/20 (mm/dd/yy)

PART 1. NAME(S) AND MAILING ADDRESS

Applicant Name:

FULL LEGAL NAME (ENTITY):

SUNSHINE COAST REGIONAL DISTRICT

Contact Name(s): Bryan Shoji s.22 **Age:** 19 or over

BC Incorporation # _____ ☐ **BC Registration #** _____ ☐ ***Society Act* #** _____

☐ Individual(s) ☐ Company ☐ Registered Society or Association

☐ Federal Government ☐ Provincial Government ☒ Municipal Government/Regional District

☐ First Nation/Indian Band ☐ University, College or Museum ☐ Private School or Public School (K-12)

Legal Mailing Address:

1975 FIELD RD

City/Town: SECHELT

Province: BC Postal code: V0N 3A1

Contact Information:

Daytime Phone: 604 885 6800

Cell:

Fax:

Email Address: bryan.shoji@scrd.ca

Billing Address (if different from legal mailing add.):

City/Town:

Province: Postal code:

Contact Information:

Daytime Phone:

Cell:

Fax:

Email Address:

Preferred method of contact: ☐ Phone ☐ Cell Phone ☐ Regular mail ☑ Email

Do you hold a Crown Land Tenure: ☐Yes ☐No	Have you previously held a Park Use Permit or Resource Use Permit: ☑Yes ☐No
If yes, provide file number(s): _____	If yes, provide file number(s): _____

PART 2: PURPOSE, LOCATION, AREA

Name of Park(s): TETRAHEDRON PARK

Purpose (Summary of Proposed Activity:
Please select all that apply

- ☐ Aquaculture and mariculture
- ☐ Alternative power project
- ☐ Grazing
- ☐ Meteorological or hydrological station
- ☐ Seismic and gravity station
- ☐ Navigation Aid
- ☐ Trapping
  - ☐ Trapline cabin
- ☐ Forestry Activities
- ☐ Mining, sand and gravel quarry
- ☐ Restoration/habitat enhancement project
- ☐ Roads and Trails
- ☐ Rights-of-way
- ☐ Privately owned structure
  - ☐ Cabin
  - ☐ Private moorage
  - ☐ Other: _____
- ☐ Provincially owned structure
- ☐ Communication sites
- ☐ Hydro transmission/distribution lines
- ☐ Pipelines (gas or oil)
- ☐ Telephone Booths
- ☐ Telephone lines
- ☑ Water impoundment (dam or dyke)
- ☐ Waterline/sewer

Location of Proposed Activities:

1) Is the activity proposed for any frontcountry* areas? ☐Yes ☒No

***"Frontcountry" means an area within one kilometre of either side of the centreline of a park road or a highway.

2) Are the activities selected above the same for all parks listed on the application? ☒Yes ☐No

***If 'No', please indicate which park(s) each activity is proposed for (if not enough space, please provide an attachment):

List of Proposed Changes (Renewal and/or Amendment Application Types):

New Helicopter Pad.

PART 3: DETAILED PROPOSAL

Please attach a detailed proposal description that addresses the following (A-D):

A. Please describe the proposed activity and provide the following information:

a) Purpose of the land use or occupancy;
b) Details of the existing uses, vegetation cover, wildlife present, water resources, geology, and historical/cultural significance of the proposed site and adjacent area;
c) Location and size of all proposed and current improvements (facilities/structures);
d) If applicable, details of the physical changes to the site that would be required to meet the needs of the proposal and the proposed mitigation of such changes;
e) Construction schedule (if applicable) for proposed new permanent and/or temporary facilities;
f) Photographs of the site and area adjacent to the proposed land use/occupancy;
g) Proposed site and adjacent area description and mapping in terms of its current legal status;
h) Type of transportation and access route to the proposed site(s); and
i) The initial 5 year operational plan related to this proposal.

B. List all experiences of the applicant and/or others involved in this proposal in previous park use permits including the name, number, date and location of the permit(s).

C. Describe expected or potential impacts on the park' environmental, cultural, recreational values changes including, but not limited to:

a) Habitat for vegetation and wildlife, particularly listed species or species at risk;
b) Any watercourses or water bodies (diversions, flows, potential siltation, etc.)
c) Special features such as unique geological formations;
d) Access to the park, and the area of the park under consideration;
e) aesthetics and visual values;
f) Cultural values, including traditional use of the area by First Nations;
g) Park visitors and local communities, including public health and safety and recreational use or enjoyment of the park; and
h) Actions that will be taken to mitigate identified impacts on the park(s).

D. Provide maps of the proposed application area, including (if required):

a) General Location Map: A map(s) of the individual protected areas within the application, drawn to 1:50 000 to 1:250 000 (or larger if required to encompass boundaries of permit area) scale that illustrates at a landscape level scale the general location of the area under application, including boundaries of the proposed permit area and major landmarks, travel/access routes.

b) Permit Area Map: Where the land use/occupancy utilizes improvements or structures, a more detailed map(s) of the proposed permit area(s) within each park, drawn to 1:20 000 to 1:50 000 scale showing the exact proposed boundaries of the permit area, including the area (in hectares) as well as any watercourses or other identifying features (trails, facilities, roads, etc.). The permit area map must clearly identify the location of travel/access routes, and specific activity site(s). If applicable, the location and construction description of any temporary facilities or the use of existing facilities within the permit area, as well as the location and size of all proposed improvements must also be included.

c) Detailed Site Map: Where the operation proposes to use any existing or to construct any new improvements, a detailed site map at 1:1 000 to 1:5 000 scale must be submitted identifying the location of all improvements (buildings, structures, roads, power lines, fences, docks, etc.) in relation to the boundaries of the permit area.

PART 4: APPLICATION CERTIFICATION

All applications must be complete. Incomplete applications will not be processed until information is submitted.
All of the following must be attached to or enclosed with this application form:

- **completed application form, including attached management plan;**
- **map(s) to standards detailed in application requirements;**
- **attachments as indicated below; and**
- **non-refundable application fee (plus applicable taxes).**

Upon submission of a complete application and application fee, allow 140 days to evaluate proposals. Applications requiring additional steps, or supplying insufficient information may delay evaluation. BC Parks reserves the right to deny any application. The information you provide will be subject to the *Freedom of Information and Protection of Privacy Act*. The submission of this form does not in any manner convey any rights to use or occupy land within a park, protected area, recreation area or conservancy.

- Businesses must either be licensed to do business in BC, or if licensed/incorporated outside of British Columbia (considered to be 'extra-provincial companies') must be in compliance with section 375 of the *Business Corporations Act* to operate in British Columbia.
- Extraprovincial societies must be registered under the *Society Act* in British Columbia in order to hold a park use permit or resource use permit. An extraprovincial society is a society or association formed outside British Columbia, and includes a branch of that society or association.

Additional costs and requirements:

Upon evaluation of the proposal it may be determined that additional costs and requirements must be provided prior to issuance of the permit, such as financial guarantees, or survey and inspection costs (as per Section 21 of the *Park Act*).

Commercial General Liability (CGL) insurance in the amount of $2 million per occurrence may be required as a minimum for in parks, protected areas, conservancies and recreation areas. Applications will be assessed to determine whether additional types of insurance, such as aviation liability or marine liability, may also be required. Insurers must be licensed to do business in British Columbia or Canada.

Additional information on insurance is available at
http://www.env.gov.bc.ca/pasb/applications/process/park_use.html#insurance

THE APPLICANT HEREBY CERTIFIES THAT ALL THE INFORMATION PROVIDED IN THIS APPLICATION IS TRUE AND CORRECT.

Signature of Applicant or Authorized Signatory of Applicant: _____

Date: AUGUST 27, 2013

Interest will be charge on all overdue accounts, the interest rate charged is 3% + the prime lending rate of the principal banker to the Province as established each 3 month quarter starting Oct 1st.

Send completed application and proposal description to:

Ministry of Forests, Lands,
and Natural Resource Operations
PASB – Park Use Permits
PO Box 9371 Stn Prov Gov
Victoria BC V8W 9M3

For more information please call:

1-866-433-7272 "extension 3" (within BC) OR 1-250-387-2928 "extension 3" (outside of BC) OR Fax: 1-250-387-1695

PLEASE RETAIN A COPY OF THIS APPLICATION FOR YOUR RECORDS

First Nations Consultations

Consulting with First Nations

The Province of British Columbia's legal duty to consult with First Nations arises from section 35 of the *Canadian Constitution Act*, which recognizes and affirms aboriginal and treaty rights. The duty to consult arises when the Crown has knowledge, real or constructive, of the potential existence of the Aboriginal right or title and contemplates conduct that might adversely affect it. Consultation with First Nations will be guided by principles of good faith, and meaningful dialogue with the intent to fully understand the nature and scope of the aboriginal right, the potential to adversely affect that aboriginal right, and address those potential impacts to an aboriginal right while balancing societal interests.

Agreements with First Nations

In many locations, the Province has agreements with First Nations. These agreements may be referred to as Collaborative Management Agreements, Reconciliation Protocol Agreements, Memorandum of Understanding or simply Working Agreements. In some cases the Province and Canada have entered into a treaty with a First Nation, which contains certain provisions regarding treaty rights within parks and protected areas. Modern treaties contain provisions to address those treaty rights in the management of parks and protected areas where a treaty right exists.

These agreements apply to a variety of parks and protected areas and conservancies and include obligations by the Province to discuss operational delivery of programs in addition to information associated with applications for park use permits with a First Nation. These discussions provide the First Nation and the Province with an opportunity to raise any questions or concerns associated with a park use permit application and/or the proposed activity in relation to aboriginal rights or title.

Important Considerations for Park Use Permit Applications

Applicants for park use permits should be aware of the Province's consultation obligations with First Nations and associated time requirements to seek meaningful consultation. There may be occasions when BC Parks may require additional, detailed information to allow for the necessary review of an application. It is important that applicants provide the necessary, detailed information as requested on the application form in order to avoid a longer than anticipated period of time to evaluate the application.

BRITISH COLUMBIA | Ministry of Environment

Land Use / Occupancy Park Use Permit Application

Only applications that are considered by BC Parks to be compatible with the conservation and recreation objectives identified for the park(s), protected area(s), conservancy(ies) and recreation area(s) (collectively 'parks') involved in the proposal will be evaluated.

All applications must include completed application form, map, attachments (as indicated below) and non-refundable application fee (plus applicable taxes). Please make payment by VISA/MasterCard/American Express or by cheque, made payable to the Minister of Finance.

INFORMATION REGARDING APPLYING FOR A PARK USE PERMIT AVAILABLE AT:
http://www.frontcounterbc.ca/index.html

Application Type:

☐ New

☐ Renewal (Authorization #) _____ Are you requesting changes to your authorization? ☐ Yes ☐ No

☐ Amendment (Authorization #) 102714

If you are requesting changes to your authorization, please clearly indicate the changes under **Part 2: List of Proposed Changes**.

Requested Period of Use (inclusive): From July 1, 2016 (mm/dd/yy) to January 31, 2024 (mm/dd/yy)

PART 1. NAME(S) AND MAILING ADDRESS

Applicant Name:

FULL LEGAL NAME (ENTITY):

Sunshine Coast Regional District

Contact Name(s): Bryan Shoji **Age:** 19 or over ☐ Yes ☐ No

☐ **BC Incorporation #** _____ ☐ **BC Registration #** _____ ☐ ***Society Act* #** _____

☐ Individual(s) ☐ Company ☐ Registered Society or Association

☐ Federal Government ☐ Provincial Government ☐ Municipal Government/Regional District

☐ First Nation/Indian Band ☐ University, College or Museum ☐ Private School or Public School (K-12)

Legal Mailing Address:

1975 Field Rd

City/Town: Sechelt

Province: BC Postal code: V0N 3A1

Contact Information:

Daytime Phone: 604-885-6810

Cell:

Fax: 604-885-7909

Email Address: bryan.shoji@scrd.ca

Billing Address (if different from legal mailing add.):

City/Town:

Province: Postal code:

Contact Information:

Daytime Phone:

Cell:

Fax:

Email Address:

Preferred method of contact: ☐ Phone ☐ Cell Phone ☐ Regular mail ☐ Email

Do you hold a Crown Land Tenure: ☐Yes ☐No	Have you previously held a Park Use Permit or Resource Use Permit: ☐Yes ☐No
If yes, provide file number(s): Water Licence for storage # C05724	If yes, provide file number(s):

PART 2: PURPOSE, LOCATION, AREA

Name of Park(s): Tetrhedron Provincial Park

Requesting temporary use for construction including installation of a 210 m long, 1200 mm intake pipe and flow control structures and area for construction worker camp, see attached for details.

Purpose (Summary of Proposed Activity:
Please select all that apply

- ☐ Aquaculture and mariculture
- ☐ Alternative power project
- ☐ Grazing
- ☐ Meteorological or hydrological station
- ☐ Seismic and gravity station
- ☐ Navigation Aid
- ☐ Trapping
  - ☐ Trapline cabin
- ☐ Forestry Activities
- ☐ Mining, sand and gravel quarry
- ☐ Restoration/habitat enhancement project
- ☐ Roads and Trails
- ☐ Rights-of-way
- ☐ Privately owned structure
  - ☐ Cabin
  - ☐ Private moorage
  - ☐ Other: _____
- ☐ Provincially owned structure
- ☐ Communication sites
- ☐ Hydro transmission/distribution lines
- ☐ Pipelines (gas or oil)
- ☐ Telephone Booths
- ☐ Telephone lines
- ☐ Water impoundment (dam or dyke)
- ☐ Waterline/sewer

Location of Proposed Activities:

1) Is the activity proposed for any frontcountry* areas? ☐Yes ☐No

***"Frontcountry" means an area within one kilometre of either side of the centreline of a park road or a highway.

2) Are the activities selected above the same for all parks listed on the application? ☐Yes ☐No

***If 'No', please indicate which park(s) each activity is proposed for (if not enough space, please provide an attachment):

List of Proposed Changes (Renewal and/or Amendment Application Types):

Installation of a gravity fed water withdrawl system to access additional water from Chapman Lake to provide water to the SCRD system during drought conditions (see Part 3 for details)

PART 3: DETAILED PROPOSAL

Please attach a detailed proposal description that addresses the following (A-D):

A. Please describe the proposed activity and provide the following information:

a) Purpose of the land use or occupancy;
b) Details of the existing uses, vegetation cover, wildlife present, water resources, geology, and historical/cultural significance of the proposed site and adjacent area;
c) Location and size of all proposed and current improvements (facilities/structures);
d) If applicable, details of the physical changes to the site that would be required to meet the needs of the proposal and the proposed mitigation of such changes;
e) Construction schedule (if applicable) for proposed new permanent and/or temporary facilities;
f) Photographs of the site and area adjacent to the proposed land use/occupancy;
g) Proposed site and adjacent area description and mapping in terms of its current legal status;
h) Type of transportation and access route to the proposed site(s); and
i) The initial 5 year operational plan related to this proposal.

B. List all experiences of the applicant and/or others involved in this proposal in previous park use permits including the name, number, date and location of the permit(s).

C. Describe expected or potential impacts on the park' environmental, cultural, recreational values changes including, but not limited to:

a) Habitat for vegetation and wildlife, particularly listed species or species at risk;
b) Any watercourses or water bodies (diversions, flows, potential siltation, etc.)
c) Special features such as unique geological formations;
d) Access to the park, and the area of the park under consideration;
e) aesthetics and visual values;
f) Cultural values, including traditional use of the area by First Nations;
g) Park visitors and local communities, including public health and safety and recreational use or enjoyment of the park; and
h) Actions that will be taken to mitigate identified impacts on the park(s).

D. Provide maps of the proposed application area, including (if required):

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c) Detailed Site Map: Where the operation proposes to use any existing or to construct any new improvements, a detailed site map at 1:1 000 to 1:5 000 scale must be submitted identifying the location of all improvements (buildings, structures, roads, power lines, fences, docks, etc.) in relation to the boundaries of the permit area.

PART 4: APPLICATION CERTIFICATION

All applications must be complete. Incomplete applications will not be processed until information is submitted.
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- **completed application form, including attached management plan;**
- **map(s) to standards detailed in application requirements;**
- **attachments as indicated below; and**
- **non-refundable application fee (plus applicable taxes).**

Upon submission of a complete application and application fee, allow 140 days to evaluate proposals. Applications requiring additional steps, or supplying insufficient information may delay evaluation. BC Parks reserves the right to deny any application. The information you provide will be subject to the *Freedom of Information and Protection of Privacy Act*. The submission of this form does not in any manner convey any rights to use or occupy land within a park, protected area, recreation area or conservancy.

- Businesses must either be licensed to do business in BC, or if licensed/incorporated outside of British Columbia (considered to be 'extra-provincial companies') must be in compliance with section 375 of the *Business Corporations Act* to operate in British Columbia.
- Extraprovincial societies must be registered under the *Society Act* in British Columbia in order to hold a park use permit or resource use permit. An extraprovincial society is a society or association formed outside British Columbia, and includes a branch of that society or association.

Additional costs and requirements:

Upon evaluation of the proposal it may be determined that additional costs and requirements must be provided prior to issuance of the permit, such as financial guarantees, or survey and inspection costs (as per Section 21 of the *Park Act*).

Commercial General Liability (CGL) insurance in the amount of $2 million per occurrence may be required as a minimum for in parks, protected areas, conservancies and recreation areas. Applications will be assessed to determine whether additional types of insurance, such as aviation liability or marine liability, may also be required. Insurers must be licensed to do business in British Columbia or Canada.

Additional information on insurance is available at
http://www.env.gov.bc.ca/pasb/applications/process/park_use.html#insurance

THE APPLICANT HEREBY CERTIFIES THAT ALL THE INFORMATION PROVIDED IN THIS APPLICATION IS TRUE AND CORRECT.

Signature of Applicant or Authorized Signatory of Applicant: _____

Date: April 13, 2016

Interest will be charge on all overdue accounts, the interest rate charged is 3% + the prime lending rate of the principal banker to the Province as established each 3 month quarter starting Oct 1st.

Send completed application and proposal description to:

Ministry of Forests, Lands,
and Natural Resource Operations
FrontCounter BC

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First Nations Consultations

Consulting with First Nations

The Province of British Columbia's legal duty to consult with First Nations arises from section 35 of the *Canadian Constitution Act*, which recognizes and affirms aboriginal and treaty rights. The duty to consult arises when the Crown has knowledge, real or constructive, of the potential existence of the Aboriginal right or title and contemplates conduct that might adversely affect it. Consultation with First Nations will be guided by principles of good faith, and meaningful dialogue with the intent to fully understand the nature and scope of the aboriginal right, the potential to adversely affect that aboriginal right, and address those potential impacts to an aboriginal right while balancing societal interests.

Agreements with First Nations

In many locations, the Province has agreements with First Nations. These agreements may be referred to as Collaborative Management Agreements, Reconciliation Protocol Agreements, Memorandum of Understanding or simply Working Agreements. In some cases the Province and Canada have entered into a treaty with a First Nation, which contains certain provisions regarding treaty rights within parks and protected areas. Modern treaties contain provisions to address those treaty rights in the management of parks and protected areas where a treaty right exists.

These agreements apply to a variety of parks and protected areas and conservancies and include obligations by the Province to discuss operational delivery of programs in addition to information associated with applications for park use permits with a First Nation. These discussions provide the First Nation and the Province with an opportunity to raise any questions or concerns associated with a park use permit application and/or the proposed activity in relation to aboriginal rights or title.

Important Considerations for Park Use Permit Applications

Applicants for park use permits should be aware of the Province's consultation obligations with First Nations and associated time requirements to seek meaningful consultation. There may be occasions when BC Parks may require additional, detailed information to allow for the necessary review of an application. It is important that applicants provide the necessary, detailed information as requested on the application form in order to avoid a longer than anticipated period of time to evaluate the application.

Environment AECOM

Sunshine Coast Regional District

Land Use / Occupancy Park Use Permit Application for Amendment. Part 3: Detailed Proposal

Prepared by:

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604 294 8597 fax

Project Number:

60485918

Date:

April, 2016

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but Consultant makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by Consultant represent Consultant's professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since Consultant has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, Consultant, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

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This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

Distribution List

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Revision Log

Revision #	Revised By	Date	Issue / Revision Description
A	David Huebert	8 March 2016	Initial Review

Signatures

Report Prepared By:

Melissa Mukai, R.P.Bio.
Biologist

Report Reviewed By:

Bruce S. Ford, MRM, R.P.Bio.
Senior Environmental Biologist

Report Reviewed By:

Executive Summary

The SCRD Water System supplies potable water to approximately 10,000 Sunshine Coast service connections between Gibsons and Secret Cove with the source being Chapman Creek and includes two headwater alpine lake reservoirs. The primary reservoir is Chapman Lake with a concrete dam and valve located on the outlet which is operated remotely by the SCRD to control releases into Chapman Creek. The existing dam on Chapman Lake is three metres high and when water levels drop below the dam crest a sluice gate at the bottom of the structure is opened to release water. The amount of water that can be released annually from Chapman Lake is currently limited to 906,600 m^3. Releasing the maximum amount of stored water from Chapman Lake results in a drawdown of approximately 3.0 m. During a typical year, water stored behind the dam is allowed to overflow naturally until the water level drops below the dam crest and at that point the SCRD begins to manage the release from the sluice gate. In determining the amount of water to be released, the first 0.2 to 0.22 m3/s is to accommodate the hatchery and in-streams conditions suitable for fish. An additional amount is released to meet the SCRD's drinking water demand which varies depending on the water use restrictions that are in effect. The current water control structures are permitted under an existing Park Use Permit and a Water Licence.

The proposed project is designed to access additional water from Chapman Lake for release into Chapman Lake during times of drought. The infrastructure required includes a gravity fed system with a 210 m long, 1200 mm diameter pipe buried beneath the existing outlet channel. The intake for the pipe would have an invert elevation of 966 m which would allow access to an additional 1 million m^3 of water. In September 2015 the SCRD Board approved a motion that in part stated that stated that this new infrastructure would "only be utilized during periods of drought and until the long term source development projects specified in the [SCRD's] Comprehensive Regional Water Plan are constructed"

A summary of the project effects, mitigation measures and determination of residual impacts of the project were completed in order to assess the construction and operations impacts for the project. The assessment focussed on seven environmental and social aspects associated with the construction and operation of the new system. The following table provides a summary the findings. The construction phase will employ standard construction techniques for which there are mitigation measures that are effective for containing and managing the effects of earth moving, blasting and general requirements (fuel handling, waste management, etc.). Because this work is being carried out in a uspoiled park environment the residual effects of some construction activities have been rated moderate but the effects are only present during construction and most will revert to pre-construction conditions once construction is finished. Site remediation will require on going monitoring to track the effectiveness of the remedial works and to if necessary identify any additional work that might be required to achieve proper restoration. Residual impacts of the operation of the proposed system were judged to be overall insignificant. However, ongoing monitoring of the effects on Chapman Lake was recommended to confirm the effects of an increased drawdown of the lake during drought conditions.

Project Effects, Proposed Mitigation Residual Effect and Assessment of the Proposed SCRD Water Project

Component	Mitigation Measures	Residual Effect	Magnitude	Geographic Extent	Temporal Bound	Overall Impact
Geophysical: Blasting	• Blasting plan to be developed by a certified blaster • Limit blasting overpressures to a maximum of 133 dB	Construction: Vibration and Noise	L	L	L	Low
		Operation: No residual effect	-	-	-	-
Air Quality	• Well maintained equipment • Apply dust suppression when required • On site fuel containers to have proper caps and to be covered • Minimize flights to the area	Construction: Degraded air quality from heavy equipment, helicopter use and dust	M	M	L	Medium
	• Monitor effects during drawdown	Operation: Increase of dust from lake drying	M	M	L	Negligible
Noise	• Properly equipment and well maintained equipment • Minimize flights required to the area • Work outside of sensitive breeding windows • Avoid areas with species sensitive to noise • Early and late day work to be avoided	Construction: noise from blasting, helicopter and construction equipment	M	M	L	Medium
		Operation: No residual effect	-	-	-	-
Terrestrial Resources	• Develop a vegetation remediation plan • Proper camp design and set up • Erosion and sediment control plan • Ensure appropriate construction timing to avoid wildlife breeding season	Construction: Temporary loss of vegetation/wildlife habitat and change in biodiversity, camp wildlife attractant, disruption of wildlife,	M	M	L	Medium
		Operation: No residual effect	-	-	-	-
Aquatic Resources	• Emergency spill response plan/spill cleanup equipment and properly trained staff • Installation of sediment and erosion control measures and maintenance • Installation of intake pipe in the dry • Fish Screen on intake	Construction: Release of sediment or other deleterious substances, resuspension of sediment, contamination with wastes	M	M	L	Medium
	• Water demand reduction programs (e.g. metering) • Infrequent drawdown below -3 m • Maintain current water release requirements for fish	Operation: increase sedimentation and erosion, changes in lake dynamics, lake bed drying. Downstream effects unchanged	M	M	L	Low
Socio-Community: Recreation	• See air quality and noise for mitigation • Planning on temporary work camp layout • Installation of information signage • Screening of construction areas • Minimize duration of construction	Construction: Reduced quality of recreational experience	L	L	L	L
	• Infrequent drawdown of lake below -3 m	Operation: Altered viewscapes leading to diminished quality of recreational experience	L	L	L	Low
Heritage Resources	• Confine work areas to sites disturbed during the original dam and channel construction in 1978 • Preliminary field investigation of the construction site will be completed	To be determined	-	-	-	-

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Appendices

1. Introduction

The summer of 2015 was exceptionally dry, and resulted in the imposition of Stage 4 water restrictions in the Sunshine Coast Regional District (SCRD) through the fall of 2015. To alleviate the acute water shortage, the SCRD was granted approval for Short Term Use of Water by the Province, permitting a maximum diversion of an additional 1 million m^3 of water from the Chapman Lake. Water restrictions were lifted in mid-September after a few days of rain refilled Chapman Lake. After water use restrictions were lifted, the SCRD Board approved a plan to upgrade the water supply infrastructure by installing a permanent gravity fed system that would be capable of accessing the additional 1 million m^3 of water. At the SCRD Board's September 10, 2015 meeting the Board also approved the following Drought Mitigation Option:

> THAT the General Manager Infrastructure Services' report dated August 25, 2015 titled Drought Mitigation Options be received; AND THAT the SCRD move forward with the design and approval process for the Deepen Channel option, recognizing that the system will only be utilized during periods of drought and until the long term source development projects specified in the Comprehensive Regional Water Plan are constructed;
>
> AND FURTHER THAT the design, engineering and environmental impact assessment of the Deepen Channel option be presented to the Board for consideration.

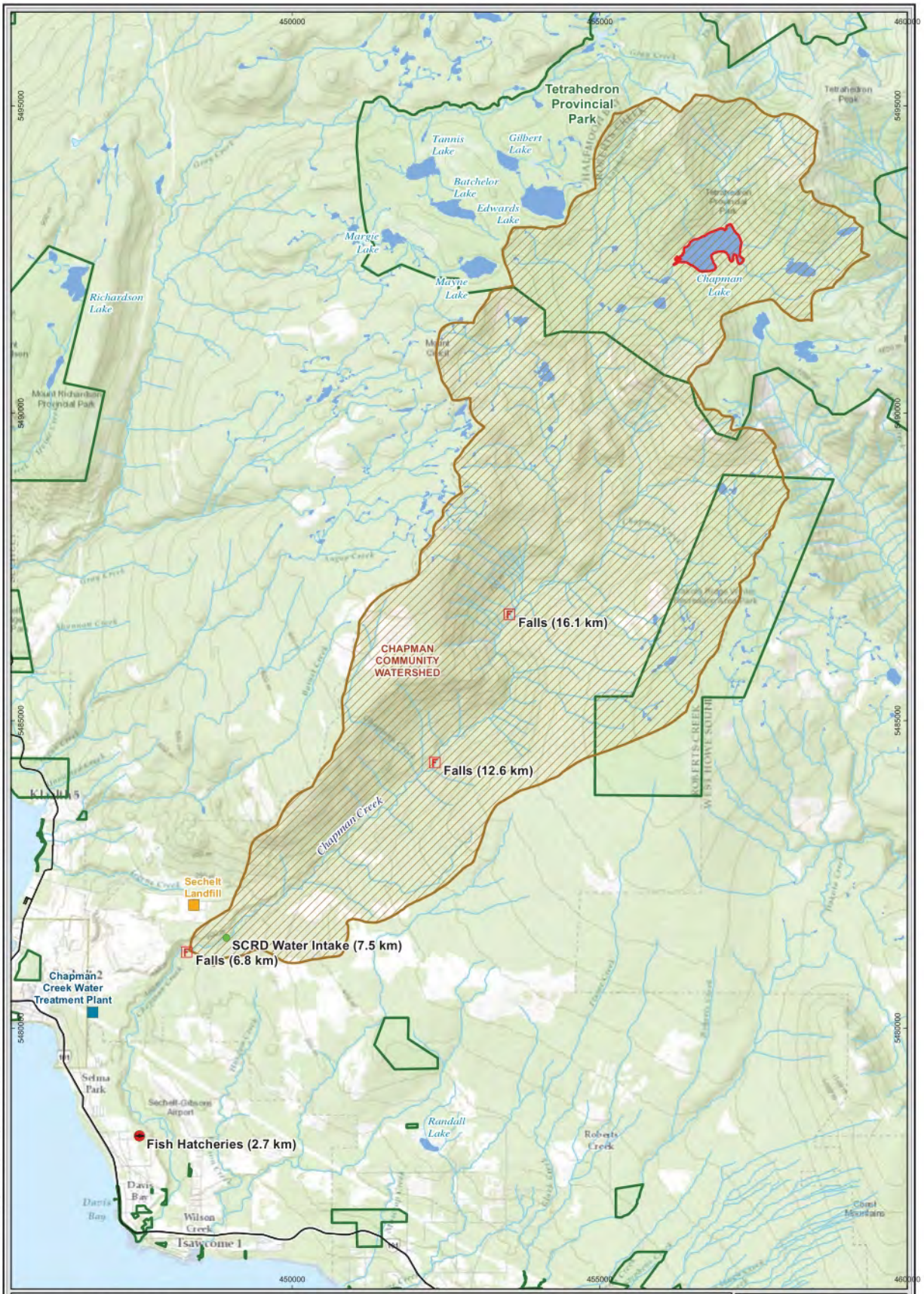
The Board committed to use the additional water from Chapman Lake only during periods of drought and other long term solutions would be investigated to meet the water demand for the growing population on the Sunshine Coast.

AECOM Canada Ltd. was hired by the SCRD to complete the engineering, public consultation, and environmental assessment work associated with the implementation of the Project. AECOM will be acting on behalf of the SCRD during the completion of the proposed modifications to the regional water supply.

This environmental review of the project has been based on previous studies conducted in the Chapman Lake watershed. In particular, the report "*Impact Assessment. Sunshine Coast's Proposed Water Storage Project (Floating Pump Station) on Chapman Lake, in Tetrahedron Provincial Park*", prepared by Whitehead Environmental Consultants in 1999 was used extensively. The Whitehead report investigated the environmental effects of drawing down Chapman Lake for a total of 8 m which is the same effect as the current project proposed by the SCRD.

1.1 Overview of SCRD Water Supply

The SCRD Water System supplies potable water to approximately 10,000 Sunshine Coast service connections between Gibsons and Secret Cove (Figure 1). The water source is Chapman Creek and surrounding watershed, which includes two headwater alpine lake reservoirs. The primary reservoir is Chapman Lake, which flows into Chapman Creek, and which is controlled and operated by the SCRD with a concrete dam and valve located on the west side of the lake (Figure 1). The existing dam on Chapman Lake is three (3) metres high and when the water levels are high the water release is uncontrolled over top of the dam. When water levels drop below the dam crest a sluice gate at the bottom of the structure is used to control the release of water from the lake. The sluice gate can be operated remotely from Regional District offices through a SCADA system. The amount of accessible water that can be released annually from Chapman Lake is currently limited to a maximum of approximately 906,600 m^3 by water licence No. C050724 and due to the configuration of the outlet channel and control infrastructure. Release of the maximum amount of stored water results in a drawdown in Chapman Lake of approximately 3.0 m. Photographs in Appendix 1 show the area of the existing dam, the outlet channel and immediately downstream in Chapman Creek.



Basemapping from ESRI Online Topographic,
Spatial Data from SCRD, 2015
Note: Distances are upstream from the mouth

N
W E
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Kilometres

1:60,000

NAD 1983 UTM Zone 10N

Legend

- Study Area
- Falls
- Fish Hatchery
- SCRD Water Intake
- Champan Creek Water Treatment Plant
- Sechelt Landfill
- Community Watershed
- Park and Protected Area
- Main Road (Arterial / Collector / Highway)
- Stream

Overview Map

Chapman Lake Water Supply Expansion Project
Location: Chapman Lake, BC

General Location

12 April 2016

AECOM

DRAFT
Figure 1

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During a typical year, water stored behind the dam is allowed to overflow naturally until the water level drops below the dam crest and there is a need to supplement the flows to Chapman Creek, at which time the dam is opened to release stored water from the reservoir. Flow in Chapman Creek is required to maintain minimum regulated flow rates (Whitehead 1999), and to supply the SCRD Water Treatment Plant, which is located on Chapman Creek approximately 17 km downstream from Chapman Lake.

Chapman Lake and the upper Chapman Creek watershed are located in Tetrahedron Provincial Park (Figure 1) a Class A park. These areas are protected under the *Park Act* and subject to conditions of the park's management plan (MELP, 1997 in Triton 2006). The lake is also in the traditional territory of the shíshálh Nation (formerly Sechelt Indian Band; Figure 1).The SCRD license for water storage in Chapman Lake pre-dates the creation of Tetrahedron Provincial Park, and once the park was established, the park management plan (BC Parks 1997) allowed for the continued use of the lake as a community water supply for the SCRD. The current water control structures are permitted under an existing Park Use Permit and Water Licence. There is also a temporary Park Use Permit and temporary short-term Water Use Permit in place for a temporary siphon system (both of which expire in August 2016).

The SCRD is in the process of implementing a water metering program throughout the Regional District and will be charging users for water usage. This program is expected to be in operation by 2018 and is predicted to reduce the existing demand by 25% (Opus DaytonKnight Consultants 2013). This overall reduction also has the potential to reduce the drawdown in Chapman Lake under drought conditions by delaying the time for water levels to reach the -3 m level and reducing the rate of withdrawal once the water level is at -3.0 m.

1.1.1 Watershed Administration

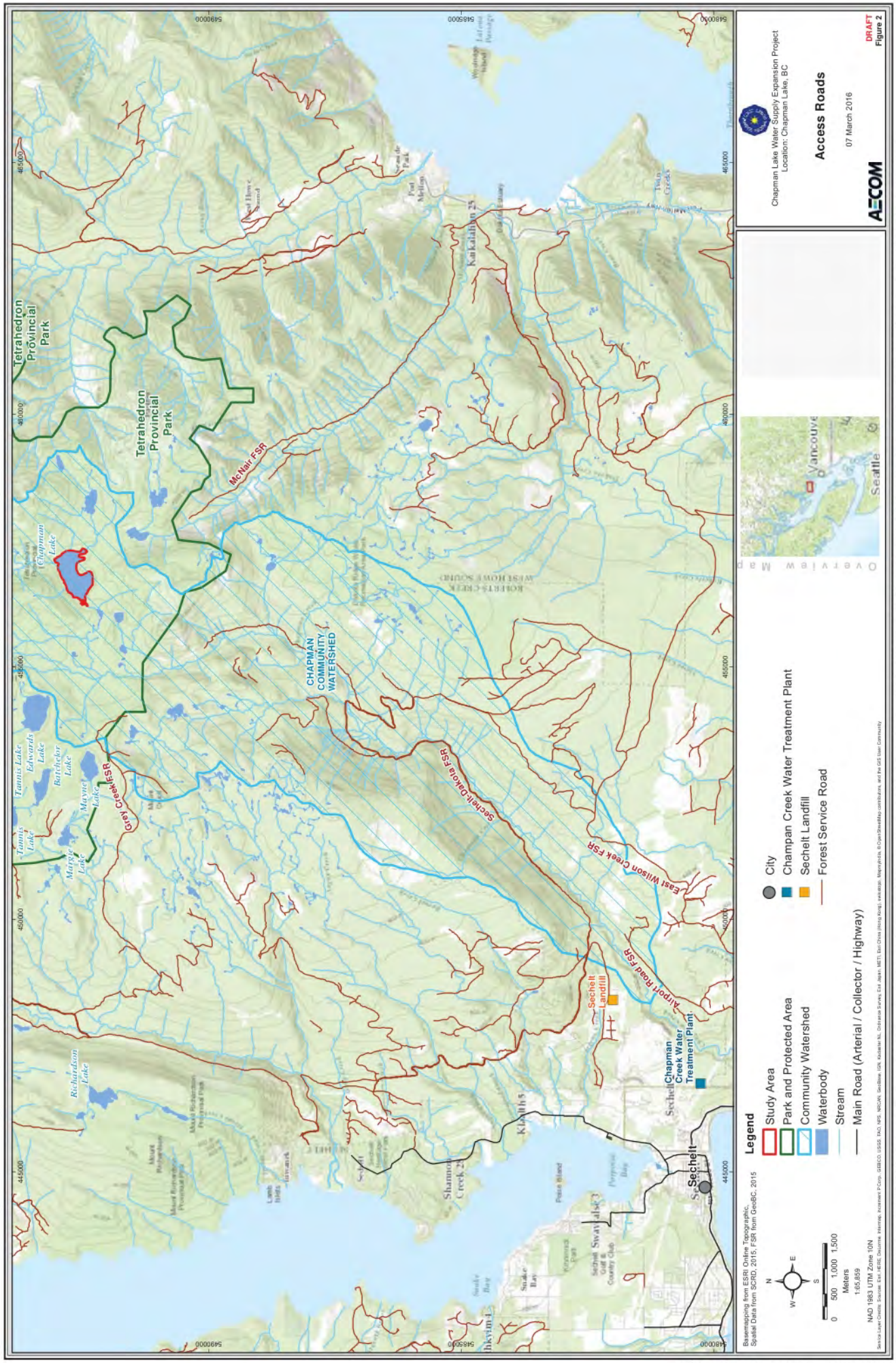
The Chapman Creek watershed intersects with the Coast Forest Region and the Sunshine Coast Forest District, the Sunshine Coast Timber Supply Area, and Tree Farm Licence Area 39 (MOF, 2005 in Triton 2006). The watershed falls under the jurisdiction of the Vancouver Coastal Health Authority North Shore/Coast Garibaldi region, responsible for overseeing drinking water quality for the SCRD.

The upper portions of the watershed (above 800 m elevation) are located within Tetrahedron Provincial Park (Figure 1). The middle portions of the watershed are mostly provincial Crown land. The lower portions of the watershed above the intake are also mainly Crown land, with five private legal parcels (District Lot 2461, 2463, 2462, 7613 and 3374).

The watershed is also located within the Chapman Landscape Unit, which is managed under the Chapman Landscape Unit Plan (MSRM, 2002 in Triton 2006). This plan specifies Old Growth Management Areas in which timber harvesting and road construction cannot occur unless no other practicable options exist, in which case there is a provision for replacement of these areas. There are at least seven OGMAs within the assessment area.

1.1.2 Access Description

The main access points into the lower watershed include the Sechelt-Dakota FSR, the Airport Road FSR and the East Wilson Creek FSR (Figure 2). Access roads within the watershed are gravel and vary in width (1 or 2 lanes) and accessibility. Since 2001 a number of access roads in the lower and mid-portions of the watershed have been deactivated and rehabilitated.



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Access to the lakes and cabins in the upper watershed (Tetrahedron Provincial Park) is via West Main Road to Gray Creek Mainline, which is located within the Gray Creek watershed and provides foot access to the upper Chapman Creek watershed from the west. Access routes used for recreational purposes to the upper watershed and Tetrahedron Provincial Park include (Access Management Plan, IWMP background report, 1998 in Triton 2006) McNair FSR and Gray Creek FSR.

1.2 Document Purpose

The Sunshine Coast Regional District has had a Park Use Permit in place since the park was created that allows the SCRD to occupy and use areas at the outlet of Chapman and Edwards Lake for the purposes of managing the drinking water supply for the Sunshine Coast. The current Park Use Permit was issued on February 1, 2014 for a period of 10 years. However, in order to construct the new infrastructure and manage additional drawdown of Chapman Lake an amendment to the existing Park Use Permit will be required. The SCRD will also be seeking changes to its Water Licence(s) for the use of water from Chapman Lake. The purpose of this document is therefore to fulfill the information requirements of a Park Use Permit application, in particular Part 3: Detailed Proposal and will also be used to support Water Licence applications or amendments.

1.3 Park Use Permit Experience

The SCRD has held a Park Use Permit (PUP) for the purposes of maintaining water impoundment infrastructure at Chapman and Edwards Lake and a helicopter pad at Chapman Lake in Tetrahedron Park. The SCRD's PUP was renewed February 1, 2014 and the current PUP No. 102714 is valid until January 31, 2024

1.4 Project Description

1.4.1 Plan

In order to access additional water to cover periods of drought the SCRD has chosen to augment the existing outlet infrastructure at Chapman Lake by adding a gravity fed system. This includes a 1200 mm diameter, 210 m long pipe buried beneath the existing outlet channel. The pipe intake would be located at an elevation of 966 m or 8 m below the current full pool water elevation of the lake (974 m) and the outlet would be drilled under the existing dam and equipment with appropriate valves to control the outflow. The location of the site to be used at the outlet of Chapman Lake and the additional park use area is provided in Figure 3. The yellow area is the extra space needed for construction, laydown and camp which represents a land area of 4,635 m^2 and an in-lake area of 10,719 m^2 that would be involved in the pipe installation. At the proposed intake depth the SCRD would have access to an additional 1 million m^3 of water that would be drawn on in the event of late summer and fall drought conditions. The intake will be fitted with a screen to avoid the entrainment of fish and debris into the pipe. Approximately 20 m east of the existing dam a precast concrete flow control structure with valves will be installed to control the flow of water through the pipe. The control system currently used to operate the water release structure when lake levels are below the crest of the dam will be upgraded and used to operate this lower level outlet. In pipe flow metering will allow water release through this new pipe to be precisely controlled.

1.4.2 Construction

Installation of this system will take approximately two months and will involve the following:

- Clear a site to set up a construction camp for up to six people
- Clear a site to store equipment, fuel, waste management facilities, etc.

- Install the syphon system to bypass water around the existing outlet channel to maintain flow in Chapman Creek
- Construct a coffer dam at the entrance to the outlet channel and dewater the channel
- Conduct geotechnical drilling around the existing dam and immediately upstream to determine the geology, extent and competency of the bedrock
- Excavate a trench approximately 5 m deep to install the low level outlet pipe. It is expected that blasting will be required to complete the trench. Blast rock will be used to line portions of the outlet channel.
- Using horizontal directional drilling techniques, drill the final 20 m of pipe through bedrock below the existing dam.
- Material removed from the trench will be used to backfill the trench and re-establish the existing channel at a -3m elevation (relative to full pool level). Excess material from the trench will be spread along the side and top of the existing channel and graded to match the existing land.
- The flow control structure will be in a pre-cast concrete housing located as shown on Figure 4
- A site restoration plan will be prepared to restore the camp, laydown and excavation areas and the banks of the outlet channel. Appropriate native grass seed will be used along with planting of trees and shrubs as appropriate.

Legend

- Chapman Lake Permit Area (0.344 ha)
- Temporary Use Area

Overview Map

Basemapping from ESRI Online Topographic, Spatial Data from SCRD, 2015

N
W E
S

0 40 80 120 160

Metres

1:5,000

NAD 1983 UTM Zone 10N

Chapman Lake Water Supply
Expansion Project
Location: Chapman Lake, BC

Temporary Chapman Lake Permit Area

05 April 2016

AECOM

Figure 3

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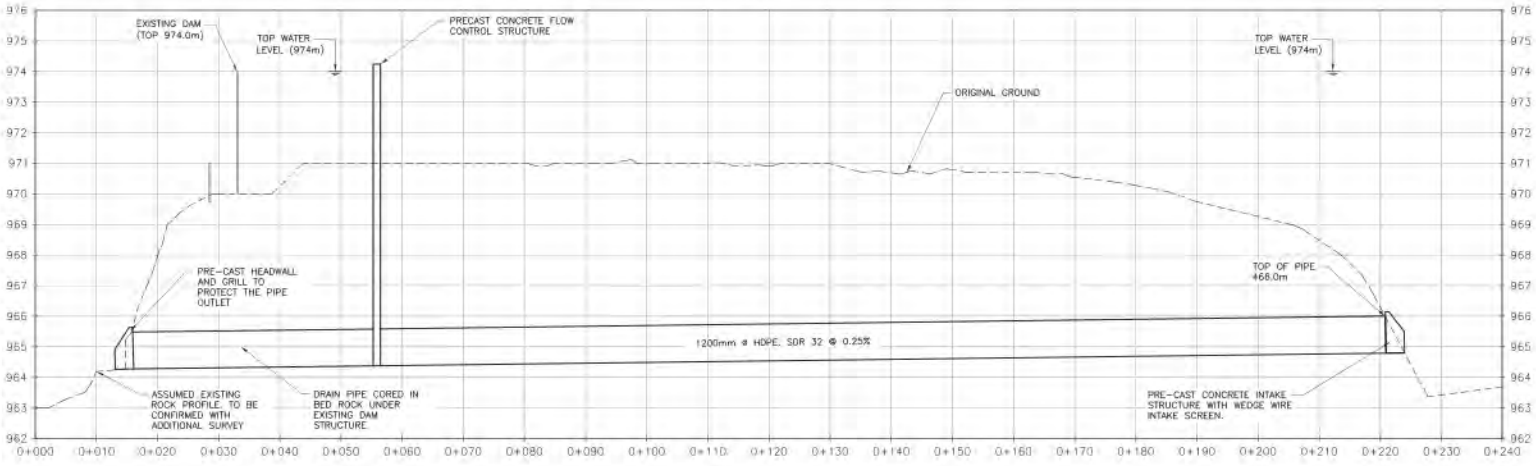

PROFILE
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A	ISSUED FOR DISCUSSION		RT	BWY	2016/03/15
REV	DESCRIPTION		DRN	CHK	DATE (YYMM/D)

IF NOT SCALE A1 PLANCHET IS REDUCED

DRN BY: GDV
DES BY: GDV
CHK BY: KJN
APP BY: BD

AECOM

Figure 4

SUNSHINE COAST REGIONAL DISTRICT
CHAPMAN LAKE

CIVIL

CHAPMAN LAKE EMERGENCY SUPPLY DRIAN PIPE
PLAN AND PROFILE

PROJECT START DATE (M / Y)
Mar 2016

PROJECT NO.
60485918

FILENAME
60485918 C-100.dwg

SHEET NO.

DRAWING NO.
C-100

1.5 Construction Schedule

Timing of this work is restricted due to weather and snowpack conditions. Typically there is considerable inflow to the lake through June. In order to carry out the construction the lake level must be lowered in to install a coffer dam to dewater the outlet channel and allow the excavation necessary to install the pipe. Work must be completed prior to the start of significant fall rain which could have the potential to overtop the coffer dam. Considering these constraints suggests that the preferred construction schedule is from July 4 to September 30, 2016. The following is the general order of work within that 3 month period. This schedule is likely to change as the design work is advanced and more details on the preferred construction methods are developed:

1. Establish construction camp and equipment laydown areas
2. Install syphon to draw down the lake
3. Conduct geotechnical drilling to confirm stability of existing dam and the plan to drill under the existing dam
4. Construct the coffer dam at the west end of the outlet channel and dewater the channel
5. Excavate the trench; install pipe and infill the trench. Anticipate this to be done in sections to avoid the need to stockpile significant volumes of trench material
6. Using horizontal directional drilling equipment, bore under the existing dam
7. Install precast valve chamber and control mechanisms
8. Final placement and contouring of overburden and excess rock along the outlet channel
9. Rehabilitate the outlet channel – seeding and planting
10. Dismantle and remove camp
11. Rehabilitate camp and laydown areas: de-compact soils, seed and plant to restore site to conditions similar to preconstruction

1.5.1 Operation:

As indicated the SCRD Board has passed a resolution that committed to only drawing water from below the existing operating level (-3.0 m) to avoid stage 4 water restrictions during times of drought. The SCRD's Drought Management Plan has identified four stages of restriction of water use. The first stage automatically goes into effect on May 1. Subsequent restrictions are imposed based on the evaluation of a set of criteria and guidelines used to assess risk of drought or water shortage. Withdrawing water from -3.0 m and lower will not occur unless drought conditions have required Stage 3 restrictions. Sufficient water will be released through the low level outlet to meet the current requirements to protect fish and to service the community. The current operation requires sufficient flow to be released from Chapman Lake to maintain an instream flow for fish of 0.3 m^3/s below the SCRD intake which can be reduced to 02 to 0.22 m^3/s in July and August with an additional amount added to meet the SCRD water demands which typically requires a total flow release from Chapman Lake of approximately 0.44 to 0.55 m^3/s.

The frequency of accessing water below the -3.0 m level is currently hard to predict. Climate change has resulted in earlier snow melt and drier summers which could increase the frequency of drought conditions (Staats 2014 summarized in Section 3.1.1). However, the SCRD's water conservation measures, in particular the implementation of universal water metering is expected to be fully operation in 2019, is expected to significantly reduce water use (Opus DaytonKnight Consultants 2013) which will minimize the need to go below -3.0 m. The Opus (2013) report assessed the drought risk assessment and estimated that the existing storage in Chapman and Edwards Lake is sufficient to support a 1 in 21 year low water return period for the current population level of the Sunshine Coast. Under the population growth scenarios and the proposed demand side management (water metering) that is estimated for the year 2036, the water supply is predicted to be sufficient to support a 1 in 15 year drought return period. Given the results presented in Staats (2014) it can be assumed that what is now predicted to be a drought

return period of 1 in 15 years, has the potential to increase in frequency and increases the uncertainty around the frequency that the SCRD will have to draw Chapman Lake below -3.0 m.

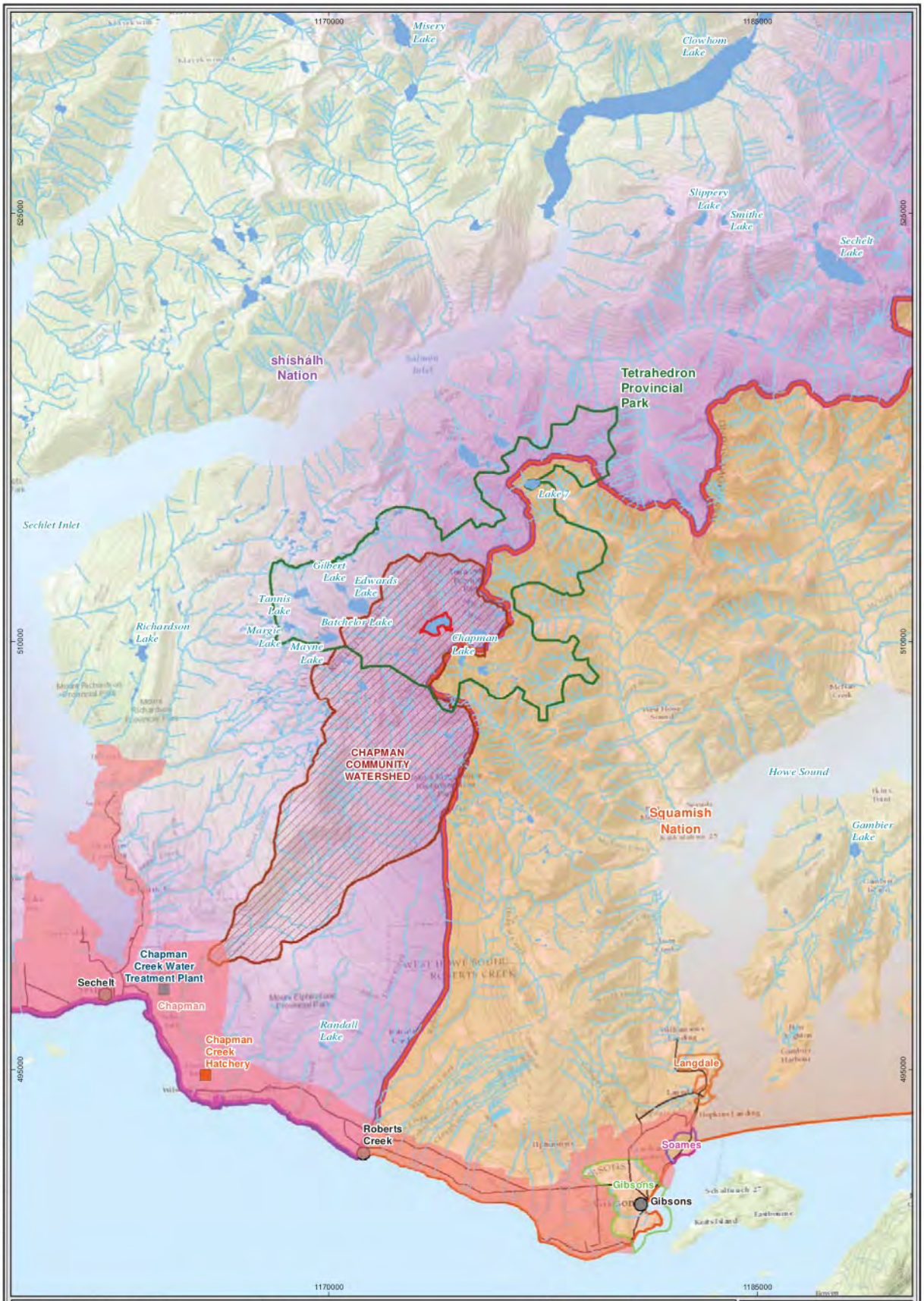
2. Consultation and Stakeholder Engagement Plan

The Project has prepared and is implementing an Aboriginal Consultation and Public Participation Plan. The Plan describes the Project, the purpose and objectives of Aboriginal consultation and public participation and the activities to fulfil regulatory requirements of meaningful consultation and active public participation in the planning process, in order to consider potential social, cultural and environmental effects and mitigation measures. The process follows extensive First Nation and public consultations undertaken as part of approval for the Sunshine Coast's Comprehensive Regional Water Plan in 2013.

Chapman Lake and the Chapman Creek watershed are located solely within shíshálh Nation territory. Tetrahedron Provincial Park is within the territories of the shíshálh Nation and the Squamish Nation (Figure 5). Given that the Chapman water system supplies water to 80% of Sunshine Coast's residents and businesses, consultation is proceeding with both the shíshálh Nation and the Squamish Nation. Detailed project information has been provided to both nations. Regulatory submissions will be reviewed through the shíshálh Nation's Lands and Resources Decision-making Policy and process, before being presented to Chief and Council. Squamish Nation will determine whether it chooses to actively participate in the consultation process now underway.

Public engagement is also proceeding with interested groups and individuals. A plain-language information package and map showing relevant project features has been prepared and distributed. Following an initial meeting with the shíshálh Nation, discussions were held with representatives from a number of local associations and organizations including the Sunshine Coast Conservation Association, the Tetrahedron Outdoors Club, the Tetrahedron Alliance and the Tuwanek Ratepayers Association. Informal discussions and information-sharing have also included the Sunshine Coast Salmonid Enhancement Society (Chapman Creek Hatchery) and the Ruby Lake Lagoon Nature Reserve Society. The District of Sechelt and town of Gibsons will continue to participate in the Project through the SCRD board, staff presentations to local councils and periodic updates. The Vancouver Coastal Health Authority will be invited to participate through the Sunshine Coast's local representative. The process will document all interests, comments and issues expressed, providing a report of this information to the SCRD, BC Parks and other regulatory agencies.

Planned Aboriginal consultation and public participation activities include a presentation to the SCRD's Infrastructure Committee, followed by consideration of the consultation process findings prior to approval of the Project's final design by the SCRD Board. An Open House to share Project details, proposed timelines and answer public questions will be held at the conclusion of the consultation and public participation process.



Basemapping from ESRI Online Topographic,
First Nation Territories from GeoBC

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Legend

- Project Area (Chapman Lake)
- Squamish Nation Territory
- shíshálh Nation Territory
- Park and Protected Area
- Community Watershed
- Waterbody
- Champan Creek Water Treatment Plant
- Chapman Creek Hatchery
- City
- Main Road (Arterial / Collector / Highway)
- Stream

Water Service System

- Chapman
- Gibsons
- Langdale
- Soames

Overview Map

Chapman Lake Water Supply Expansion Project
Location: Chapman Lake, BC

First Nation Territories

03 March 2016

AECOM

DRAFT
Figure 5

File Location: P:\604859\18\900-Work\928-929 (GIS)\02_Maps\First Nations\2016-03-01-FNTerritories\Figs-2016-03-01-FNTerritories\Portrait-604859\8-002.mxd Date Revised: March 03, 2016 Reviewed By: AM Paper Size: 11"x17" Scale is referenced to the specified paper size.

3. Existing Conditions

3.1 Geology

Chapman Lake lies within an area of granite rock of the late Jurassic and early Cretaceous ages (156 to 114 million years old), characterised as quartz diorite (Triton 2006). Coastal watersheds underlain by rock types such as quartz diorite tend to be slightly acidic due to the low buffering capacity of these rocks and the natural low pH of rainfall (McKeown *et. al.* 2002 in Triton 2006).

The dominant soil-types within the Chapman watershed contain large concentrations of organically combined iron and aluminium in their subsoils (Carson 1999 in Whitehead 1999). In poorly-drained soils on the Tetrahedron Plateau organic matter is not broken down as quickly as in areas of well-drained soils, which means that organic and clay colloids, and aluminium and iron compounds are common elements in the water supply and characterize the natural water quality in this area (Triton 2006).

3.2 Water Resources

The Chapman Creek watershed (Watershed Code: 900-120400) is located approximately 5 km east of Sechelt, BC and provides approximately 85% of the drinking water and fire protection for 21,000 residents between Langdale and Earl's Cove, including the District of Sechelt. Water storage is provided by both Chapman and Edwards Lakes which are located on the Tetrahedron Plateau in Tetrahedron Provincial Park (Figure 1). A control structure on Edwards Lake allows water to be released when required to augment flows in Chapman Creek.

Chapman Creek flows south from the Tetrahedron Plateau for approximately 24 km and discharges into the Georgia Strait. Chapman Creek watershed is approximately 73 km². The SCRD drinking water intake is located approximately 7.5 km upstream of the mouth of Chapman Creek and is approximately 175 m above sea level. Approximately 65 km² of the Chapman Creek watershed is located above the SCRD water intake.

3.2.1 Chapman Lake

Chapman Lake lies at an elevation of 976 m above sea level in steeply sloping terrain; surrounding ridgetops and peaks typically reach over 1,500 m elevation. The lake has a surface area of 31.2 ha and a maximum depth of approximately 30 m (Whitehead 1999), making it the largest lake in the Chapman Creek watershed. The catchment area of the lake is 6.58 km², and the lake is fed by 2 main streams, both of which enter at the east end of the lake. The lake volume at the high water level is approximately 3.7 million m^3 with an average outflow rate of 0.476 m^3/s. Based on these data, the average retention time of water in the lake is approximately 90 days (Whitehead 1999). The short retention time reflects the high level of precipitation in the watershed. Outflow from the lake is controlled by a concrete dam and valve located on the west side of the lake and operated by the SCRD. During a typical year, water stored behind the dam is allowed to overflow naturally until there is a need to supplement the flows to Chapman Creek, at which time the dam is opened to release stored water from the reservoir. The annual lake level variation is currently between 1.5 m to 3 m (Whitehead 1999).

3.2.2 Chapman Lake Water Quality

Whitehead (1999) reported the results of limited water quality monitoring on Chapman Lake. Parameters measured included Secchi disc transparency, temperature and dissolved oxygen. The Secchi disk indicated clear water with a reading at 6.5 metres. Temperature and dissolved oxygen results ranged from 16°C at the surface to 7°C at depth and from 16 mg/l at the surface to 6.5 mg/l at depth, and indicated the lake was stratified with a thermocline between

2 m and 3 m. During the monitoring program gas bubbles were observed throughout the lake and particularly at the east end in the shallower areas. Based on the smell of hydrogen sulphide it was concluded the gas bubbles were originating from anaerobic decomposition originating in the lake sediments (Whitehead 1999).

3.2.3 Water Quantity

A water demand and supply analysis under changing climatic conditions was conducted on the Chapman water system on the Sunshine Coast (Staats 2014). The study assessed the impacts of climate change on water consumption and water supply within the Chapman watershed. Historic temperature, precipitation and discharge data were collected to determine historic trends. The impacts from Pacific Decadal Oscillations and El Niño Southern Oscillations on climate and discharge were analyzed to determine the impacts of climate change.

The results from this study indicated that climate patterns on the Sunshine Coast have changed over the last 50 years, with annual average temperatures increasing by approximately 2°C and average total annual precipitation decreasing by 24 mm. Climate trends were determined to impact the available water supply as temperatures and snowpack elevation were increasing. This increased temperatures and diminishing snow pack is causing the snow to melt earlier and more rapidly during the spring season and existing streamflow regime in Chapman Creek is shifting towards a more rain dominated regime, which would change the entire water holding dynamic of the watershed. Discharge data further showed that peak discharge occurred earlier in the spring, which affects summer base flows when demand for domestic distribution and environmental services was highest. Climate conditions during the summer season were also determined to be impacting supply as the increasing temperatures were assumed to cause the snowpack to be depleted earlier in the summer season and the decreasing trends in precipitation were resulting in less recharge to storage reservoirs.

The increases in temperature and decreases in precipitation trends were shown to be correlated to water consumption during the summer season when water supplies are the most limited. The significant correlation between water consumption and temperature and precipitation identifies how climate change may impact water consumption behaviors on the Sunshine Coast. If average summer temperatures continue to increase with population growth and the Sunshine Coast, in addition to increase in population due to summer tourism, regular water scarcity issues could occur more frequently in the near future.

As part of the study, a sensitivity analysis was completed and identified that the total water consumption during the summer could regularly exceed the equivalent to the available water supply in the next 10 years if water demand does not change, snow pack continues to decrease in the winter, summer temperatures increase by an average 1 or 2 °C, and prolonged droughts become more common.

3.3 Fisheries Resources

3.3.1 Chapman Lake

The provincial Fish Inventory Summary System[1] database reports that the headwaters section of Chapman Creek supports resident populations of Dolly Varden char (*Salvelinus malma*) and rainbow trout (*O. mykiss*). A fish sampling program was undertaken to supplement existing information to support the impact assessment in 1998. Gill netting and minnow trapping methods were used to sample the lake during a 24 hour period. Only Dolly Varden averaging 14 cm long were captured in the lake during this sampling period (Whitehead 1999).

[1] http://a100.gov.bc.ca/pub/fidq/welcome.do

Benthic macroinvertebrate sampling by Whitehead (1999) included sampling substrates at 3 m and 5 m depths and caddis fly and bloodworms were the most common animal captured. Overall density results indicate that benthic macroinvertebrate levels are low in Chapman Lake (Whitehead 1999).

3.3.2 Chapman Creek

Fisheries information was gathered using the FISS database for Chapman Creek and Chapman Lake (FISS 2016). Fish species found in Chapman Creek include five species of anadromous fish: coho (*Oncorhynchus kisutch*), Chinook (*O. tshawytscha*), chum (*O. keta*), pink (*O. gorbuscha*), steelhead (*O. mykiss*) and anadromous cutthroat (*O. clarkii clarkii*). These fish can access the first 6.8 km of Chapman Creek up to an impassable series of two waterfalls. In 2015 the SCRD commissioned FSCI Biological Consultants to conduct a study of low summer flows in Chapman Creek and how they affect salmonid migration. The purpose of the study was to determine the limitations imposed on salmonid populations in the lower sections of Chapman Creek during low late summer flows. The SCRD has control over the flow levels in lower Chapman Creek through its operation of the outlet structure on Chapman Lake. The current operating procedure is to maintain flows of at least 0.3 m3/s downstream of the SCRD intake and 0.2 to 0.22 m^3/s in July and August to provide sufficient instream flows for fish. The total amount released from the lake is first set to achieve the required instream flow and then an additional amount is added for the community water needs. The amount released from the lake also takes into account the contributions from several small tributaries and from groundwater that enter the creek below the lake. The fish hatchery located downstream of the SCRD intake typically uses 0.1 m^3/s of the instream flow but their water licence allows them to take a maximum of 0.28 m^3/s. .

FSCI Consultants report (full report provided in Appendix 2) assessed habitat conditions at three flows ranging from 0.12 to 0.9 m^3/s and evaluated the amount of habitat available for rearing juveniles and migrating adults, including restrictions to upstream migration. The assessment concluded that low flows appear to be adequate to support rearing juveniles but there were potential restrictions to upstream migration for adult salmon. The migrations restrictions seem to be most evident at flows below 0.2 m^3/s. The timing of the low water conditions will normally only affect pink and chinook salmon. Chinook salmon have been introduced to the system and appear to be sustained through hatchery production. The more important local species, chum and coho typically do not start to migrate into the creek until later in the fall, end of September at the earliest when water levels are typically increasing with the onset of fall weather. The report recommends a plan for flow manipulation during pink spawning years (odd years only) which would include pulsed releases of 0.4 m^3/s for approximately 4 hours to occur a number of times over the pink migration period to facilitate their upstream migration.

3.4 Wildlife Resources

Wildlife values within the Chapman Creek watershed are not well known and information is limited. The watershed appears to support populations of Columbian black-tailed deer (*Odocoileus hemionus columbianus*), black bear (*Ursus americanus*), cougar (*Puma concolor*) and other furbearing animals. Other wildlife known to use the watershed include: waterfowl, gulls, shorebirds, raptors, upland game birds, woodpeckers, a variety of songbirds, small mammals, amphibians and reptiles (IWMP 1998). Species recorded in Tetrahedron Provincial Park include: mountain goat (*Oreamnos americanus*), coyote (*Canis latrans*), mink (*Mustela vison*), marten (*Martes Americana*), river otter (*Lontra canadensis*) and bobcat (*Lynx rufus*), a variety of rodents, rock ptarmigan (*Lagopus muta*), woodpecker, grouse, ravens (*Corvus corax*), and marbled murrelets (*Brachyramphus marmoratus*; MELP 1997). It is thought that many of the larger animals tend to be transient users wildlife corridors to pass through the park (MELP 1997). Hunting is prohibited within the park; however, the lower reaches of the watershed provide recreational hunting opportunities (IWMP, 1998). There are no approved Wildlife Habitat Areas in the assessment area. There is a lack of emergent vegetation (e.g., cattail, bulrush) within the high water perimeter of Chapman Lake, however, some limited opportunities for nesting birds is available in this area (Whitehead 1999).

3.4.1 Sensitive Wildlife Species

A list of sensitive wildlife species potentially found in the study area was compiled using the BC Conservation Data Centre database. The search categories used to compile the information included a search of the Sunshine Coast Forest District and refining the search results using the Coastal Western Hemlock and Mountain Hemlock biogeoclimatic zones. Habitat types used to further filter survey results included forest, grassland/shrub, lakes, riparian, stream/river and wetland. Appendix 3 provides a summary of the resulting species, including the BC designation and Species at Risk statuses. BC Red listed species include any plant, animal or plant community that is extirpated, endangered or threatened and Blue listed species are considered to be of special concern in BC, but are not extirpated, endangered or threatened. The Species at Risk Act, Schedule 1, is federal government legislation enacted to protect extirpated, endangered and threatened species and species of special concern across Canada. A total of 45 sensitive BC wildlife species were identified, with 16 SARA listed species results.

3.5 Vegetation

3.5.1 Vegetation Overview

Forest cover around Chapman Lake and the upper Chapman Creek watershed consists of mountain hemlock (*Tsuga mertensiana*), yellow cedar (*Chamaecyparis nootkatensis*) and Pacific silver fir (*Abies amabilis*), while lower elevations in Tetrahedron Provincial Park contain western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*; Triton 2006).The canopy formed by the tree cover varies from relatively open to dense. Throughout the park, semi-open meadows, marsh complexes, and areas of dense shrub [e.g., blueberry (*Vaccinium sp.*)] are also found (Whitehead 1999).

The mid and lower reaches of the Chapman Creek watershed, outside the park boundaries, fall within the Coastal Western Hemlock biogeoclimatic zone, and are characterized by forests dominated by Douglas fir (*Pseudotsuga menziesii var. menziesii*), western hemlock, western redcedar and a variety of understory shrub species. Widespread logging and associated disturbance and revegetation have resulted in a change in forest composition from old-growth conifer forests to communities with a higher proportion of broadleaved trees. Much of the riparian zone in the mid and lower reaches of Chapman Creek now consists of alder stands (Whitehead 1999). The park is situated within the Southern Pacific Ranges ecosection and Coastal Western Hemlock/Mountain Hemlock biogeoclimatic zones. The park contains one of the oldest undisturbed forests in Canada with stands containing trees over 1,000 years. Semi-open meadows, marsh complexes and dense understorey (e.g. blueberry) are characteristic of the park, which also contains ten lakes (MELP 1997).

3.5.2 Riparian Vegetation

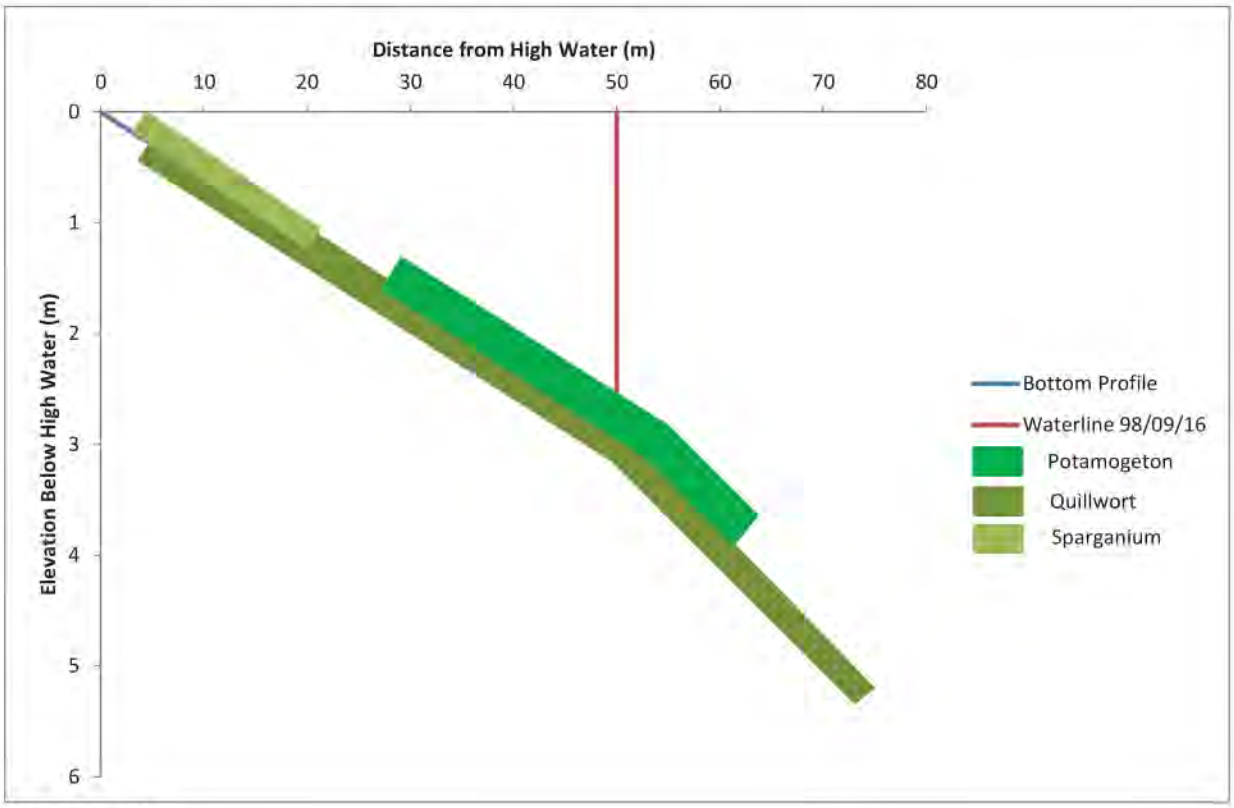
Riparian vegetation surveys were completed in 1998 (Whitehead 1999) as part of impact assessment from the 5 m lake depth to 5 m above the high water level. The riparian area is largely forested to the high water level with several smaller areas where shrubs and/or herbaceous species predominate. The four habitat types identified include forest, shrubland, wet meadow and wetland/aquatic. Forest vegetation consisted of mountain hemlock and amabilis fir with some yellow cedar. The shrub layer was dominated by Alaskan blueberry (*Vaccinium alaskaense*) and oval-leaved blueberry (*Vaccinium ovalifolium*) with the herb layer consisting of moss. Meadow and wetland areas contained a graduation from one to the other with an increase in soil moisture. Meadow areas tended to be moist due to subsurface drainage from hillslope areas. Vegetation growth within the lake that was less than 2 m in depth was considered part of the wetland habitat.

3.5.3 Aquatic Vegetation

Aquatic vegetation transects were conducted in Chapman Lake during late summer of 1998 (Whitehead 1999). Aquatic plants surveyed were limited to submergent species; however, water levels in the lake were below normal high water levels. The dominant species inventoried consisted of bristle-like quillwort (*Isoetes echinospora*) and was observed growing on suitable substrates throughout the lake. Dominant plant species typically occur between the 1 m and 4 m below the high water level. Narrow-leaved bur-reed (*Sparganium sp.*) and pondweed (*Potamogeton sp.*) were observed on the exposed or shallow lake areas, particularly at the east end of the lake. Figure 6 illustrates the zonation of aquatic vegetation in Chapman Lake from the survey transects for the study completed in 1998.

The main disturbance to aquatic vegetation during operations was identified as desiccation due to drying; however, it was noted that drying stress is already present seasonally in the littoral zone where most of the aquatic vegetation occurs and the dominant plant (quillwort) appeared to be very tolerant to desiccation under existing water level fluctuations in the reservoir. It is likely that the reduced growing season caused by existing drawdown leads to increased thermal drying stress on bur-reed and pondweed and abundance levels were low (Whitehead 1999).

Figure 6. Zonation of Aquatic Vegetation in Chapman Lake



Source: Whitehead 1999

3.5.4 Sensitive Species

A list of plant species potentially within the study area was compiled using the BC Conservation Data Centre database. The same search categories as above were used to compile the information. Table 1 provides a summary of the resulting species, including the BC designation and Species at Risk statuses. A total of seven sensitive BC species were identified, with no SARA listed species results.

Table 1. Sensitive Plant Species in the Sunshine Coast Forest District

Common Name	Scientific Name	Species Type	BC Status	SARA Status
elegant Jacob's-ladder	*Polemonium elegans*	Dicot	Blue	
Kamchatka spike-rush	*Eleocharis kamtschatica*	Monocot	Blue	
poison oak	*Toxicodendron diversilobum*	Dicot	Blue	
Roell's brotherella	*Brotherella roellii*	Nonvascular plant	Red	
slimleaf onion	*Allium amplectens*	Monocot	Blue	
small spike-rush	*Eleocharis parvula*	Monocot	Blue	
snow bramble	*Rubus nivalis*	Dicot	Blue	

A search was also conducted in the BC Conservation Data Centre database for terrestrial ecological communities in the area surrounding Chapman Lake. Criteria used to focus the search results was applied using the regional and forest districts for the Sunshine Coase filters. In addition, the biogeoclimatic zone of Coastal Western Hemlock, subzone very wet maritime and montane (CHWvm2) variant filters were applied. Table 2 below provides the results of the ecological community database search of the area, which includes BC sensitive species status.

Table 2. Sensitive Ecological Community Plant Species in the Sunshine Coast, Coastal Western Hemlock Biogeoclimatic Zone (CHWvm2)

Common Name	Scientific Name	BC Status	Endemic
amabilis fir - Sitka spruce / devil's club	*Abies amabilis - Picea sitchensis / Oplopanax horridus*	Blue	
amabilis fir - western redcedar / salmonberry Very Wet Maritime	*Abies amabilis - Thuja plicata / Rubus spectabilis* Very Wet Maritime	Yellow	
amabilis fir - western redcedar / three-leaved foamflower Very Wet Maritime	*Abies amabilis - Thuja plicata / Tiarella trifoliata* Very Wet Maritime	Yellow	
Sitka sedge / peat-mosses	*Carex sitchensis / Sphagnum* spp.	Red	Y
Sitka willow / Sitka sedge	*Salix sitchensis / Carex sitchensis*	Blue	Y
western redcedar - western hemlock / sword fern	*Thuja plicata - Tsuga heterophylla / Polystichum munitum*	Blue	
western redcedar - yellow-cedar / spleenwort-leaved goldthread	*Thuja plicata - Xanthocyparis nootkatensis / Coptis asplenifolia*	Yellow	
western redcedar - yellow-cedar / skunk cabbage	*Thuja plicata - Xanthocyparis nootkatensis / Lysichiton americanus*	Yellow	
western hemlock - amabilis fir / deer fern	*Tsuga heterophylla - Abies amabilis / Blechnum spicant*	Blue	
western hemlock - amabilis fir / Alaskan blueberry	*Tsuga heterophylla - Abies amabilis / Vaccinium alaskaense*	Yellow	
western hemlock - lodgepole pine / grey reindeer	*Tsuga heterophylla - Pinus contorta / Cladina rangiferina*	Yellow	Y
western hemlock - western redcedar / salal Very Wet Maritime	*Tsuga heterophylla - Thuja plicata / Gaultheria shallon* Very Wet Maritime	Blue	Y
yellow-cedar / peat-mosses	*Xanthocyparis nootkatensis / Sphagnum* spp.	Yellow	

3.6 Historical/Cultural Significance

There were no available records of archaeological, historical and cultural heritage values at Chapman Lake. Chapman Lake lies within the traditional aboriginal territory of the shíshálh Nation. An assessment by Global Village Research Consultants (1998) confirmed the '*no sites recorded....within a 9 to 10 mile vicinity of Chapman Lake and the upper drainage of Chapman Creek*" (Whitehead 1999). AECOM recently reviewed the BC archaeological site database for any newly recorded sites in the project area and no new records have been added.

The SCRD will be contracting In Situ Consulting through the shíshálh Nation to conduct a preliminary field reconnaissance of the areas that will be affected by construction. This work will involve an ethnographic and desk-top review of the project area and when conditions allow, a field survey of the sites as well. The completion of this assessment will depend on snow melt at the project site and may not be available until early May.

4. Potential Impacts and Mitigation

This section describes the potential effects of the construction and operation of the infrastructure necessary to draw the lake down below the – 3 m level and the mitigation measures that can be applied to reduce or eliminate the effect. Each section concludes with an assessment of project residual effects, those effects that are anticipated to remain after mitigation measures have been applied.

4.1 Soils, Vegetation and Wildlife

4.1.1 Construction

Construction will require:

- Regular helicopter flights to the work area and associated noise
- the establishment of a work camp,
- laydown area for equipment and supplies including on-site fuel containment
- excavation and blasting to create a trench to install a deep water withdrawal pipe
- disposal of excess overburden and rock removed from the trench, and
- drilling through bedrock to install the low level outlet.

Disturbance during construction will include removal of vegetation, compaction of soils, and excavation of a 5 m deep trench. Efforts will be made to contain the areas impacted by construction to one continuous area rather than creating several smaller areas. The construction is expected to take 3 months, during which time wildlife will likely avoid the work area. Also, the current plan anticipates a work camp to be assembled at the site. Given the nature of the area there is also potential for human/wildlife interactions. To minimize disturbance to vegetation the camp and laydown areas will be confined to areas used during the original dam construction in 1978.

Mitigation measures would include:

- Setting up the camp so that wildlife is deterred from entering the camp area
- Limiting the work area by flagging areas where equipment does not need to go
- Conducting pre-construction survey for any rare plants and relocate the plants to suitable habitat nearby either permanently or to for use in site rehabilitation after construction.
- Site hygiene including secure bins for garbage, no garbage left around the site, regular removal of garbage
- Application of appropriate erosion and sediment control measures, particularly in area where vegetation is removed and soils disturbed
- Emergency response plans in the event of accidental release of deleterious materials (i.e. sediment, fuel)

- Remediate areas used for construction camp and laydown including de-compacting soils, seeding and other plantings to re-establish vegetation and pre-existing habitat values. A full remediation plan will be developed prior to start of construction
- Develop a reclamation plan for overburden and/or rock disposal area

Potential effects on terrestrial habitat and wildlife could result from direct disturbance of vegetation or exclusion from habitat areas. Most direct disturbance will occur during the construction phase and will be short term. These effects are expected to be repaired through site remediation works resulting in a medium residual effect.

4.1.2 Operation

Deer, bear and other mammals use the lakeshore for drinking water. With receding water levels, segments of the shoreline may be soft, which can interfere with an animal's ability to approach the water. Also, animals crossing the shore to drink may be exposed to increased predation as the water line recedes from the cover provided by riparian vegetation. Whitehead (1999) identified areas around the lake where the substrate is firm, as well as small watercourses and ponds, where animals can access water without undue risk of predation or becoming hampered by soft ground. The potential effects on terrestrial wildlife from additional drawdown of the lake were not considered significant by Whitehead (1999).

Disturbance of terrestrial species and habitat during the operational phase is not considered significant. Drawdown below -3 m will only occur to avoid Stage 4 water use restrictions. Disturbance to wildlife during operation will be limited to human visits to check and maintain the infrastructure which takes place a few times a year. Essentially this aspect will be no different than the current operational and maintenance activities that the SCRD undertakes each year at Chapman Lake. There is no residual effect anticipated due to the infrequent drawdown of the lake below the -3 m level.

4.2 Aquatic Resources

4.2.1 Construction

The construction phase of the project has the potential to affect water quality in Chapman Lake and downstream. Potential sources of adverse effects on water quality during construction include:

- Accidental release of fuels, lubricants and other substances used in construction
- Erosion of soils and release of sediments to the lake or downstream into Chapman Creek
- Contamination by human and other wastes

The volumes of fuels, lubricants and other substances can be expected to be relatively small. Precautions will be taken during construction to avoid spills. However, small spills and leaks of hydrocarbons (fuel, grease and oils) or other substances from construction equipment are possible. Fuels, lubricants and other substances used in construction will be stored well away from the water, at least 30 m from the high water line. A Spill Prevention Plan will include details on refueling and maintenance of equipment that will reduce the potential for oils and greases from entering the lake.

The potential for spills to enter the lake waters and streams will be mitigated by providing the on-site workers with appropriate training in the handling and storage of deleterious substances and in spill response. The Spill Prevention Plan will also include specifications for spill cleanup equipment that will be on site during construction and procedures for handling and reporting spills.

To control adverse effects of resuspension of sediment, construction activities will be completed by excavating and installing the intake pipe in the dry. Only at the end of the pipe installation will any work be carried out that could cause sedimentation and degraded water quality. A water management plan will be developed to handle any water that seeps into the construction area and how any sedimentation will be contained during the final installation of the pipe. To assess the effectiveness of this plan and its associated mitigation measures, routine monitoring of water quality in the lake and in Chapman Creek will be carried out. Evidence of degraded water quality will require a review of the mitigation measures and the environmental monitor shall make recommendations for the application of additional measures.

In general the risk to water quality during construction will be low provided that adequate preventive measures are implemented. If mitigation measures are not fully effective, elevated sediment levels released into Chapman Creek should have minimal impact on drinking water as there are numerous pools in the creek that will allow sediments to drop out of suspension during the approximately 17 km course from Chapman Lake to the intake at the water treatment plant.

Residual effects from construction include change in water quality that could not be fully mitigated during construction but conditions are expected to return to normal soon after construction is completed resulting in a medium impact.

4.2.2 Operation

4.2.2.1 Chapman Lake

The operation of the low level outlet will result in drawing the lake level down below the -3 m level during periods of drought. The timing of additional drawdown would be during the summer and early fall. Opus DaytonKnight (2013) predicted that by 2036 if the SCRD initiated intensive demand side management (i.e. water metering) the existing Chapman Creek storage would be robust enough to handle drought conditions expected to occur as infrequently as once every 15 years. Opus DaytonKnight (2013) also recognized the effect of climate change and concluded that it should have minimal impact on available summer lake storage through 2036.

Potential effects of drawdown below -3 m:

- Increased sedimentation from shoreline erosion, either by wave action or rilling and other effects from rain.
- Changes in lake dynamics that causes changes to temperature regimes and/or dissolved oxygen
- Lake bed drying

Erosion could occur on the exposed lake bed due to runoff and wave action. Runoff would occur during heavy rainfall and increase sediment transport into the water. Impacts of erosion would be the greatest immediately after the onset of fall rains when the greatest sediment surface area occurs; however, the still water within the lake will act as a settling basin, which will likely mitigate any significant increase in turbidity at the outlet (Whitehead 1999). Wave action can create turbulence that may re-suspend particulates and transport the material into the water. The length of exposed shoreline to wave action is expected to decrease with increasing drawdown from 3,800 m during high water to 2,500 m during the lowest water level predicted during a 1:20 year drought (Whitehead 1999). Impacts of wave action are expected to be not significant.

Aquatic life is constrained by physical and chemical factors such as temperature and dissolved oxygen. Typically, the biota does not occupy the entire lake volume, but are restricted to favourable areas. The short-term carrying capacity of the lake may decrease, as these organisms will continue to occupy the same relative upper strata within a reduced lake volume during the drawdown period (Whitehead 1999). Release of hydrogen sulphide from the

sediment may be accelerated as a result of drawdown, due to the decrease in water pressure on the sediments and may affect benthic biota at a very localized level.

The surface area of exposed lakebed increases as the water level retreats. Under normal conditions the maximum annual drawdown typically ranges from 1.5 to 3.0 m. With the low level pipe in place the predicted drawdown would increase. In 1998 it was predicted that a maximum draw down of 8 m would occur during 1:20 year drought conditions (Whitehead 1999). However, those numbers did not contemplate the type of demand side management that the SCRD is now committed to (water metering) which could reduce demand by 25% or more (Opus DaytonKnight 2013).

The current maximum allowed drawdown of 3.0 m exposes approximately 6.7 ha of lake shore. The exposed area will increase to 12 ha at a full drawdown of 8 m. Exposure of this additional area of the lake bed to air and sun effects include partial to complete drying and warming of the sediment surface; physical-chemical reactions in the surface layer; biotic community effects; and, lateral flow of pore water from the upper sediment layer toward the contiguous retreating water. Also the increased area will expose a larger area to erosional effects of rainfall and wave related erosion. Both could cause increased sedimentation and turbidity in the lake. The extent of this effect is unknown but past experience has shown no significant concern with elevated turbidity of water leaving Chapman Lake when the water level is close to -3m. The field work completed for the assessment of the previously proposed pump station measured the transparency (secchi reading) of the lake water during a time of low water levels and reported a transparency of 6.25 m which indicates low levels of particulate matter in the water column (organic of inorganic). Since there has been no systematic sampling of turbidity or total suspended solids carried out to quantify conditions in the lake, a sampling program that collects routine water quality data should be developed to support monitoring of potential project effects.

Fish spawning habitat, which are limited to the appropriate habitats in the larger inlet streams, will not be affected since it is not within the reservoir. Access to the spawning area may be affected if the lake level is lowered by 8 m but under the drought conditions necessary to require such a drawdown would likely result in insufficient flow in these tributaries that would be required for spawning. The lake is known to re-fill rapidly when fall rains start which should provide the fall spawning Dolly Varden access spawning areas.

At full drawdown fish will be restricted to a smaller volume of water. During the summer, fish tend to remain in the upper layers of the water column due to thermal stratification and are expected to stay in this zone as the water level recedes. The drawdown to the lower levels would not likely occur until late summer or early fall when the air temperature begins to drop (in part due to shorter days). Therefore the temperature of the upper, oxygenated layer of the lake is not expected to rise to a level that will impact the health of the fish. Benthic invertebrates provide a food source for fish and would remain available throughout a drawdown of the lake; however, there is a possibility of a decrease in the herbivorous prey species due to impacts of the drawdown on aquatic vegetation (Whitehead 1999). Overall the drawdown of Chapman Lake below the current level of 1.5 to 3 m is likely to have a minor effect on fish during those years when lake levels drop below -3 m. The effect will be temporary and current projections of the frequency of drawdowns suggest that there will be adequate years of normal drawdown that the sustainability of the fish populations in Chapman Lake will be maintained.

The additional drawdown of Chapman Lake to supply water during times of drought is judged to have a low impact on aquatic resources of the lake.

4.2.2.2 Chapman Creek

The SCRD current policy is to replicate natural flows in Chapman Creek below the intake and target minimum flow rate of 220 L/s during July and August and 300 L/s for the remainder of the year. The proposed project would not

impact this water release policy and would have a positive benefit to fish in the lower sections of Chapman Creek during times of drought. Without the low level pipe, once the lake drops to the -3.0 m level there would be no more water released from Chapman Lake to augment flows in the salmon bearing reaches of the creek. With the low level pipe the water allocation would remain as it has in the past, 0.22 m3/s would be released for fish needs and then the drinking water requirements would be added. It is anticipated that access to the additional 1,000,000 m^3 of water would sustain water releases from Chapman Lake until the fall rains begin, even under severe drought conditions to the benefit to both fish and people. Also, the new valve and control mechanisms that will be installed on the pipe will provide the SCRD with precise control over the amount of water released from the lake allowing the most efficient release of water and maximizing the duration that water can be released

4.3 Park Access

There will be no changes to park access during construction or operation. Helicopters will be used to move people and equipment to the site. The proposed works during construction would not obstruct the existing hiking trails.

4.4 Aesthetics and Visual Values

Chapman Lake is not highly visible from the surrounding terrain and trails due to its position at the foot of steep slopes, the forest cover, and lake of unobstructed view corridors from the trails. Chapman Lake is a visual feature of the area but can only be appreciated from a close distance directly from the shore or from the air.

Construction will affect the visual quality for some hikers passing the construction site. Mitigation measures that may be appropriate and could include layout of the construction camp, use of information signs and screening if there are significant concerns about the presence of a temporary work camp and site.

4.5 Air Quality

4.5.1 Construction

Potential sources of emissions that could degrade air quality include the helicopter, excavators, horizontal directional drill rig, generators, fires and fugitive dust. All these sources are considered minor due to the small scale and temporary nature of the project.

4.5.2 Operations

The only potential air quality effect during operation could be the dispersal of dust from newly exposed and dried out lake sediments. This impact will be limited to those years when the lake is drawn down below -3 m and will be restricted to a few weeks at the end of the summer. Also, the lake sediments contain a high organic content that tends to hold the sediments together and limits the fraction that is small enough to become airborne during periods of wind (Whitehead 1999).

4.6 Noise

4.6.1 Construction

Helicopters will occur be used during construction to transport people, equipment and supplies to the work site. Several trips per day will likely be required during the initial start-up and then intermittently during the construction phase. During construction noise would also be generated through use of an excavator, generators, power tools

and other incidental construction activities. Recreational use of the trail near the project site is reported to take place mostly during the winter (Whitehead 1999); however, there is known summer use of trails around Chapman Lake.

The potential effect to the area from construction noise will be to area wildlife and human park users. The greatest wildlife impacts will be to those species sensitive to noise, such as nesting birds during breeding season. To mitigate the risk to wildlife from noise, construction timing should occur outside sensitive breeding times such as spring and early summer. Mitigation measures for helicopter use includes the development of a standard flight path that can be used to efficiently fly between the pick-up and drop off spots but also minimize flying close to park trails and any sensitive environmental features such as active raptor nests. Additional mitigation measures to limit impact on park users could include scheduling the noisiest activities (i.e. blasting and helicopter use) to mid-day hours. Mitigation measures to minimize the impact of helicopter noise and the temporary and transient nature of the helicopter noise should result in minor impact. Further mitigation, similar to visual effects, would include putting up signs and using other methods to inform users that the construction activity is taking place. Noise associated with ground based activities isn't likely to travel far from the site due to the surrounding forest and mitigation measures should limit the impact to a moderate level.

4.6.2 Operational

There is no additional noise impact associated with the operation of this gravity fed system. The valve controls will be operated remotely by the SCRD and helicopter visits to the site will be similar to the frequency of visits to the site for the existing facility.

4.7 Cultural Values

As indicated in Section 3.6, In Situ Consultants will carry out a preliminary field investigation of the construction site once snow conditions allow. If there is an indication of potential archaeological findings in the area a more detailed Archaeological Impact Assessment will be required prior to start of construction.

4.8 Park visitors and Local Communities

The proposed work during construction would not obstruct the existing hiking trails. The project will not affect access to Chapman Lake by park visitors and the local community at any time of the year, as it does not impinge on any of the trails or other identified use areas.

5. Environmental Management Plan

Prior to start of construction a detailed environmental management plan (EMP) will be prepared and provided to BC Parks, Ministry of Forests Lands and Natural Resources Operations and the shíshálh Nation for review and approval. The plan will identify the mitigation strategy to offset each of the impacts identified in this report and will define the role of an environmental monitor and the frequency of monitoring during the construction phase. The following provides high level content to be included in the Construction EMP with the final EMP developed when specific construction details are known (likely when a construction contractor is hired):

- Environmental monitor(s) and frequency of monitoring
- Daily monitoring form to be completed by the monitors
- Reporting requirements
- Details on how the mitigation measures will be implemented including:

  - Sediment and erosion control
  - Management of human waste
  - Noise management program
  - Management of visual aesthetics
  - Water quality monitoring
  - Protection of riparian vegetation
  - Wildlife management
  - Archaeological resources
  - Site restoration plan based on current vegetation found in the areas to be disturbed
- Provision for pre-construction site visit to identify the presence of any rare or endangered plant species in the area to be disturbed
- Survey of nesting birds in the construction area and raptor nests along the flight path of the helicopter
- Development of a helicopter flight path for flying into and out of Chapman Lake

An operation phase EMP will also be developed and will include:

- Provisions for In Situ Consultants to examine the draw down area when it is 1 m or more below the existing – 3 m drawdown level
- Monitoring of shoreline conditions during drawdown
- Monitoring water quality in Chapman Lake under normal conditions and under extreme drawdown conditions (i.e. temperature, oxygen profiles, turbidity)
- Monitoring and assessment of the effectiveness of the site restoration works

6. Summary

A summary of the project effects, mitigation measures and determination of residual impacts of the project were completed in order to assess the construction and operations impacts for the project. The assessment focussed on seven environmental and social aspects associated with the construction and operation of the new system. Table 3 provides a summary the findings. The construction phase will employ standard construction techniques for which there are established mitigation measures that are effective for containing and managing the effects of earth moving, blasting and other general requirements (fuel handling, waste management, etc.). The application of the mitigation measures will be presented in detail in a construction EMP. Because this work is being carried out in an unspoiled park environment the residual effects of some construction activities have been rated moderate but the effects are only present during construction and most will revert to pre-construction conditions once construction is finished. Site remediation will require on going monitoring to track the effectiveness of the remedial works and to if necessary identify any additional work that might be required to achieve proper restoration. Residual impacts of the operation of the proposed system on the assessment components were determined to be negligible to low resulting in an overall assessment that operational impacts will be insignificant. However, ongoing monitoring of the effects on Chapman Lake was recommended to confirm the effects of an increased drawdown of the lake during drought conditions.

Table 3. Project Effects, Proposed Mitigation Residual Effect and Assessment of the Proposed SCRD Water Project

Component	Mitigation Measures	Residual Effect	Magnitude	Geographic Extent	Temporal Bound	Overall Impact
Geophysical: Blasting	• Blasting plan to be developed by a certified blaster • Limit blasting overpressures to a maximum of 133 dB	Construction: Vibration and Noise	L	L	L	Low
		Operation: No residual effect	-	-	-	-
Air Quality	• Well maintained equipment • Apply dust suppression when required • On site fuel containers to have proper caps and to be covered • Minimize flights to the area	Construction: Degraded air quality from heavy equipment, helicopter use and dust	M	M	L	Medium
	• Monitor effects during drawdown	Operation: Increase of dust from lake drying	M	M	L	Negligible
Noise	• Properly equipment and well maintained equipment • Minimize flights required to the area • Work outside of sensitive breeding windows • Avoid areas with species sensitive to noise • Early and late day work to be avoided	Construction: noise from blasting, helicopter and construction equipment	M	M	L	Medium
		Operation: No residual effect	-	-	-	-
Terrestrial Resources	• Develop a vegetation remediation plan • Proper camp design and set up • Erosion and sediment control plan • Ensure appropriate construction timing to avoid wildlife breeding season	Construction: Temporary loss of vegetation/wildlife habitat and change in biodiversity, camp wildlife attractant, disruption of wildlife,	M	M	L	Medium
		Operation: No residual effect	-	-	-	-
Aquatic Resources	• Emergency spill response plan/spill cleanup equipment and properly trained staff • Installation of sediment and erosion control measures and maintenance • Installation of intake pipe in the dry • Fish Screen on intake	Construction: Release of sediment or other deleterious substances, resuspension of sediment, contamination with wastes	M	M	L	Medium
	• Water demand reduction programs (e.g. metering) • Infrequent drawdown below -3 m • Maintain current water release requirements for fish	Operation: increase sedimentation and erosion, changes in lake dynamics, lake bed drying. Downstream effects unchanged	M	M	L	Low
Socio-Community: Recreation	• See air quality and noise for mitigation • Planning on temporary work camp layout • Installation of information signage • Screening of construction areas • Minimize duration of construction	Construction: Reduced quality of recreational experience	L	L	L	L
	• Infrequent drawdown of lake below -3 m	Operation: Altered viewscapes leading to diminished quality of recreational experience	L	L	L	Low
Heritage Resources	• Confine work areas to sites disturbed during the original dam and channel construction in 1978 • Preliminary field investigation of the construction site will be completed	To be determined	-	-	-	-

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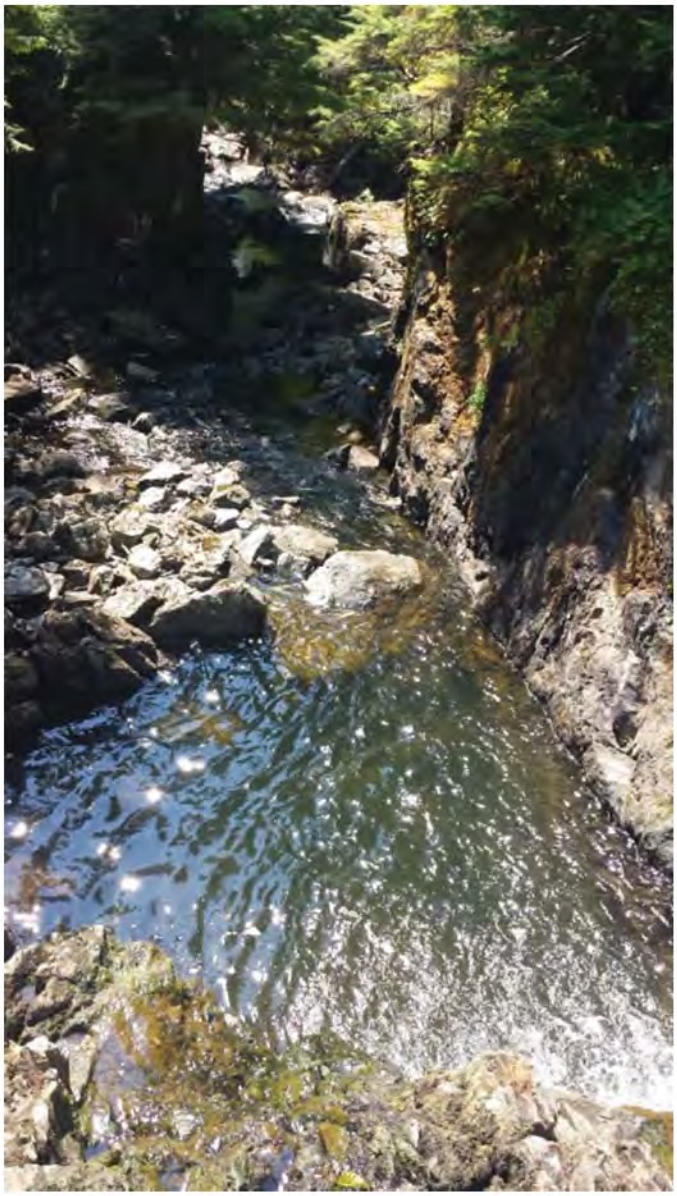
Appendix 1 – Photo Log

Photograph 1. ↑
Chapman lake downstream of dam left side

Photograph 2. ↑
Chapman lake downstream of dam right side

Photograph 3. ↑
Chapman Lake looking at lake and channel intersection

Photograph 4. ↑
Chapman Lake dam from inside lake area looking downstream



Photograph 5. ↑
Chapman Lake outlet top of waterfall looking downstream

Photograph 6. ↑
Chapman Lake dam from inside lake area looking downstream

Appendix 2

FSCI Biological Consultants

Preliminary review of low summer flow on salmonid habitat/passage in Chapman Creek

FSCI Biological Consultants

December 6, 2015 Our File No.: FSCI-15-0034

Mr. Dave Crosby
Sunshine Coast Regional District
1975 Field Road
Sechelt, BC V0N 3A1

Re: Preliminary review of low summer flow on salmonid habitat/passage in Chapman Creek

Dear Mr. Crosby:

As requested we reviewed the change in available anadromous fish habitat and upstream passage in Chapman Creek at low to moderate late summer flows. This review, which is based on limited field data and professional opinion, was completed in response to concerns raised about possible detrimental effects of low summer flows on rearing juvenile salmonids, specifically Coho salmon, Steelhead and Cutthroat trout and migrating adult Pink, Chum and Coho salmon. As stated above, the focus was the period of low flows that occur in August and September, as the regional water demand on Chapman Creek increases.

In order to provide a "snapshot" and opinion on low flow impacts to fish and fish habitat for SCRD management, habitat was surveyed in late summer and early fall at three flows: <0.2 (0.12), 0.42 and 0.90 cubic metres per second (cms). Instream flows were determined using data from the WSC station below the SCRD intake and it was assumed that no significant water inputs occur below the WSC station in the anadromous section (below the Cabin Pools) of the mainstem.

A modified fish habitat assessment (Johnston and Slaney, 1996[1]) was completed at each target flow. The assessment was conducted from the upper extent of anadromous fish distribution (aluminum footbridge-Cabin Pools) downstream to the Highway 101 bridge at Brookman Park. The total length of stream surveyed during each assessment was approximately 3.5 km.

Throughout this length, the area of accessible and useable mesohabitat (pools, riffles and glides) was determined. The assessment crew also noted the distribution of adult salmon helping formulate an opinion on both fish access and quality on rearing/spawning habitats at the target flows. It should be noted that the individuals(s) conducting the assessment have many years (15-20+) experience working on Chapman Creek.

Results of the habitat assessments were predictable. Habitat at low flow provides the least available area, although the quality of habitat was considered high. Rearing

[1] Johnston, N.T. and Slaney, P.A. 1996. Fish Habitat Assessment Procedures. Watershed Restoration Technical Circular No 8., BC Ministry of Environment, Lands and Parks, Victoria, BC.

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juvenile salmonids were observed throughout the entire stream length and measured water temperature within an acceptable range (18°C) when measured mid-day. The density of juveniles appeared to be greater in the upper reaches, although this based on crew observation and not quantitative data. There was no indication that the lower flow (0.12 cms) had any detrimental affect on rearing salmonids.

Typically, south coast streams and rearing population size is driven by low summer stream flow. It is assumed that this is also true in Chapman Creek. In reviewing low flow records I found that Chapman Creek, has reached low flows less than 0.2 cms (as low as 0.1 cms) but for short periods of time. While lower flows may occur, and on occasion may be unavoidable, it is my opinion that the population will be better protected at the managed release flow of 0.22 cms. This managed discharge should only be allowed to drop under extenuating circumstances after consultation and approval by regulatory agencies, thus ensuring continued protection of the rearing salmonid population in Chapman Creek.

In order to defend this managed minimum release (0.22 cms), additional information on population status and size would be beneficial. Therefore, I recommend that:

1. During the low flow period (summer only), that the SCRD consider collecting standing stock data from Chapman Creek targeting anadromous salmonids. Monitoring over a series of low water events will help provide a level of "comfort" that lower managed water release (0.22 cms) does protect rearing salmonids, and

2. Water temperature is monitored at select locations through the rearing length of the mainstem. This could be important if low water events extend through the warmer months (July/August). While physical space may be adequate, hot weather coupled with low water may reduce available physical space by creating thermal zones unsuitable for rearing.

The following graphs/photos show the amount/characteristics of measured habitat during the survey dates and the predicted areas available at a range of low to moderate flows (0.12 to 0.9 cms) (Figure 1 and 2) and an example of the habitat at low flow (Figure 3 and 4).

While low flows appear to be adequate to protect rearing salmonids, there is an issue with adult salmonid migration during the low flow period. The assessments identified three locations where adult passage may be hampered at low flows (Figure 5). These locations are:

- Upstream of the highway 101 bridge. This riffle is constructed of deposited, transient materials that in low waters provide a barrier to upstream passage. This riffle is mobile and changes yearly.

- The section of stream between the hatchery outflow and intake. This stream section has lower flows because of the diversion of flows for the operation of the hatchery. There is a significant reduction in stream flow in this area during summer, that creates passage problems for adult salmonids.

- The riffle/weir immediately upstream of the intake. This riffle was constructed in the 1990's to prevent continual head cutting of the channel and protect valuable spawning substrates and rearing habitats upstream. The riffle functions as designed and have provided valuable stable habitats upstream. It can slow upstream movement of adult salmonids under low summer flows, but adults do eventually move through at low flows.

Observations made during the fall found that while upstream movement of salmonids was hampered at flows approx. <0.2 cms that as water levels increased to 0.4 cms, adult salmonids were able to navigate the lower reaches.

The question of exactly what low water impacts are on adult salmonids has been posed. Typically low water periods occur in August and September. The species impacted the most is Pink salmon and to a lesser extent enhanced and introduced Chinook salmon. Pink salmon are an odd year return and should only be a concern during these peak return years (next is 2017). The Chinook salmon is introduced and will also have problems accessing upstream reaches during the lowest flows in September. More important local species, Chum and Coho Salmon typically do not start to migrate in large numbers until the end of September into December when stream flows are greater and access is not considered an issue.

Adult fish were observed moving at lower water conditions as the river comes up. At flow approaching 0.4 cms Pink salmon were observed migrating upstream and distributing accordingly. As a result an adaptive management approach for water release may be appropriate. Flow augmentation should target Pink salmon and include:

- Noting the period of movement for Pink salmon and a communication agreement with the local salmonid enhancement group. This group could provide important information on the observed number of adults holding and waiting for water levels to rise. Information regarding return timing and numbers of fish holding should be conveyed to the SCRD;

- Planned water release at predetermined times during the migration "window". Water release should be pulsed where water releases result in an increase in flow from a managed low of 0.22 cms to 0.4 cms for a set period of time (4-hrs). More than one pulsed release may be required with the goal of pushing or coaxing adults upstream through the most critical sections of river that hamper migration at low flow. Water pulses would be planned through the night on flood tides.

All pulsed flow data should be documented including duration and volume. The goal is to develop a manageable system that, under extreme conditions can be used to move fish upstream to the hatchery (assuming they have enough water to hold adults) or above the hatchery to the upper reaches.

In summary, the results of our preliminary low flow review suggest rearing juvenile salmonids have access to good stable rearing habitat. While juvenile salmonid needs are met, the low flow appears to hamper upstream migration of at least 2 species of adult salmon, namely Pink and Chinook. Pink salmon are the most abundant and should be considered a greater concern. Chinook while present represent a much smaller escapement number and appear to be sustained through introduction and hatchery

augmentation. Increasing water flow to adequately support migration of larger Chinook may not be feasible, but increasing flows for encouraging Pink salmon migration may be realistic. Increased flow release for Pink salmon should be considered only during peak return years (odd years) using pulsed release (i.e. 0.22 to 0.4 cms) over a short preset period that can be repeated (4-hr duration) at night and on a flood tide.

I trust this information will assist you and welcome the opportunity to discuss in detail the above approach. If you would like to meet please let me know as soon as possible.

Sincerely

D. Bates, PhD, RPBio (#405)
Biologist

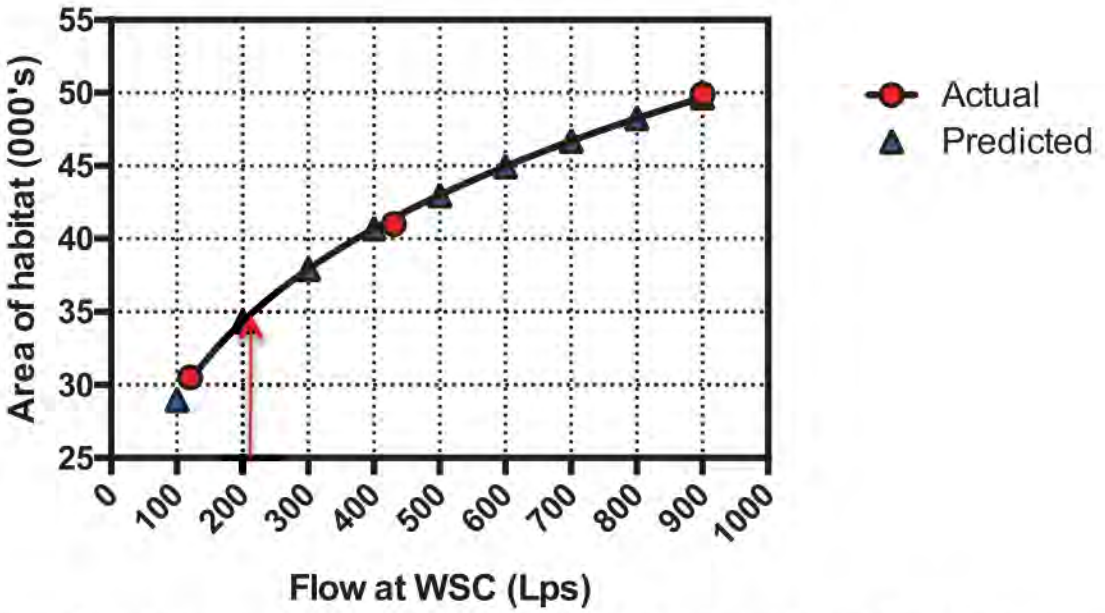

Figure 1: *The estimated total available habitat area in the anadromous length of Chapman Creek at three target flows. The predicted available habitat is also shown using the relationship of the three flows. The minimum release is highlighted.*

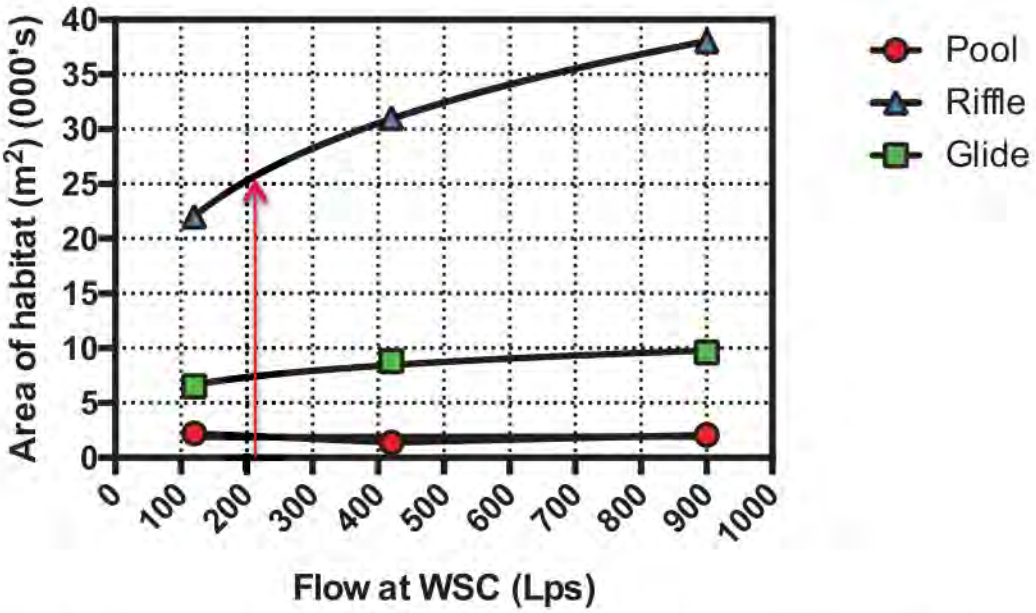

Figure 2: *The estimated total available mesohabitat (pools, glides, riffles) areas in the anadromous length of Chapman Creek at three target flows. The minimum release is highlighted.*

Figure 3: *Example of habitat in Chapman Creek at low flows. The flow is approximately 0.12-0.20 cms and the available rearing habitat found in the upper reaches above the hatchery intake.*

Figure 4: *Examples of the area below between the hatchery intake and Brookman Park where low flows impede adult salmon passage, The problem can affect Pink salmon migrating into Chapman Creek during September.*

Figure 5: *Photo showing the lower reach of Chapman Creek. Three areas were identified as potential problem riffles that may restrict upstream movement of returning adult Pink salmon. The problem is most evident during stream flows <0.2 cms.*

Appendix 3
Wildlife Sensitive Species List

Common Name	Scientific Name	Species Type	BC Status	SARA Status
Autumn Meadowhawk	*Sympetrum vicinum*	Insect	Blue	
Band-tailed Pigeon	*Patagioenas fasciata*	Bird	Blue	1-SC (Feb 2011)
Barn Swallow	*Hirundo rustica*	Bird	Blue	
Black Petaltail	*Tanypteryx hageni*	Insect	Blue	
Black Swift	*Cypseloides niger*	Bird	Blue	
Blue Dasher	*Pachydiplax longipennis*	Insect	Blue	
Clodius Parnassian, *claudianus* subspecies	*Parnassius clodius claudianus*	Insect	Blue	
Coastal Tailed Frog	*Ascaphus truei*	Amphibian	Blue	1-SC (Jun 2003)
Common Nighthawk	*Chordeiles minor*	Bird	Yellow	1-T (Feb 2010)
Common Wood-nymph, *incana* subspecies	*Cercyonis pegala incana*	Insect	Red	
Double-crested Cormorant	*Phalacrocorax auritus*	Bird	Blue	
Fisher	*Pekania pennanti*	Mammal	Blue	
Great Blue Heron, *fannini* subspecies	*Ardea herodias fannini*	Bird	Blue	1-SC (Feb 2010)
Green Heron	*Butorides virescens*	Bird	Blue	
Grizzly Bear	*Ursus arctos*	Mammal	Blue	
Johnson's Hairstreak	*Callophrys johnsoni*	Insect	Red	
Keen's Myotis	*Myotis keenii*	Mammal	Blue	3 (Mar 2005)
Marbled Murrelet	*Brachyramphus marmoratus*	Bird	Blue	1-T (Jun 2003)
Meadow Rams-horn	*Planorbula campestris*	Gastropod	Blue	
Monarch	*Danaus plexippus*	Insect	Blue	1-SC (Jun 2003)
Mountain Goat	*Oreamnos americanus*	Mammal	Blue	
Northern Goshawk, *laingi* subspecies	*Accipiter gentilis laingi*	Bird	Red	1-T (Jun 2003)
Northern Red-legged Frog	*Rana aurora*	Amphibian	Blue	1-SC (Jan 2005)
Northern Rubber Boa	*Charina bottae*	Reptile	Yellow	1-SC (Jan 2005)
Olive-sided Flycatcher	*Contopus cooperi*	Bird	Blue	1-T (Feb 2010)
Pacific Sideband	*Monadenia fidelis*	Gastropod	Blue	
Painted Turtle	*Chrysemys picta*	Turtle	No Status	1-E/SC (Dec 2007)
Peregrine Falcon, *anatum* subspecies	*Falco peregrinus anatum*	Bird	Red	1-SC (Jun 2012)
Prairie Fossaria	*Galba bulimoides*	Gastropod	Blue	
Purple Martin	*Progne subis*	Bird	Blue	
Rocky Mountain Physa	*Physella propinqua*	Gastropod	Blue	
Roosevelt Elk	*Cervus elaphus roosevelti*	Mammal	Blue	
Silver-spotted Skipper, *californicus* subspecies	*Epargyreus clarus californicus*	Insect	Red	
Sinuous Snaketail	*Ophiogomphus occidentis*	Insect	Blue	
Striated Fingernailclam	*Sphaerium striatinum*	Bivalves	Blue	
Sunset Physa	*Physella virginea*	Gastropod	Blue	
Threaded Vertigo	*Nearctula* sp. 1	Gastropod	Red	1-SC (Jul 2012)
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Mammal	Blue	

Common Name	Scientific Name	Species Type	BC Status	SARA Status
Western Branded Skipper, *oregonia* subspecies	*Hesperia colorado oregonia*	Insect	Red	
Western Pine Elfin, *sheltonensis* subspecies	*Callophrys eryphon sheltonensis*	Insect	Blue	
Western Pondhawk	*Erythemis collocata*	Insect	Blue	
Western Screech-Owl, *kennicottii* subspecies	*Megascops kennicottii kennicottii*	Bird	Blue	1-SC (Jan 2005)
Western Thorn	*Carychium occidentale*	Gastropod	Blue	
Western Toad	*Anaxyrus boreas*	Amphibian	Blue	1-SC (Jan 2005)
Wolverine, *luscus* subspecies	*Gulo gulo luscus*	Mammal	Blue	