Clowhom Project Water Use Plan

Monitor of Aquatic Wildlife in Wetlands Affected by Dam Operations

Implementation Year 14

Reference: COMMON-1

Clowhom Falls Reservoir Yearly Report

Study Period: May-August 2019

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Summary

In 2018/2019 the shíshálh First Nation and BC Hydro completed the 14th Year of a 20-year monitoring program intended to document wildlife utilization adjacent to the upper Clowhom Lake Reservoir wetland complex. This wetland, located at the head of the reservoir, floods and "dries" during operation of hydro plant and reservoir drawdown.

In 2019, the original study Terms of Reference was revised with a change in sampling design, intensity and target wildlife. The revisions to the TOR ensure alignment with the Water Use Plan (WUP) Order by refining management questions and target data. The most significant revision provides increased focus on the wetland directly affected by reservoir operations.

The new Management Questions, stipulated in the revised TOR (BC Hydro 2019) are:

1. What is the diversity and distribution of breeding birds and amphibians in the study area, and how are these related to habitat and elevation in the reservoir drawdown zone?
2. How, and to what extent, might the reservoir operations affect productivity of birds and amphibians in the drawdown zone study area? And
3. How, and to what extent, might the implementation of the WUP alter the impact of the reservoir operations on the productivity of birds and amphibians in the drawdown zone study are?

In the spring/summer of 2019 the new process and data collection under the TOR were completed. A total of three surveys were conducted using a 2-person crew hiking a predetermined route and documenting all observed birds (sight and sound) and amphibian presence (Visual) within the wetland complex. Data from each field survey was recorded in the field on georeferenced maps and later downloaded and plotted on the newly created vegetation mapping provided by BC Hydro.

In addition to the wildlife sightings recorded, the survey team field-verified vegetative cover, originally delineated from LiDAR images and provided realignment to the spatial mapping of vegetative cover.

Field work and additional surveys will be conducted in 2020, targeting mid-April for the first survey.

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1.0 Introduction

In 2018/2019 the shíshálh First Nation and BC Hydro completed the 14th Year of a 20-year monitoring program intended to document wildlife utilization adjacent to the upper Clowhom Lake Reservoir wetland complex. This complex, located at the head of the reservoir, floods and "dries" during operation of hydro plant.

In 2019, the original study Terms of Reference was revised with a change in sampling design, intensity and target wildlife. The revisions tom the TOR ensures alignment with the Water Use Plan (WUP) order by refining management questions and target data. The most significant revision provides increased focus on the wetland directly affected by reservoir operations. Specific changes to the TOR include:

- Revised management questions to improve clarity:
- Removal of the original Management Question (design of physical works) which was not directly related to the Order, was poorly related to the monitoring study, and too open ended. The question of physical works can be addressed better by a dedicated project if deemed necessary;
- Removal of the original Management Hypotheses. These were phrased for statistical hypothesis testing, were complex, and unlikely to be testable;
- The addition of five new simple Management Hypotheses, phrased as working hypotheses, or predictions, based on our understanding of reservoir ecology and this particular system. These are useful to state as they are used as assumptions in the design of the field study, and form a context for addressing the Management Questions;
- Narrowing of the seasonal timing of the monitoring program to focus on the time of year when interactions between reservoir operations and wildlife productivity are most likely;
- Increased specificity with respect to the study area in the reservoir drawdown zone; and
- Re-design of monitoring tasks to focus on impacts of reservoir operations on birds and amphibians which breed/nest within the reservoir drawdown zone, and vulnerable to having their productivity impacted by reservoir operations. Birds and amphibians are also readily observable, and are important populations to consider.

The revised Management Questions address specific wildlife risks related reservoir operations and include:

- What is the diversity and distribution of breeding birds and amphibians in the study area, and how are these related to habitat and elevation in the reservoir drawdown zone?
- How, and to what extent, might the reservoir operations affect productivity of birds and amphibians in the drawdown zone study area? And
- How, and to what extent, might the implementation of the WUP alter the impact of the reservoir operations on the productivity of birds and amphibians in the drawdown zone study are?

This report presents the changes to the study area and the results of the first year (Year 14) of the revised TOR.

2.0 Study Area

The general study area for the revised monitoring plan remained unchanged from the initial delineated in 2006. The survey area targets a wetland complex, that floods and drains with reservoir stage change. The wetland, located at the northeastern end of Clowhom Lake Reservoir, and approximately 500 meters upstream from the lake is adjacent to the northwest shoreline of the Clowhom River (**Figure 1**). The wetland is located in low elevation Coastal Western Hemlock Dry Maritime (CWHdm) biogeoclimatic subzone.

Back-flooding and draining of the area occurs throughout the year with changes in lake stage height. Natural inundation also occurs in the spring and fall following freshet events that occur in the Clowhom River.

The study area (wetland) is approximately 40 hectares in size and is characterized by a mix of deciduous and conifer forest of various seral stages, a diverse shrub and herbaceous understory, large areas of wetland grasses and sedges and areas of depositional muds and silts.

Access to the wetland is best gained from the Clowhom valley forestry road that runs along the northwest boundary.

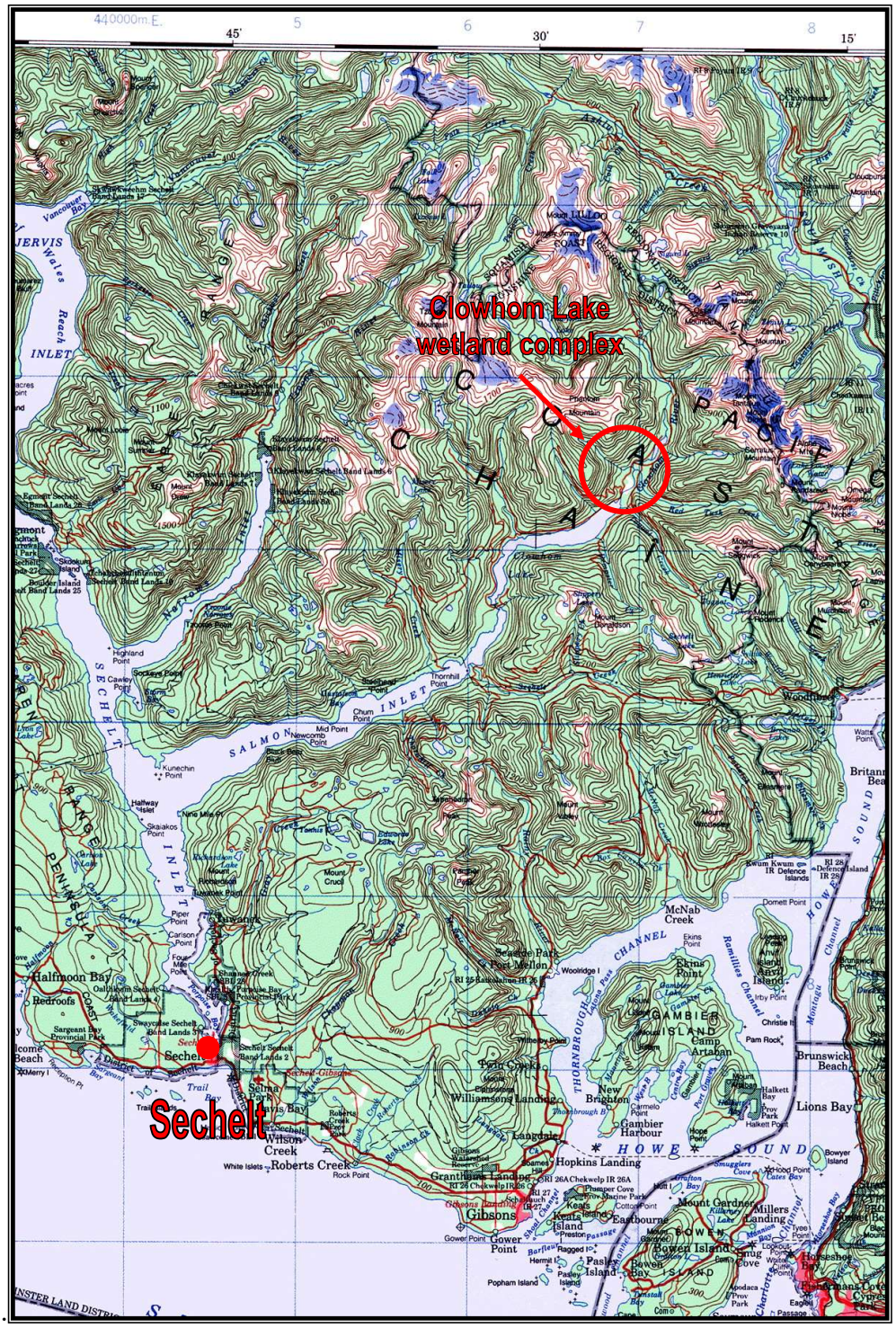

Figure 1: The approximate location of Clowhom Lake Reservoir wetland complex census area.

3.0 Methods

3.1 Groundcover Mapping

In 2018, Clowhom Lake and the study wetland had LiDAR flown by BC Hydro. This imagery was used to produce spatially accurate orthophotos and topographic data for the wetland. Using the data provided, BC Hydro developed seamless imagery for the wetland that included high resolution imagery of the current groundcover, topographic and morphological features of the wetland at low lake level.

In addition to the imagery showing vegetative cover and landforms, the topographic contours for low and high lake levels were produced (**Figure 2**). All this data was converted to shape and feature files in ArcMap® 10.1-10.8.

Using the imagery provided by BC Hydro, the area was broken into polygons representing specific vegetative cover and land features. The vegetation types and land features considered important habitats included:

- Mature conifer canopy
- Mature mixed conifer/deciduous canopy
- Riparian – mixed forest
- Riparian – shrub/willow
- Shrub and bog
- Open bog
- Graminoid
- Wet graminoid
- Mud and sediments
- Open wetland/ponds
- Channels/rivulets
- Stream channel

All digitized features are layered onto the new imagery in ArcMap (**Figure 4**) and from that a georeferenced PDF file was created. This PDF was then uploaded to field Apple iPad's running Avenza Maps® 3.11.1 software.

3.2 Field Survey

A two-person crew that included a biologist and technician representing the shíshálh Nation conducted all field surveys. The crew started at a predetermined start point and followed pre-determined routes (Route 1 and 2) (**Figure 3**). Crew members each carried a field iPad with the PDF map(s) loaded into Avenza Maps®, binoculars and a camera.

Surveys were conducted monthly in 2019 from May through July (**Appendix III**). In future new proposed study design will attempt to complete 4-5 surveys starting around March 15 (beginning of bird nesting window) and continue monthly until mid-July

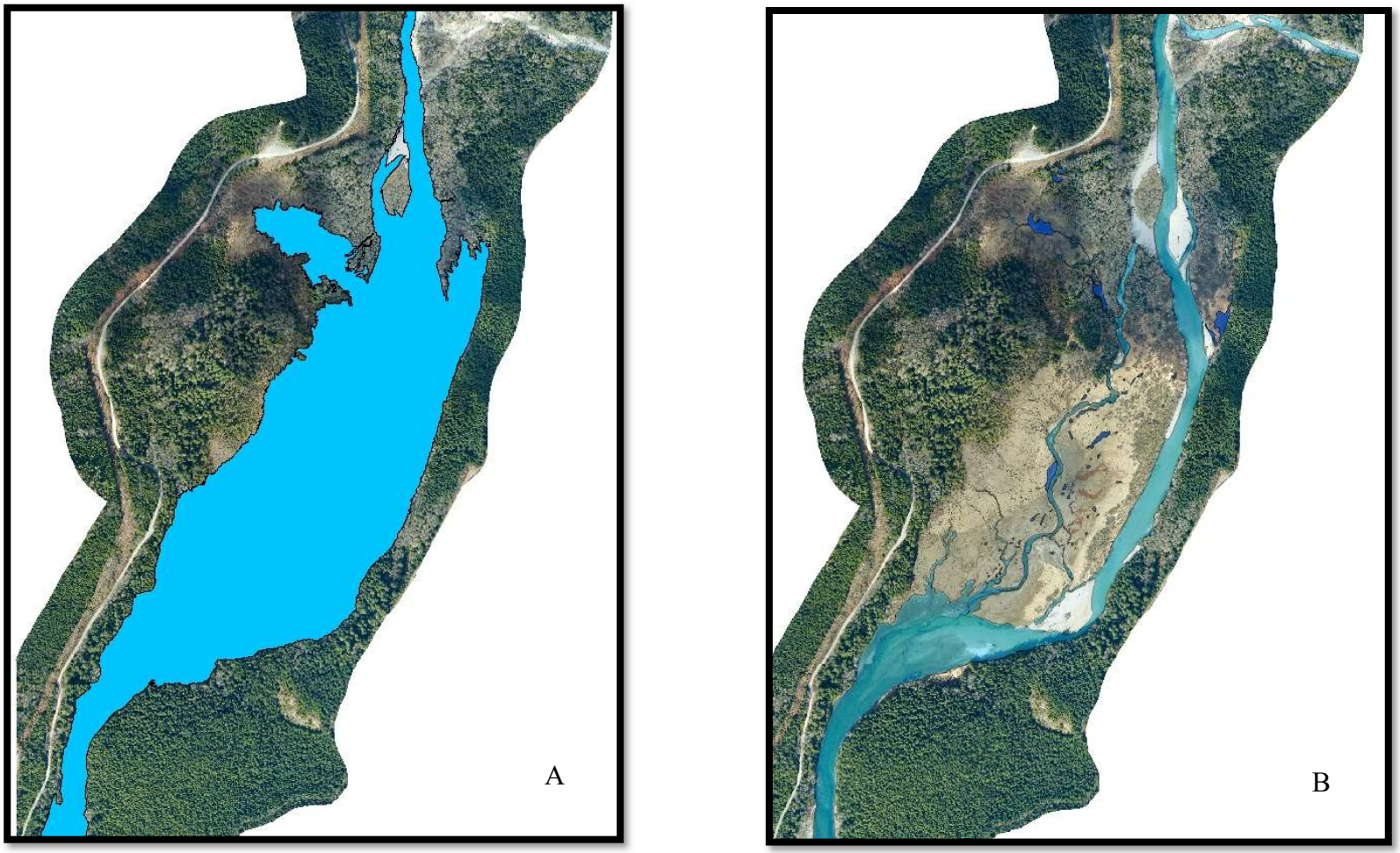

Figure 2: The Clowhom reservoir wetland project area when flooded by a "full" reservoir (A) and at low reservoir stage level (B). Surveys are conducted at low reservoir levels in the spring and early summer.

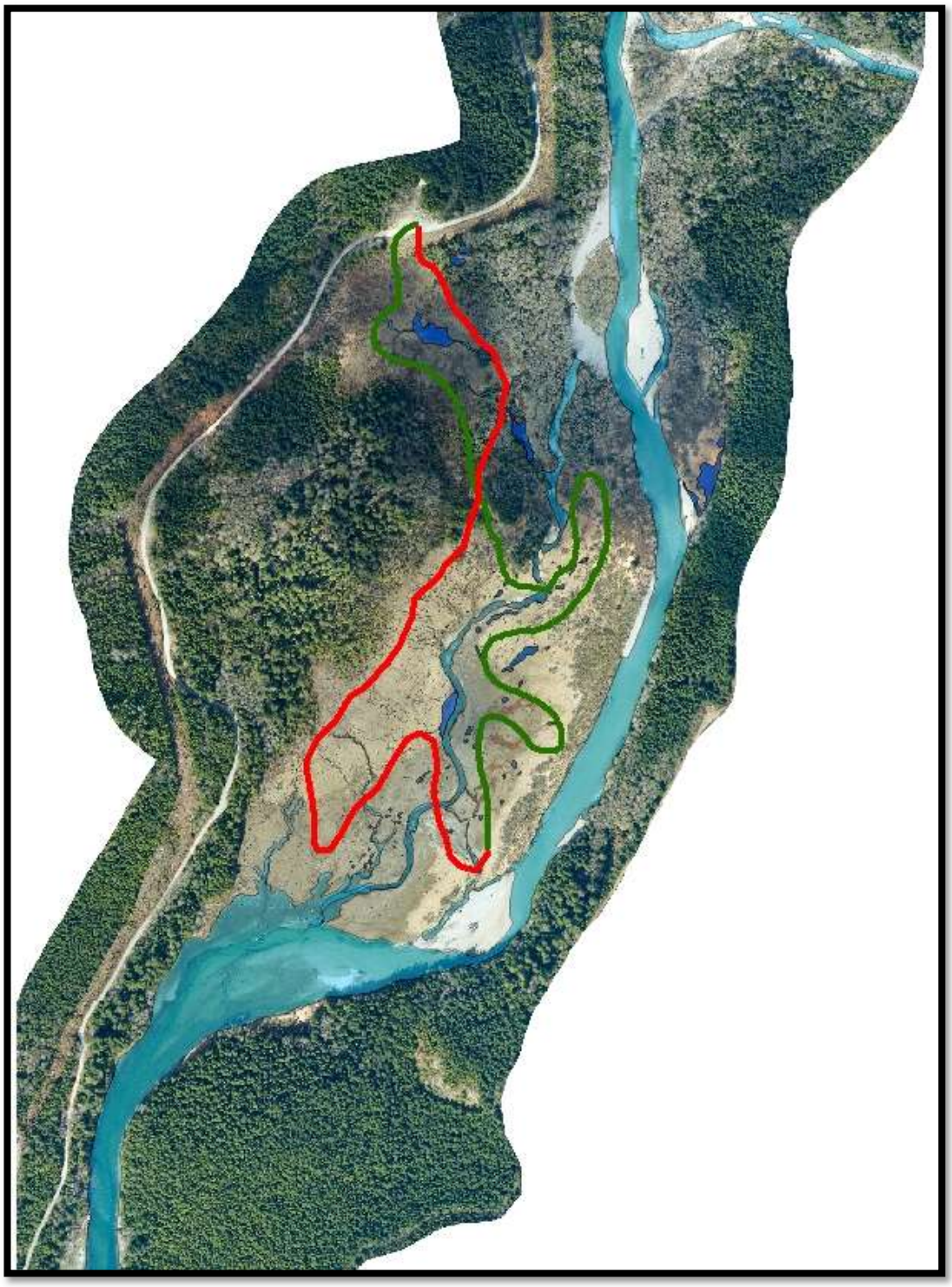

Figure 3: The survey route used by each crew member (green -person 1 and red -person 2) used by crew during the field surveys. Each crew member walked the assigned route and documented avian and amphibian presence using visual and sound. The routes allowed the entire area wetland area from tree buffer on the upland side to the Clowhom River to be observed.

All surveys followed the same route using the two-person crew and start within an hour of sunrise and continue until mid-day at the latest. The route allowed the observation and on both sides of the route line from the treed riparian areas on the upland and along the Clowhom River. Crew maintained radio contact in the event of possible duplication of sightings. Data collected along the routes include:

- Avian activity, species and numbers, sightings (visual and sound) and features such as active and in-active nests;
- Amphibians by species, life stage and number (where appropriate);
- Incidental wildlife, including sightings, tracks, habitat use (i.e., Roosevelt elk wallows);
- Habitat and vegetative composition in various polygons provided in field maps. Unusual of rare vegetation is documented.

Data, recorded as a point location were added, on the ground, into georeferenced PDF Maps loaded on an iPad. The recorded data included:

- Related coordinates (UTM's);
- Species;
- number observed (when possible);
- behaviour; and/or
- incidental observations where possible.

3.3 Data Entry

Collected data was downloaded from iPad data collectors as csv (comma separated values) files, then imported into Microsoft Excel®. The Excel spreadsheets were reformatted and then uploaded into ArcMap® 10.1-10.8 and the data stored. Final spreadsheets with the accompanying data and comments was provided to BC Hydro.

4.0 Results/Discussion

4.1 Ground Cover Mapping

The vegetation typing was completed in ArcMap with the delineated polygons assigned a vegetation type (**Figure 4**). Each type and the associated area is provided in **Appendix I**. Ground truthing of the polygons and adjustments to the spatial size of each polygon was completed after the final field survey. These adjustments will continue annually in areas where vegetative change is noted during the surveys.

Anticipated changes to the vegetative cover, while expected, may be small over the remaining years of the study. Therefore, significant change to the polygons in the mapping for this study may be insignificant.

In addition to the vegetative cover, the second most important feature mapped includes the rivulets, ponds and wetland areas. These areas provide aquatic features important to area wildlife, and in particular, amphibians. Western Toad (*Anaxyrus boreas*) has been documented in this area and is a listed as a Species at Risk (SAR). Significant change in the

frequency of ponded water, rate with which they fill, and empty may be influenced from reservoir operations.

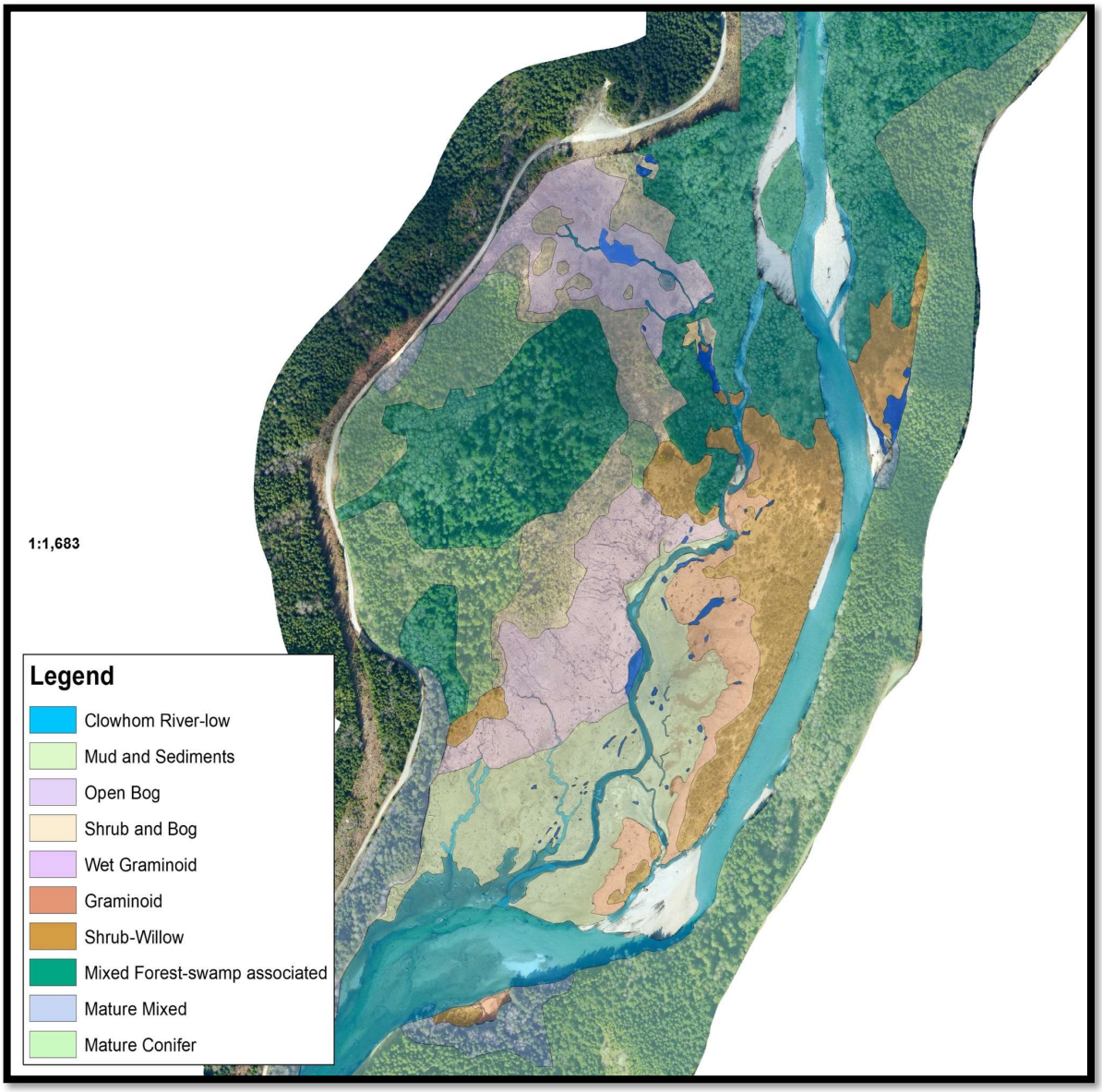

Figure 4: The Clowhom wetland with vegetation and landforms delineated at low reservoir level. The area (aquatic and terrestrial) is surveyed monthly from March to July. The areas of each vegetative polygon is included in Appendix I.

4.2 Wildlife Census

A total of three surveys were conducted in 2019; on May 3, June 14 and July 24 (**Appendix III**). Each survey started as early as logistics would allow and the duration of the survey lasted between 3-5 hours. In total twenty (20) species of birds were either documented through visual or sound, two (2) amphibian species, including a species at risk (**Figure 5**), and one reptile documented throughout the wetland complex. The locations are presented in **Figure 6** where each survey date is represented by a different colour. The summary data, submitted as Excel spreadsheets is presented as a table in **Appendix I**. **Figure 7** provides the sighting data overlayed on the vegetation polygons in to order to relate the sightings to habitat.

5.0 Conclusion

The survey in 2019 was delayed as the methodology was refined. In future survey seasons, crews will attempt to begin the season in March to capture the beginning of the bird nesting period and extent the surveys to July when both avian and amphibian breeding, incubation and eventual vacating of the breeding and nesting areas has been completed.

6.0 References

BC Hydro, 2019. Clowhom Water Use Plan COMMON-1 Monitoring Program Terms of Reference Revision 1. February 28, 2019

Figure 5: Documented presence of Western Toad eggs desiccated and dead from receding pond waters (top) (WP21) and tadpoles that were documented in 2 ponds containing suitable water volume. The tadpoles (bottom) consisted of Western Toad and Chorus Frog juveniles.

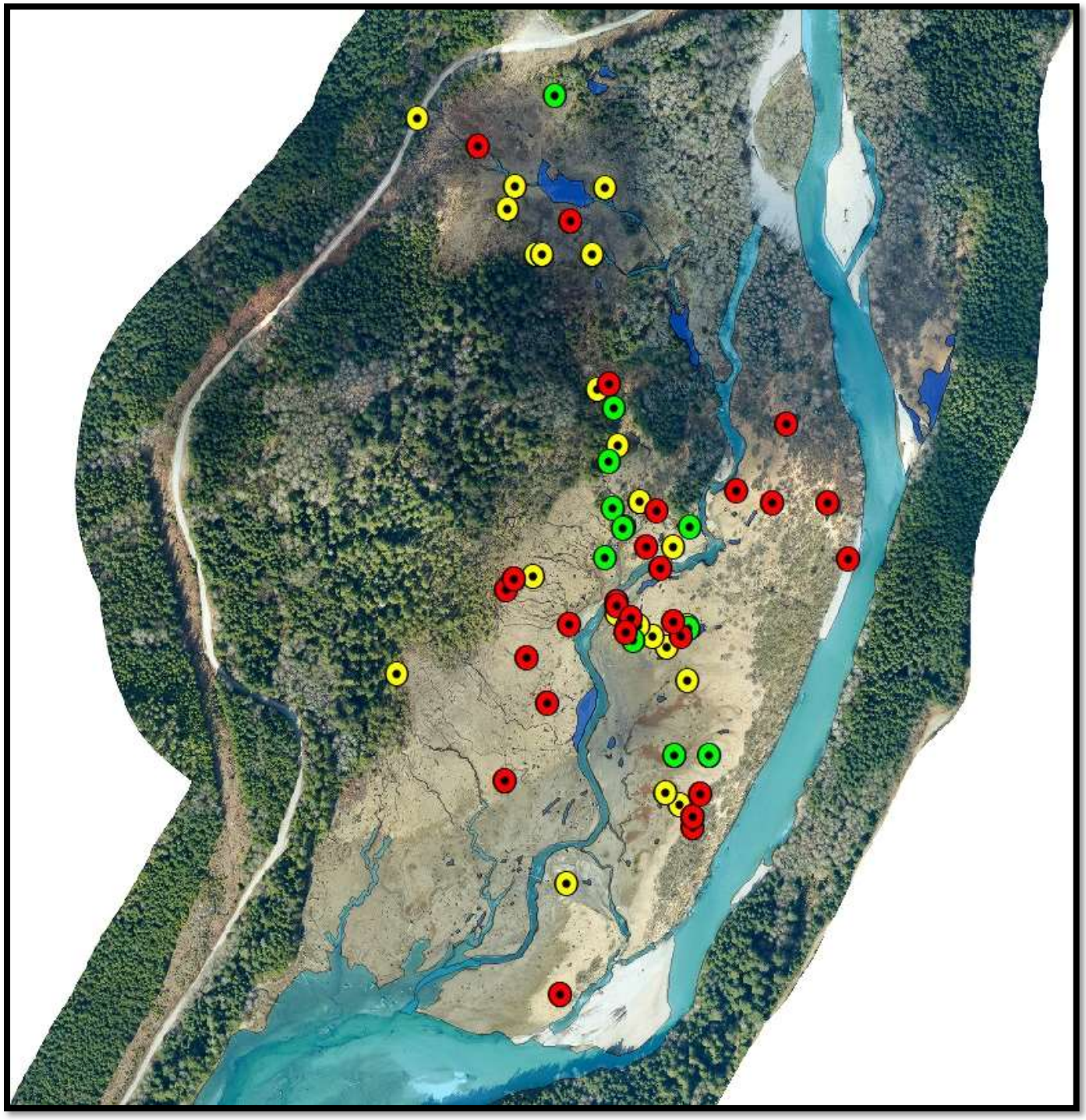

Figure 6: Wildlife observation data collected in 2019 over the three survey dates. Each survey date is represented by a different colour where; red represents May 3, yellow represents June 14 and green represents July 24, 2019.

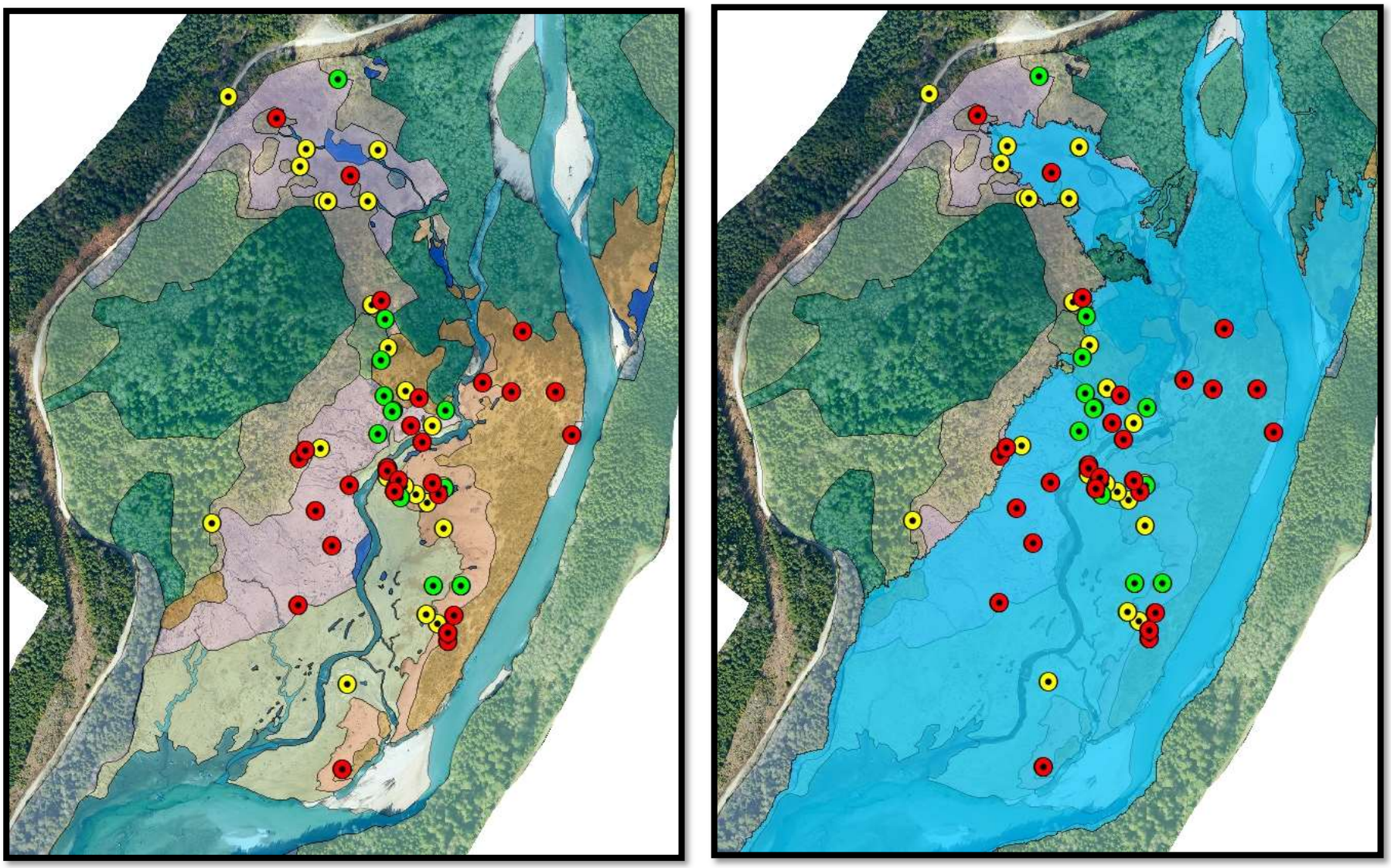

Figure 7: Wildlife observation data collected in 2019 over the three survey dates, May 3, June 14 and July 24, 2019. The point data is overlayed on the habitat type found in the wetland area and then the same area when the reservoir stage is at 54-m ASL.

6.0 Appendices

Appendix 1. The vegetation polygon areas delineated within the study wetland located at the northern end of the Clowhom reservoir.

Clowhom Wetland Vegetation Typing and Wetted Habitats
2018

FID	HabClass	area
0	Open Bog	32077.26
1	Shrub and Bog	43156.89
2	Wetland Creek	8983.87
3	Graminoid	23129.47
4	Wet Graminoid	42279.05
5	Mature Conifer	399989.05
6	Mature Mixed Forest	66007.08
7	Mixed Forest-swamp associated	292464.28
8	Mud and Sediments	76488.25
9	Ponds	5883.68
10	Clowhom River	137079.44
11	Rivulet	3361.50
12	Shrub-Willow	69611.20

Appendix II. The wildlife observations by survey date, species, behaviour and habitat.

Clowhom Reservoir Wetland Survey									
Crew	DB/JW		**Start:**	855	**Finish**	1255	**Weather**	Overcast	
WP	**Zone**	**Easting**	**Northing**	**Date**	**Wildlife_Code**	**Wildlife**	**Life Stage**	**Comments**	**Habitat Class**
1	10	469161	5513647	2019-5-3	GRBL	Great Blue Heron	Adult	Tracks	
2	10	469355	5513601	2019-5-3	AMRO	American Robin	Adults		
3	10	469363	5513634	2019-5-3	SWTH	Swainson's Thrush	Calling		
4	10	469227	5513802	2019-5-3	SOSP	Song Sparrow	Adult		
5	10	469162	5513836	2019-5-3	COYE	Common Yellowthroat	Adults (M&F)		
6	10	469205	5513724	2019-5-3	CAGO	Canada Goose	Nest	On Stump	
7	10	469184	5513769	2019-5-3	CAGO	Canada Goose	Nest	On Stump	
8	10	469170	5513847	2019-5-3	TRSW	Tree Swallow	Foraging	4	
9	10	469170	5513847	2019-5-4	VISW	Violet-green Swallow	Foraging	2	
10	10	469515	5513867	2019-5-3	COME	Common Merganser	Pair		
11	10	469400	5513934	2019-5-3	PAWR	Pacific Wren	Adult		
12	10	469494	5513923	2019-5-3	CEWA	Cedar Waxwing	Adults	Tree tops	
13	10	469436	5513923	2019-5-3	WIFL	Willow Flycatcher	Adults	4	
14	10	469451	5514001	2019-5-3	AMRO	American Robin	Adults singing		
15	10	469342	5513790	2019-5-3	WETD/CHFR	Western Toad/Chorus frog	Tadpoles/eggs		
16	10	469355	5513612	2019-5-3	AMRO	American Robin	Adults - 5		
17	10	469355	5513612	2019-5-3	WIFL	Willow Flycatcher	Adult calling		
18	10	469355	5513612	2019-5-3	AMRO	American Robin	Nest		
19	10	469218	5513435	2019-5-3	WIFL	Willow Flycatcher	Old nest		
20	10	469277	5513824	2019-5-3	CHFR	Chorus frog	Eggs	Dead	
21	10	469277	5513824	2019-5-3	WETO	Western Toad	Eggs	Dead	
22	10	469321	5513857	2019-5-3	WETO	Western Toad	Eggs	Dead	
23	10	469307	5513879	2019-5-3	WETO	Western Toad	Eggs	Dead	
24	10	469229	5514202	2019-5-3	TRSW	Tree Swallow	Adult	Foraging (4)	
25	10	469333	5512772	2019-5-3	WETD/CHFR	Western Toad/Chorus frog	Tadpoles/eggs	Pond	

26	10	469340	5512774	2019-5-3	WETD/CHFR	Western Toad/Chorus frog	Tadpoles/eggs	Pond	
27	10	469335	5513804	2019-5-3	WETD/CHFR	Western Toad/Chorus frog	Tadpoles/eggs	Pond	
28	10	469276	5513820	2019-5-3	WETD/CHFR	Western Toad/Chorus frog	Dead/dried	Pond	
29	10	469291	5513809	2019-5-3	WETD/CHFR	Western Toad/Chorus frog	Dead/dried	Pond	
30	10	469286	5513794	2019-5-3	WETD/CHFR	Western Toad/Chorus frog	Dead/dried	Pond	
31	10	469133	5514275	2019-5-3	SPTO	Spotted Towhee	Adults (M)	Foraging	
32	10	469380	5512741	2019-5-3	SOSP	Song Sparrow	Adults	4 total	
33	10	469325	5512929	2019-5-3	NOFL	Northern Flicker	Adults	Foraging along timber	
34	10	469269	5514040	2019-5-3	COYE	Common Yellowthroat	Adults (M&F)	Foraging	
35	10	469317	5513914	2019-5-3	RYKI	Ruby-crowned Kinglet	Male	Foraging	

Clowhom Reservoir Wetland Survey									
Crew	DB/JW		**Start:**	830	**Finish**	1235	**Weather**	Sun	
WP	**Zone**	**Easting**	**Northing**	**Date**	**Wildlife_Code**	**Wildlife**	**Life Stage**	**Comments**	**Habitat Class**
1	10	469172	5514236	14-Jun-19	STBA	Stickleback			
2	10	469164	5514214	14-Jun-19	TRSW	Tree Swallow	Adults/juveniles	Foraging	
3	10	469193	5514169	14-Jun-19	VISW	Violet-green Swallow	Adults/juveniles	Foraging	
4	10	469200	5514169	14-Jun-19	COYE	Common Yellowthroat	Adult	Foraging	
5	10	469200	5514169	14-Jun-19	COYE	Cedar Waxwing	Adults	6	
6	10	469251	5514169	14-Jun-19	AMRO	American Robin	Nest	Vacant	
7	10	469278	5513979	14-Jun-19	TOWA	Townsend Warbler	Adult	Forage	
8	10	469300	5513924	14-Jun-19	SPTO	Spotted Towhee	Calling		
9	10	469300	5513924	14-Jun-19	WIFL	Willow Flycatcher	Adults	6	
10	10	469300	5513924	14-Jun-19	RUHU	Rufous Hummingbird	Adults	1	
11	10	469335	5513879	14-Jun-19	CAGO	Canada Goose	Adults	4	
12	10	469349	5513801	14-Jun-19	WETO/CHFR	Cedar Waxwing	Tadpoles		
13	10	469328	5513779	14-Jun-19	WETO/CHFR	Western Toad/Chorus Frog	Tadpoles		
14	10	469292	5513801	14-Jun-19	REBL	Red-winged Blackbird	Adults (M and F)	Behaviour suggests nest	
15	10	469277	5513813	14-Jun-19	SOSP	Song Sparrow	Adults (M and F)	Forage	
16	10	469313	5513790	14-Jun-19	SOSP	American Robin	Adults (M and F)	Forage	
17	10	469349	5513746	14-Jun-19	WETO/CHFR	Western Toad/Chorus Frog	Tadpoles		
18	10	469341	5513623	14-Jun-19	WETO/CHFR	Western Toad/Chorus Frog	Tadpoles	Stickleback	
19	10	469225	5513546	14-Jun-19	BLBE	Black Bear		Track	
20	10	469327	5513635	14-Jun-19	WETO/CHFR	Western Toad/Chorus Frog	Tadpoles		

21	10	469327	5513635	14-Jun-19	SOSP	Song Sparrow	Adults	2	
22	10	469299	5513801	14-Jun-19	TRSW	Tree Swallow	Adults	2	
23	10	469257	5514035	14-Jun-19	AMRO	American Robin	Adults	Forage	
24	10	469257	5514035	14-Jun-19	PAWR	Pacific Wren	Adults	Forage	
25	10	469071	5514303	14-Jun-19	COYE	Common Yellowthroat	Adults	Forage	
26	10	469257	5514035	14-Jun-19	SWTH	Swainson's Thrush	Singing	1	
27	10	469190	5513849	14-Jun-19	TRSW	Tree Swallow	Adults (M and F)	Foraging	
28	10	469050	5513753	14-Jun-19	NOFL	Northern Flicker	Sound	Foraging	
29	10	469265	5514235	14-Jun-19	COYE	Common Yellowthroat	Adult	Foraging	

Clowhom Reservoir Wetland Survey									
Crew	DB/JW		**Start:**	1000	**Finish**	1300	**Weather**	Cloudy	
WP	**Zone**	**Easting**	**Northing**	**Date**	**Wildlife_Code**	**Wildlife**	**Life Stage**	**Comments**	**Habitat Class**
1	10	469272	5513917	24-Jul-19	AMRO	American Robin		2	
2	10	469268	5513963	24-Jul-19	SPTO	Spotted Towhee	Male	Foraging	
3	10	469284	5513899	24-Jul-19	STJA	Stellar's Jay	Adult	Foraging	
4	10	469352	5513898	24-Jul-19	TRSW	Tree Swallow	Adults/Immature	Foraging	
5	10	469283	5513897	24-Jul-19	COYE	Tree Swallow	Adults/Immature	Foraging	
6	10	469372	5513673	24-Jul-19	GASN	Garter Snake			
7	10	469287	5513799	24-Jul-19	SOSP	Song Sparrow	Adults/Immature	Foraging	
8	10	469336	5513672	24-Jul-19	CAGO	Canada Goose	Adults/Immature	Foraging	
9	10	469265	5513868	24-Jul-19	REBL	Red-winged Blackbird	Adult	Foraging	
10	10	469294	5513786	24-Jul-19	SPSA	Spotted Sandpiper	Adult	Foraging	
11	10	469274	5514016	24-Jul-19	COYE	Common Yellowthroat	Adult	Foraging	
12	10	469213	5514326	24-Jul-19	TRSW	Cedar Waxwing	Adults/Immature	Foraging (8)	
13	11	469350	5513798	24-Jul-19	CHFR	Chorus Frog	Adult		

Appendix III. Clowhom Reservoir hydrograph for 2019, showing reservoir elevations throughout the year. Black points represent the three surveys (May 3: 49.143 masl; June 14 50.995 masl; July 24: 51.085 masl). Figure provided by BC Hydro.