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MEMORANDUM

TO: **Nechako Water Engagement Initiative**
FROM: **Nicole Wright, Ph.D., P.Geo, PWS, Candace Ashcroft, B.Sc., and Jayson Kurtz, B.Sc., R.P.Bio, Ecofish Research, Ltd.**
DATE: **January 19, 2022**
FILE: **1316-06**

RE: **Wetlands within the Nechako Reservoir basin potentially affected by operations**

1. INTRODUCTION

To support the Nechako Water Engagement Initiative (WEI), Ecofish Research Ltd (Ecofish) was asked by the WEI Technical Working Group to determine the presence, amount (number and area), and type of wetlands adjacent to the Nechako Reservoir and identify whether these wetlands are located within the drawdown zone of the reservoir (i.e., within the area exposed to air due to changes in water level from reservoir operations). This memo details the methods used to identify the wetlands and determine those that may be affected by operations and provides a summary of the results.

2. METHODS

Given the objectives of WEI and the timeframe and information available, the number, location and type of wetlands adjacent to the reservoir was identified with publicly available spatial data. These wetlands were compared with elevations derived from a digital elevation model (DEM) to determine which were located within the drawdown zone of the reservoir.

The primary source for publicly available hydrological information in British Columbia is the Freshwater Atlas (FWA; GeoBC 2021[1]), which is a standardized dataset of hydrological features, including watershed boundaries, streams, lakes, and wetlands, among others. Nechako Reservoir polygons were extracted from the FWA Lakes and Watersheds data to produce a shapefile of the Nechako Reservoir basin, which includes Tahtsa Lake and Tetachuck Lake. The FWA Wetlands data were used to determine the presence, number, and area of the different types of wetlands within the Nechako Reservoir basin. The FWA wetland polygons are based on Terrain Resource Information Management (TRIM[2]) 1:20,000 enhanced base map from which wetlands are classified as swamps, marshes, and other inundated lands. Note that TRIM wetland data has been shown to be less accurate

[1]GeoBC. 2021. Freshwater Atlas Stream Network, Lakes, Watersheds, Wetlands. Available online at: https://www2.gov.bc.ca/gov/content/data/geographic-data-services/topographic-data/freshwater. Accessed February 18, 2021.

in depicting the amount, distribution, and type of wetlands within a region compared to other modelling and mapping methods (e.g., Filatow *et al.* 2018[3]); however, this is the best data available at the time of the assessment and sufficient for the purposes of determining the overall magnitude of risk to wetlands.

To determine the area of wetlands potentially affected by operations, a digital elevation model (DEM) of the Nechako Reservoir was created from contour data[4] provided by Triton Environmental Consultants (D. Warburton, personal communication to J. Carter, Ecofish, February 17, 2021). FWA wetland shapefiles were overlayed on the DEM, and the number and area of wetlands affected by reservoir elevation changes were calculated for the following scenarios: maximum operating elevation (853.44 m or 2800 ft), minimum operating elevation for the Main (Ootsa Lake) Reservoir (849.17 m or 2786 ft) and for Tahtsa Lake (843.9 m), and at three 0.5 m incremental elevation bands between minimum and maximum operating elevation. No elevation data were available for Tetachuck Lake; the minimum operating elevation was assumed to be the same as that for Tahtsa Lake. This assumption is not expected to alter the results as all wetlands around Tahtsa and Tetachuck Lake were mapped at elevations greater than 850 m. Since the DEM was created from contour data, each scenario was classified as an elevation band or range of elevations, from which the number and area of wetlands were determined. The location and area of wetlands within each band were compared to operational data from the past 20 years (2001-2020) provided by Rio Tinto to determine the operating elevation(s) that will impact wetlands.

3. RESULTS

The FWA Wetlands data shows that there are 13,736 wetlands that occur within the Nechako Reservoir watershed, 122 of which are located within 12.7 m above the maximum operating level, but only one of these wetlands directly intersects the Nechako Reservoir. The wetland that overlaps with the reservoir was classified by FWA data as marsh. Table 1 provides a summary of the area of this marsh that is potentially affected by reservoir operations due to its overlap with the reservoir at different operating levels. Wetlands within the Nechako Reservoir watershed and the wetland potentially affected by operations are shown in Map 1.

The results of this mapping/desktop exercise show no FWA wetlands at the minimum operating levels. One wetland overlaps with the reservoir during operating levels of 851 m to 853.44 m

[3] Filatow, D., T.Carswell, and E. Cameron. 2018. Predictive wetland mapping of the FWCP-Peace Region. Prepared by Ministry of Environment and Climate Change Strategy for the Fish and Wildlife Compensation Program. Available at: https://www.env.gov.bc.ca/esd/distdata/ecosystems/TEI/WETLANDS/Williston_Wetlands_Reporting/Predictive%20Wetland%20Mapping%20of%20the%20Wiliston%20Drainage%20Basin_24_07_2018.pdf Accessed on May 18, 2021.

[4] The contour data were derived from several source data including topography contours and planimetric features produced using photogrammetry techniques from federal aerial photography, and TRIM contours of the Nechako Reservoir (D. Warburton, personal communication to J. Carter, Ecofish, February 17, 2021).

(maximum operating level); but the overall area of overlap compared with the size of the wetland is relatively small (0.78% to 26%). The wetland appears to be most affected when reservoir elevations are between 852.5 m and 853.44 m (2797 and 2800 ft), which has occurred 13 times in the last 20 years and five times in the last seven years (Figure 1).

To maintain wetland functions, wetlands should not be completely inundated or without water for more than 12 months in three consecutive years (National Research Council 1995[5]; Quinlan and Mulamoottil 1987[6]). Except for in 2000 and 2001, a portion of the marsh has been inundated for a minimum of three months in each year over the last 20 years (Figure 1). Maximum inundation from reservoir operations has occurred in 13 of the last 20 years and in five of the last seven years; however, inundation occurred no more than seven months of the year and most of the wetland area (73.6%) was not affected by reservoir operations.

This desktop analysis was based on the available data at the time of the assessment, and wetland classification and aerial extent were not field verified. The assessment assumes FWA Wetland data are current and accurate, and that classification includes shallow water wetlands. However, it is unlikely that the FWA has identified small ephemeral ponds and pools that are within the reservoir operating range that might provide wetland function.

Table 1. Number and area of the FWA wetlands that are affected by Reservoir operating levels.

Operating Levels	Elevation (m)	DEM Elevation Band (m)[1]	Count	Area (m^2)	Overlap with reservoir (m^2)	% Area Overlap Relative to Area of Wetland[2]
Min operating elevation - Tahtsa Lake	843.69	1 (0 - 843.70)	0	0	0	0
Min operating elevation - Main Reservoir[3]	849.17	2 (843.70 - 849.17)	0	0	0	0
Normal operating elevation[4]		3 (851 - 851.5)	1	46,983	368	0.78
		4 (851.5 - 852.0)	1	46,983	926	1.97
		5 (852 - 852.5)	1	46,983	4,079	8.68
		6 (852.5 - 853.0)	1	46,983	12,424	26.44
Maximum operating level	853.44	7 (853 - 853.44)	1	46,983	10,081	21.46

[1]An elevation band between min operating elevaiton at the Main Reservoir and Band 3 (849.17-851 m) was reviewed; no wetlands overlapped this area.

[2] Represents the range of operating elevations over the past 20 years (2001-2020).

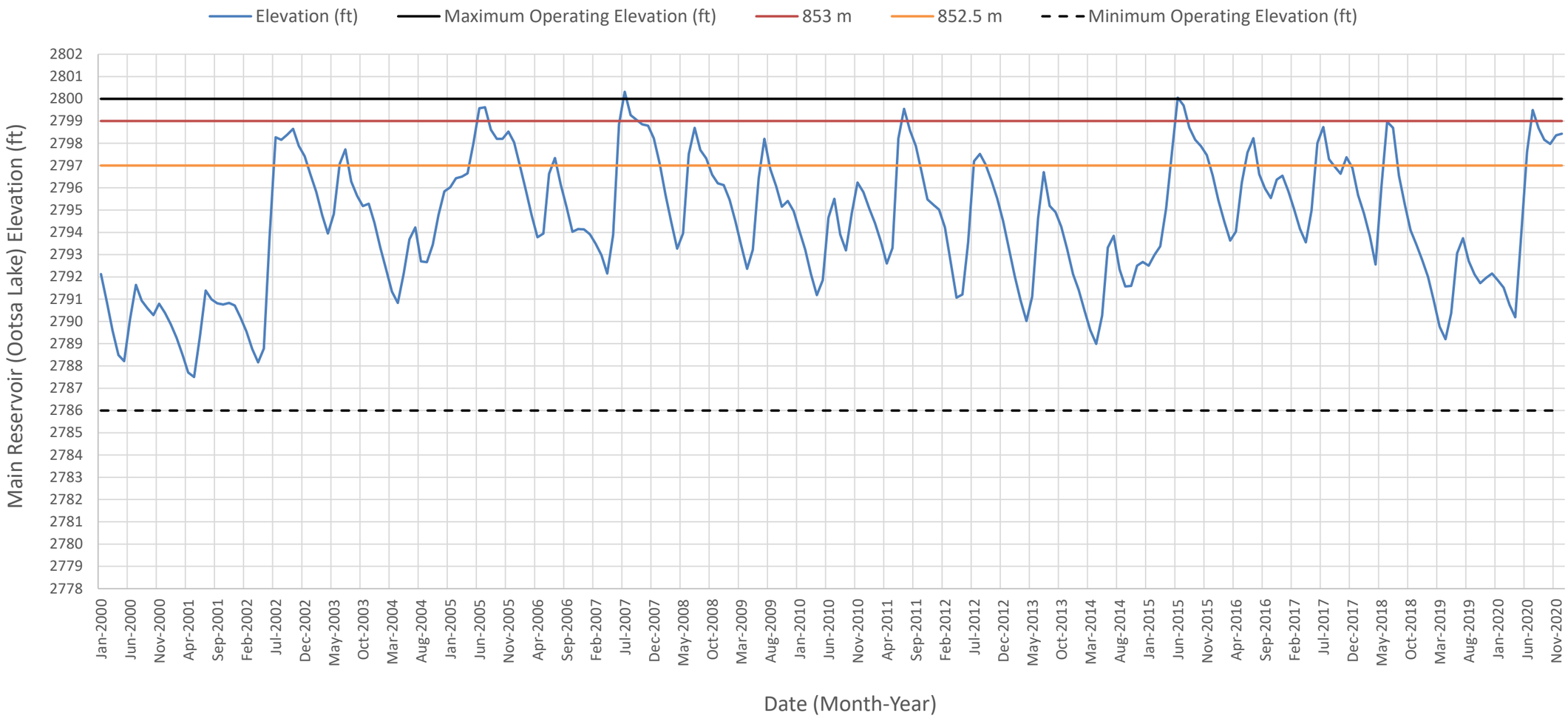
[3]Also referred to as Ootsa Lake

[4] % area overlap at maximum operating level is lower than normal operating level because of the shape of the wetland at that elevation band.

[5] National Research Council. 1995. Wetlands: Characteristics and Boundaries. Washington, DC: The National Academies Press, 308 p. https://doi.org/10.17226/4766.

[6] Quinlan, C. and G. Mulamoottil. 1987. The Effects of Water Level Fluctuations on Three Lake Ontario Shoreline Marshes. Canadian Water Resources Journal 12:1, 64-77, DOI: 10.4296/cwrj1201064

Figure 1. **Main Reservoir elevation (ft) recorded from 2000-2020. Elevation bands 852.5 m to 853 m, and 853 m to maximum operating elevation represent 26% and 21%, respectively, of the total 46,983 m^2 wetland area that overlaps with the reservoir.**



4. CONCLUSION

Utilizing the data available, wetlands within the Nechako Reservoir watershed were mapped to determine the number and area of wetlands that directly overlap with the Reservoir and may be affected by different reservoir operation elevations. The results of this desktop exercise show only one wetland is potentially affected by reservoir operating levels, and the area potentially affected is relatively small (<26%) compared to the total area of the wetland . There appears to be sufficient variability in reservoir elevations within and between years to maintain wetland ecological function in this wetland. This analysis assumes that FWA wetland data are accurate.

We trust this information will be useful to the Nechako Water Engagement Initiative in future decision making.

Yours truly,

Ecofish Research Ltd

Prepared by:	Reviewed by:
Signed	*Signed*
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Disclaimer:

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NECHAKO RESERVOIR

Nechako Reservoir Wetlands

Legend

- Community

Affected FWA Wetlands

- Marsh

FWA Wetlands

- Marsh
- Swamp

Resevoir Elevation (m)

- 0 - 843.69 m
- 843.69 - 849.17 m
- 849.17 - 853.44 m

MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES

0 3 6 12 18 24 30 Km

Scale: 1:615,000

NO.	DATE	REVISION	BY
1	2021-05-04	1316_NCH_WetlandsOverview_4120_20210504	CGA
2			
3			
4			
5			

Date Saved: 2021-05-04
Coordinate System: NAD 1983 UTM Zone 10N

ECOFISH RESEARCH

Map 1

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330000 340000 350000 360000

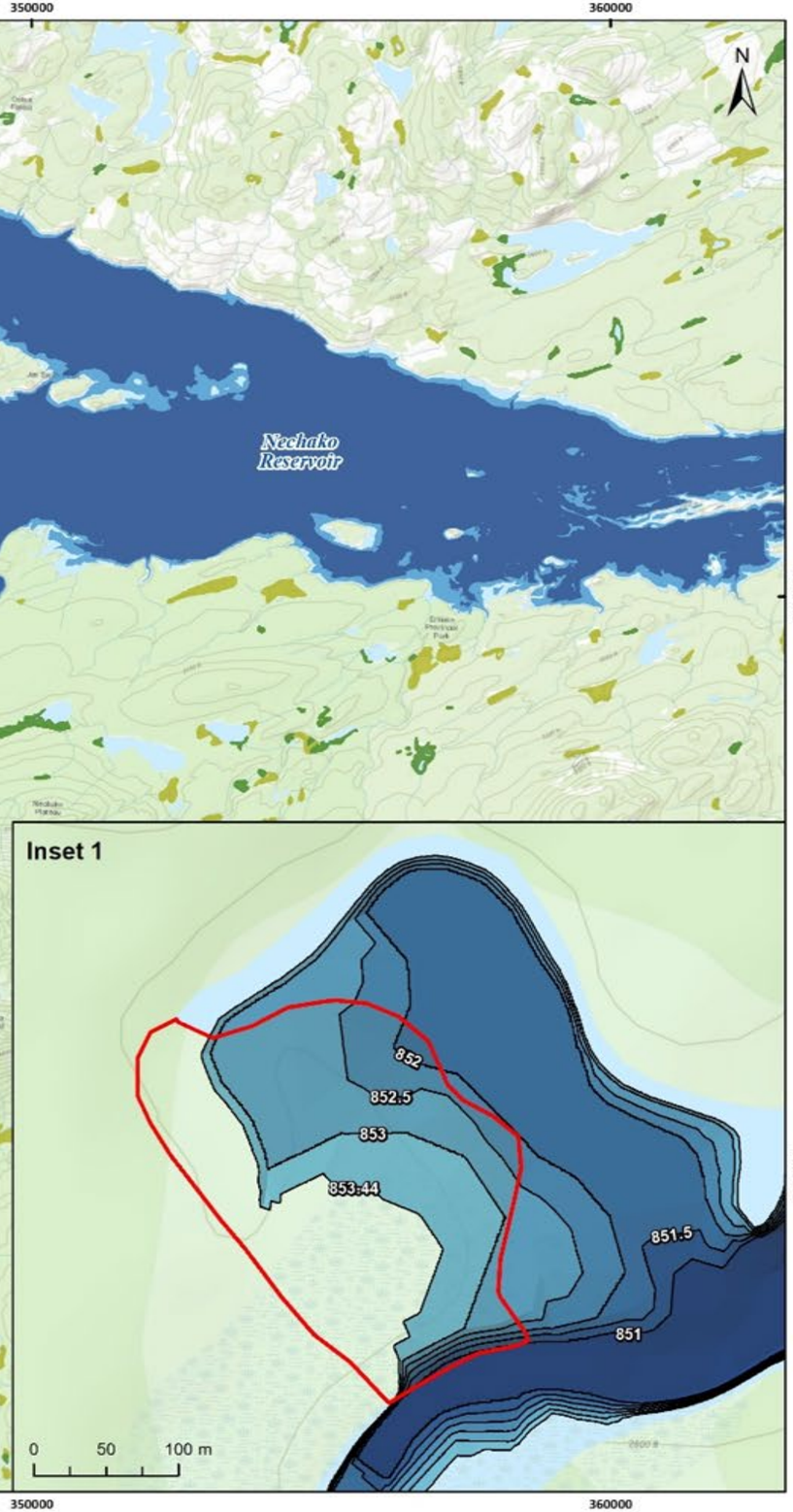
5920000

5910000

N

Nechako Reservoir

Inset 1



NECHAKO Reservoir

Nechako Reservoir Wetlands

Legend

- Community

Affected FWA Wetlands

- Marsh
- Marsh Boundary

FWA Wetlands

- Marsh
- Swamp

Resevoir Elevation (m)

- 0 - 843.69 m
- 843.69 - 853.44 m

MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES

0 0.5 1 2 3 4 5 Km

Scale: 1:100,000

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Date Saved: 2021-05-04
Coordinate System: NAD 1983 UTM Zone 10N

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Map 2

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