Baseline Vegetation and Wetland Monitoring Technical Report

December 2021

By Aleena Oates BSc. & Kylie Adebar BSc.

Tsolum River Restoration Society
www.tsolumriver.org

1. Introduction & Context

1.1 Introduction

Wetlands provide numerous important ecosystem services and functions. They aid in flood mitigation and groundwater recharge; support critical habitat and ecological services for many endangered species within British Columbia (B.C.); and host productive and critical ecological functions like the filtration of sediments, nutrients, and other pollutants through saturated soils and hydrophytes (plants adapted to grow in waterlogged soils) (Cox & Cullington, 2009).

Anthropogenic activities have the potential to negatively impact wetland environments through changing the water balance or inflow. In southern B.C., 60-98% of original wetlands have been drained or filled. These environmental changes are seen having large impacts on seasonal water levels and the frequency of floods, which subsequently impact the ecology and classification of a wetland (Cox & Cullington, 2009).

Climate Change is also continuing to influence the distribution, size, and function of wetlands. Increasing temperatures and changes in the hydrologic regimes can impact the composition of species in wetlands. This is especially true for sensitive or native species that are adapted to a specific range of conditions and can be easily overpowered by 'generalist' or invasive species that can survive in a wide range of conditions (Harrison and Moore, 2013). Increased attention, monitoring, and wetland management are needed to ensure these environments receive the necessary protection to maintain their ecological functions.

This technical report outlines the approach, objectives, and recommendations for studying the wetland matrix behind 6928 Railway Avenue in Merville, B.C.

Wetlands in the Merville area, as seen in Figure 1, are impacted by logging activity, the agricultural industry, and urban development. During heavy rain events, these wetlands are seasonally connected to their respective watersheds. The wetland behind 6928 Railway Avenue is seasonally connected to the Tsolum River (Extent View of Study Area, Figure 2).

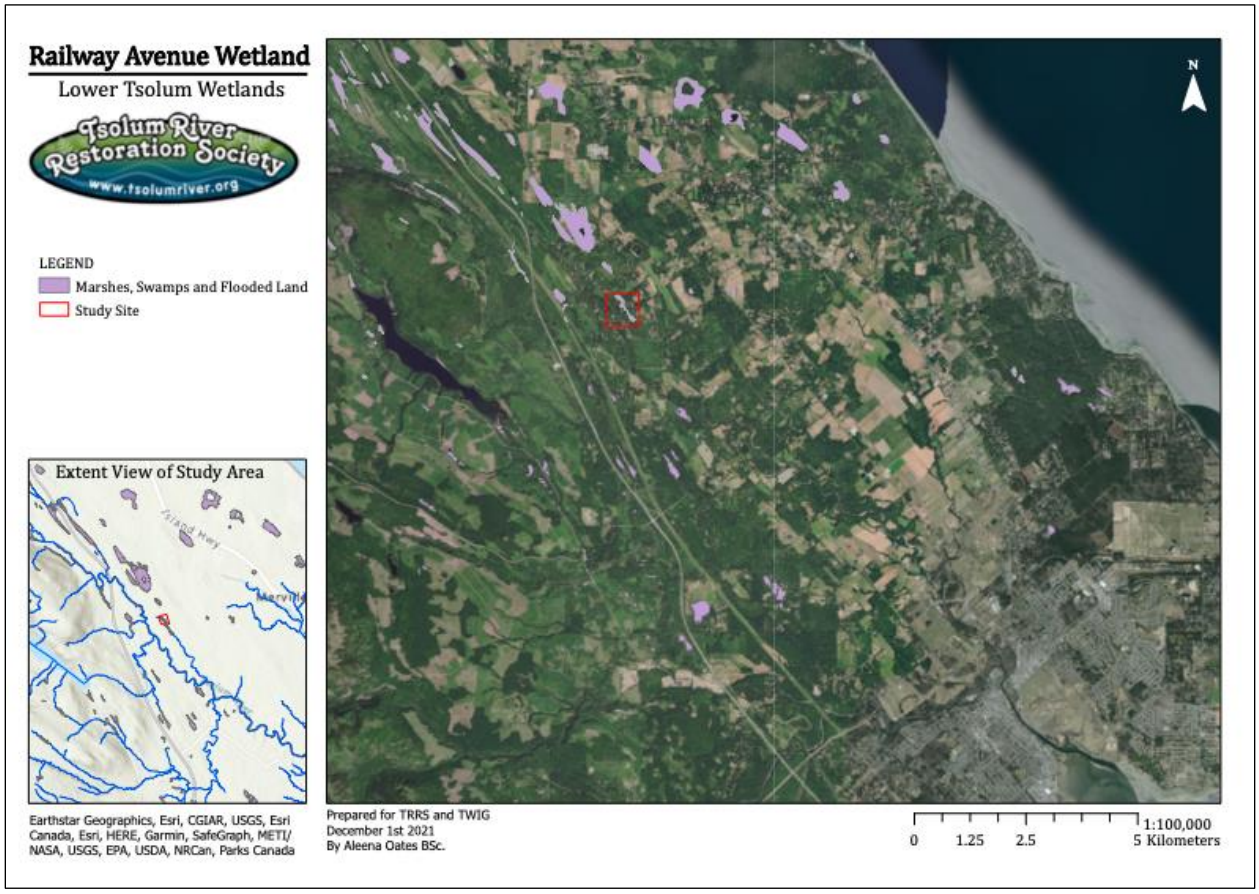

Figure 1: Merville and Black Creek Wetlands. Red Box Delineates where Figure 2 is located. Extracted from ImapBC.

1.2 Project Context

Tsolum River Restoration Society (TRRS) in partnership with Tsolum Wetland Interest Group (TWIG) have been working diligently to preserve and protect wetlands and riparian areas within the Tsolum Watershed. In the summer of 2021, with funding from the Canadian Summer Student Jobs, TRRS was able to appoint two summer students (Aleena Oates BSc. and Kylie Adebar BSc.) to work with TWIG volunteers (Sally Gellard and Cheri Lamb) to study the wetland environment in Merville.

Throughout the course of the data collection phase of this report, local community members and landholders of the area were collaborated with. Many of the local landholders are keen to understand more about the wetland matrix and with their permission allowed Oates and Adebar to access different sections of the wetland through their properties.

1.3 Project Location

For this work, the study area was narrowed down to a central focus area located to the east of Railway Avenue, between River Avenue North and Headquarters Road (Figure 2).

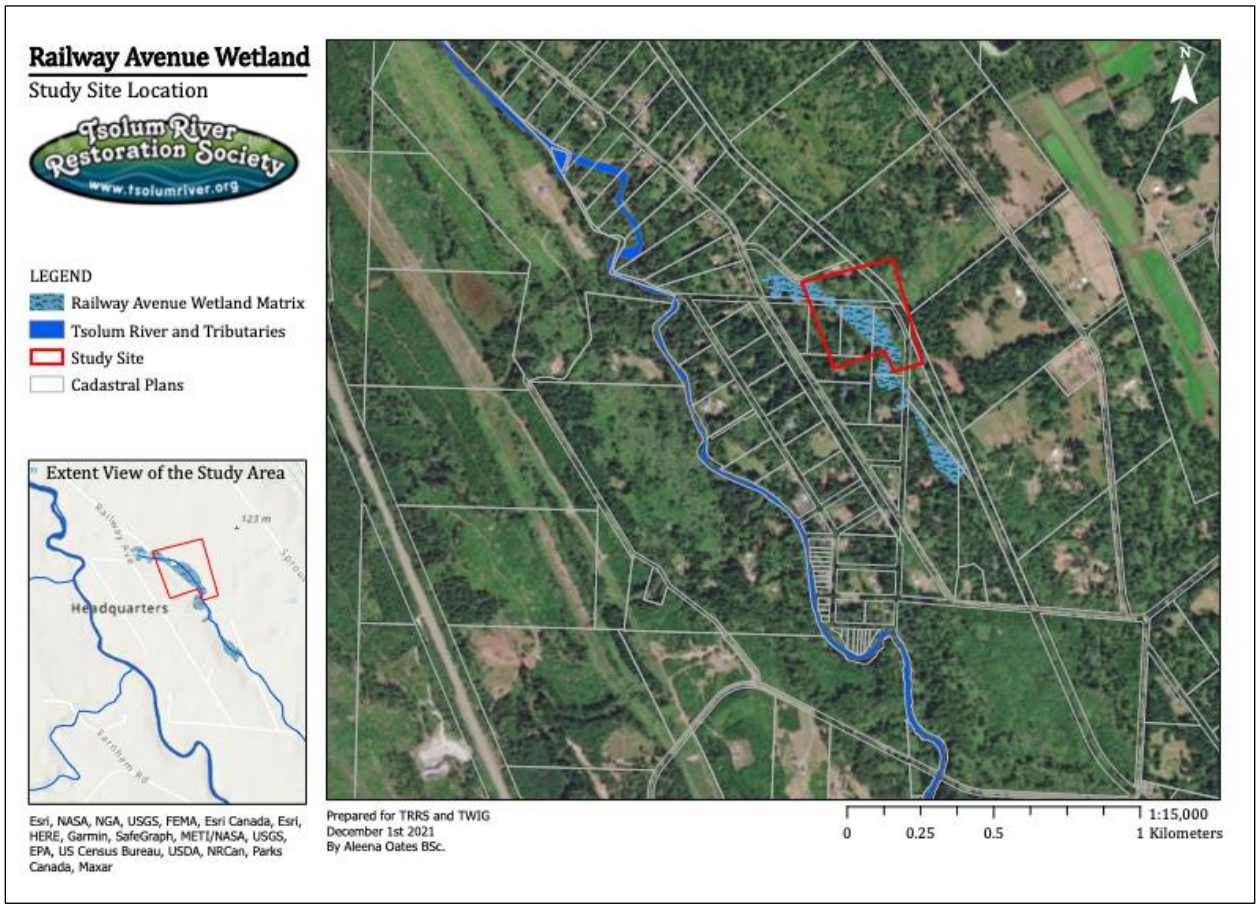

Figure 2: Study Site Location

2. Methods

2.1 Monitoring Approach

The monitoring approach in this plan is based on the advice and guidance found in the following documents:

- Wetlands Restoration Review: an analysis of 26 sites across southern British Columbia (B.C. Wildlife Federation, 2019)
- Interim Guidelines for Wetland Protection and Conservation in British Columbia (Wetland Stewardship Partnership, 2009)

- B.C. Wetland Trends Project: Okanagan Valley Assessment (Ducks Unlimited & Environment Canada, 2013)

These documents were developed to guide and ensure the success of collecting baseline data for the wetland. Principles from these guiding documents have been applied to the study design.

2.2 Study Design & Objectives

To understand how the Merville wetlands are changing from pressures such as climate change and urban development, baseline data was collected over the summer months. This monitoring took place over a twelve-week period from June 8th to August 23rd, with the exemption of two weeks (July 13th & August 17th). To carry out the monitoring Oates and Adebar launched a canoe from 6928 Railway Avenue every Tuesday, between 11am and 1pm. To aid with the monitoring of baseline data, the study area of the wetland was divided into four zones, easily classified by natural breaks in the wetland shape and vegetation types. From the canoe Oates and Adebar were able to revisit the same four sites each week (Figure 3).

The approach for monitoring the Merville wetland was designed to accomplish three things; observe water quality, document all species, and map the wetland's furthest extents. The study was designed to be built upon and easily repeated.

2.3 Monitoring Background: Zone Descriptions

Zone 1 starts at the northernmost part of the study area and is 3300 m^2. It is narrower at the north end, and comprised of a variety of vegetative species. Zone 2 is shaped like a long rectangle and is connected to zone 1 at its northernmost extent where the upland tree species naturally cinches on the wetland vegetation, it is 3400m^2. Zone 2's vegetation is mainly composed of emergent-floating species with a strip down the center that is clear of any vegetation. In the center of zone 2, there is an active beaver dam that may be contributing to the large variation of depth within this zone.

Zone 3 consists of the old railway that used to run through the landscape. All remnants of the railway have long since disappeared apart from the straight line of raised vegetation that separates zone 2 and zone 4. The zone measures

1375 m^2. Due to the vegetative nature of zone 3, no depth or dissolved oxygen measurements were taken in this zone. Zone 4 is the largest zone, measuring 13,705 m^2. It lays on the eastern side of zone 3, the southern third is open water and measures the deepest part of the wetland. At the southern end, beavers will occasionally dam the runoff flow in the wet seasons.

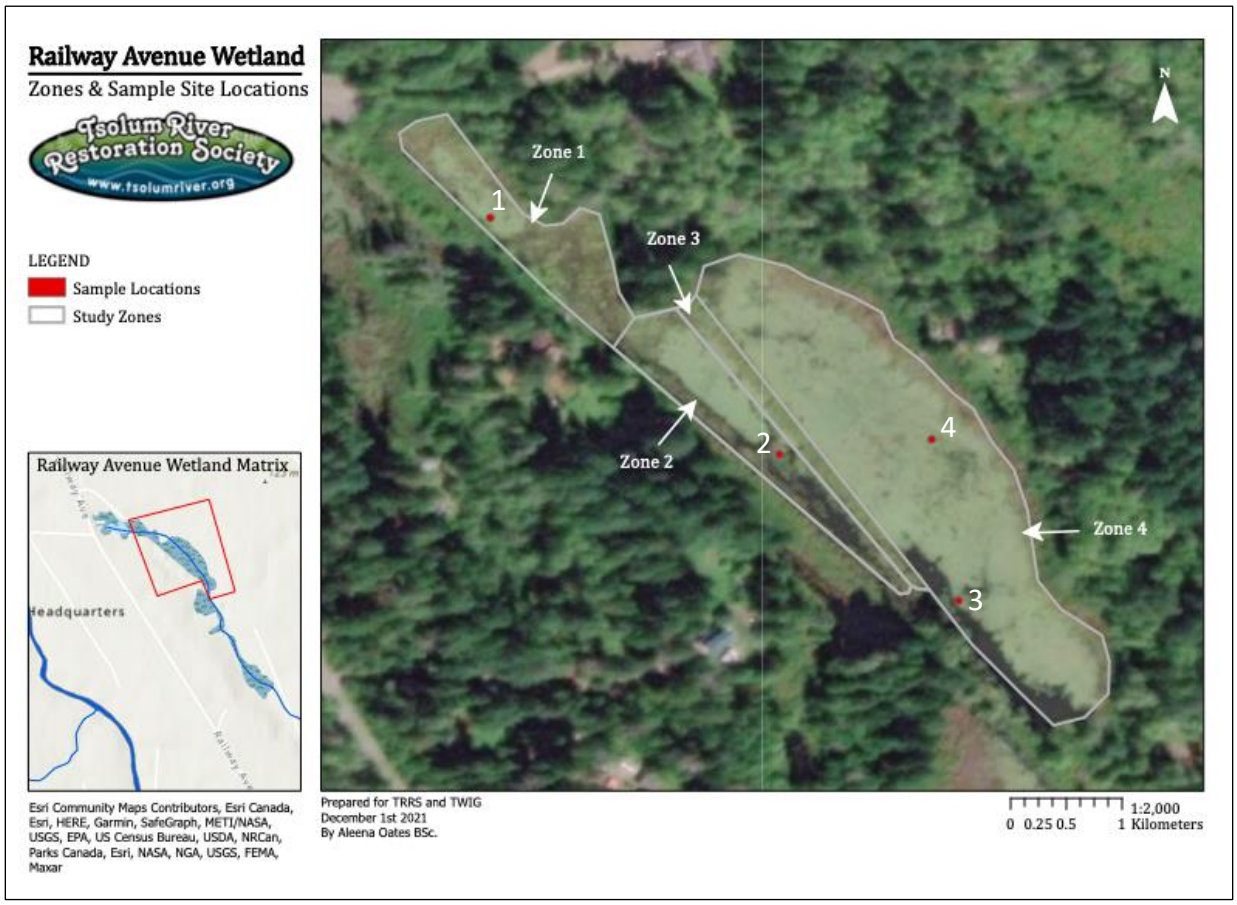

Figure 3: Zones and Sample Site Locations

2.4 Data Collection

2.4.1 Water Quality and Depth

Monitoring of water quality and quantity was done by measuring the temperature, dissolved oxygen (DO), and depth in the wetland over the summer months at the 4 sampling sites within the wetland. At each site measurements of DO and temperature were taken using an instrument -OxyGuard with an electrical membrane submerged in the water at the surface (8 cm below surface) and bottom (measured around 1 m below surface except for site 4 whose depth

is much shorter than the other sites). A depth measurement was taken each week using a rigid tape measure.

2.4.2 Species Observations

2.4.2.1 Wetland Vegetation

Collecting vegetation data for the wetland matrix was completed by taking photographs of various observed species, throughout the entirety of the wetland matrix, with a focus on the four study zones. More observations were also collected from research grade citizen science photos posted on Inaturalist.com, within wetland environments in the Merville area (Inaturalist, 2021). These additional observations can be seen in the Merville Wetland - Vegetation Classification Guide attached to this report (Appendix A).

The wetland extent and vegetation were mapped out using an app (FieldAreaMeasure) and the extent of the wetland was delineated by hydrophilic plants and edge species such as cattails, rather than by the presence of water. The dominant species were mapped out by observing the species in different sections of the wetland. For example, in an area where 60% or more of the vegetation cover consisted of one specific species that species would get classified as the dominant specie. Although, travelling between zones 1 and 4 was done through a canoe to complete this work, hip-waders and a vehicle were used access the other areas of the wetland.

2.4.2.2 Fish and Amphibians

Various fish and amphibians were observed and trapped in the wetland. Baited traps were set three times during the summer months, and once in the fall (Appendix B). Once species were observed and document they were released back into the wetland. Within the twelve-week period, minnow traps were set up at two of the sampling sites- site 1 and site 3. Each trap was set for three hours during the day as water quality testing was completed. Some species were also noted near the trapping sites but did not make it into the traps.

3.0 Findings

3.1 Water Quality and Depth

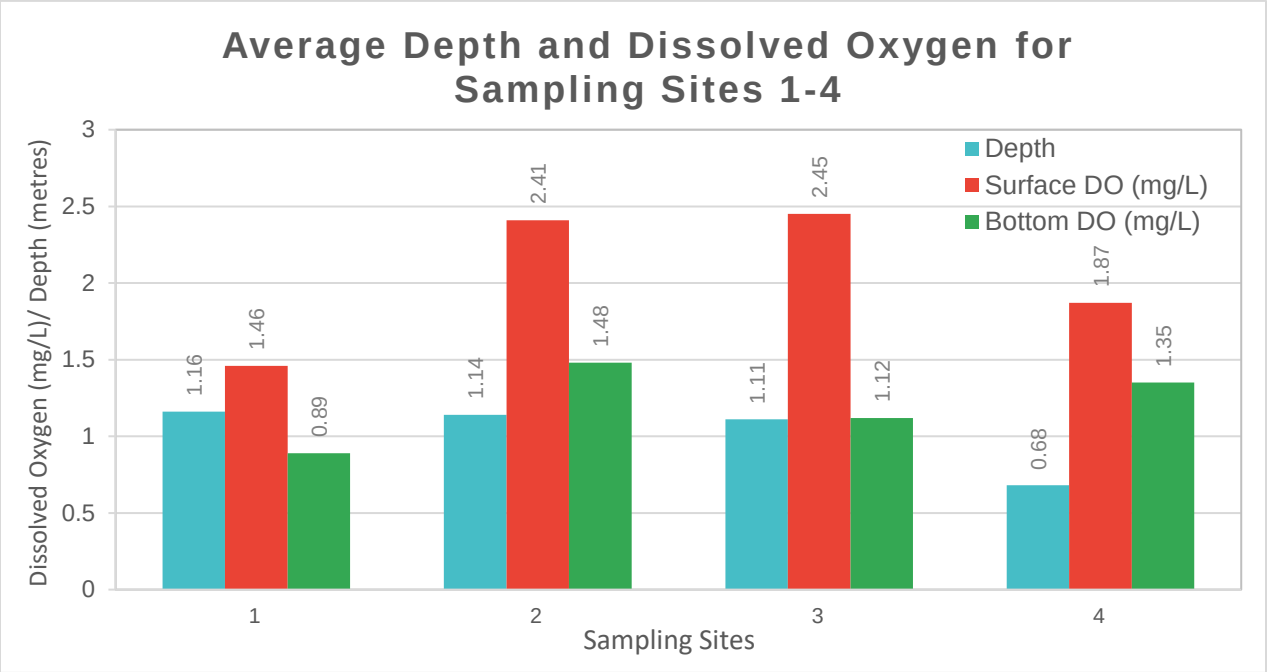

Figure 4: Average Depth and Dissolved Oxygen for Sampling Sites 1-4. Measured throughout the twelve-week monitoring program.

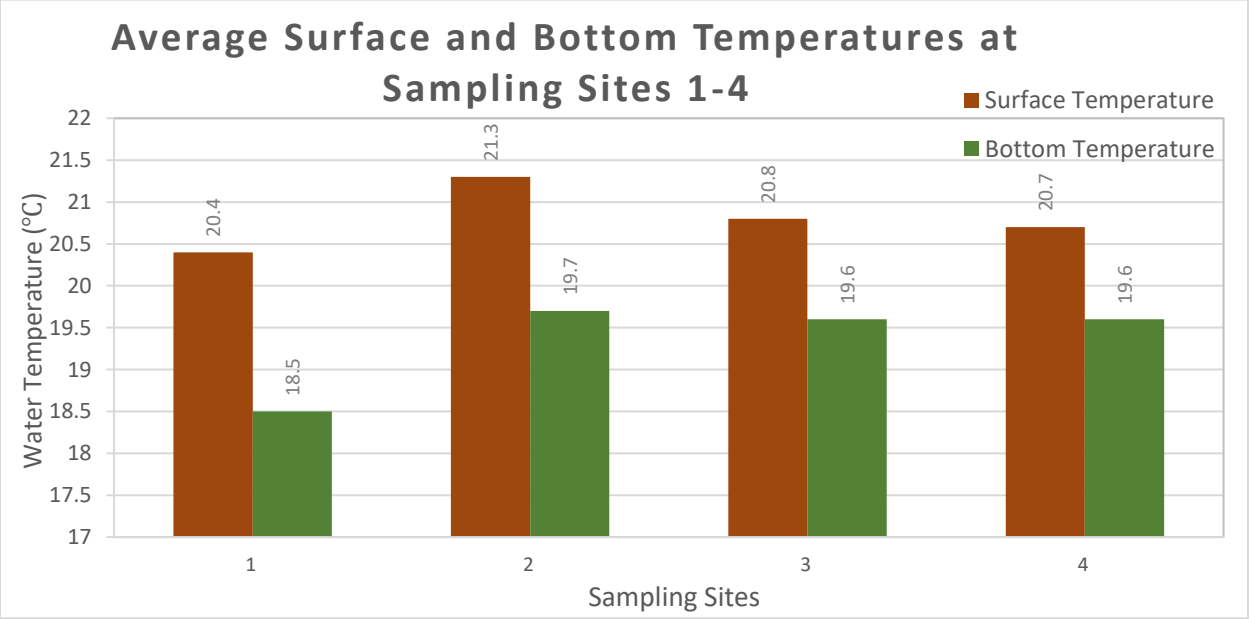

Figure 5: Average Water Temperature at Surface and Bottom Sampling Sites 1-4. Measured throughout the twelve-week monitoring program.

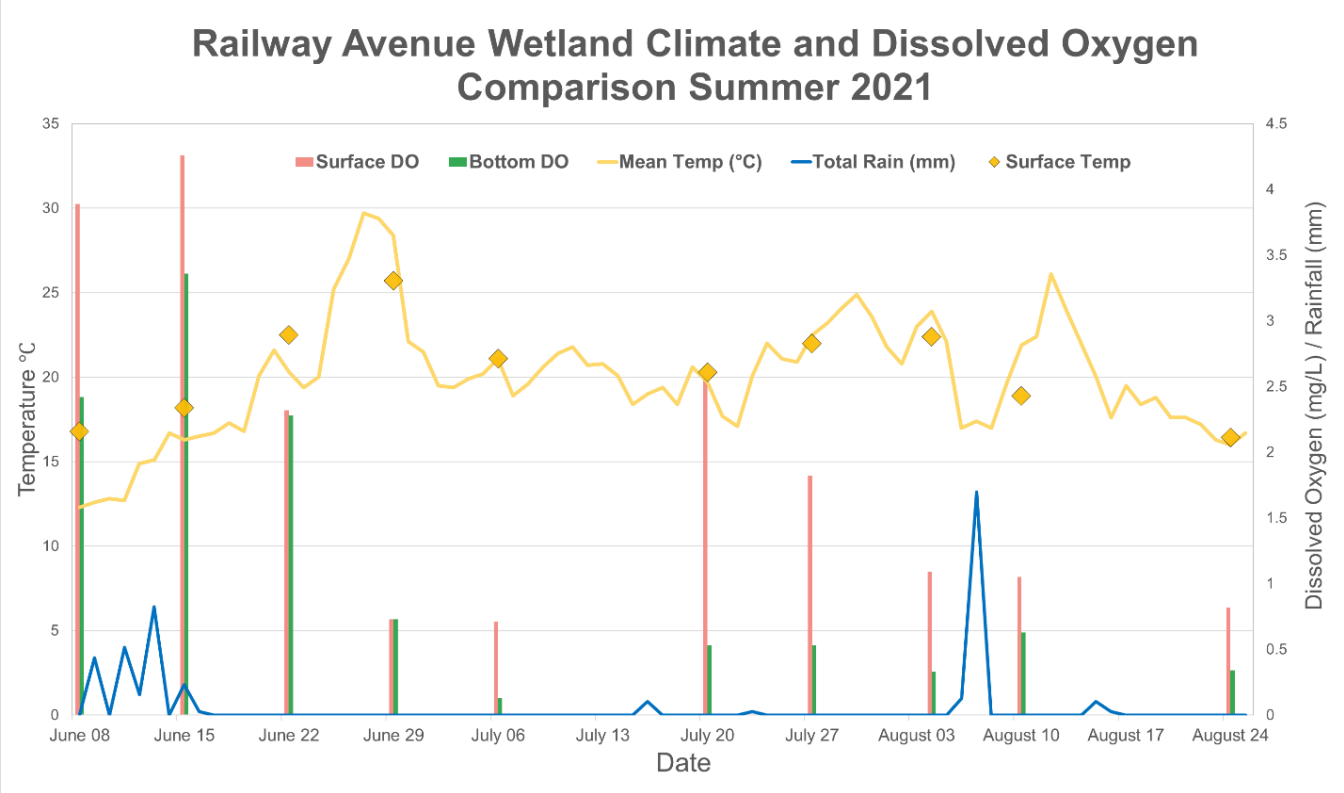

Figure 6: Wetland Water Quality and Quantity Characteristics over Twelve-Week Monitoring Program with Temperature and Rainfall Data (Environment Canada, 2021)

3.2 Species Observation Findings

3.2.1 Wetland Vegetation

The predominant vegetation of each zone was observed and described below. Additionally, the Railway Avenue wetland predominant vegetation was also classified beyond the study area (Figure 9). Use the Vegetation Classification Guide to see photos and aid with identification of these species (Appendix A).

Zone 1 is largely comprised of Broadleaf Catails (*Typha latifolia*). Throughout the rest of the zone, the predominant species, consist of Yellow Pond-Lilies (*Nuphar polysepala*) and Watershield (*Brasenia schreberi*) with various sedges (genus

Figure 7: Zone 1 (left) and Zone 2 (right)

Carex) and Rose Spiraea (*Spiraea douglasii*) at the edges of the wetland (Figure 7).

Zone 2 vegetation is mainly composed of floating-leaved pondweed (*Potamogeton natans*) on the western side. Yellow Pond-Lilies (*Nuphar polysepala*) are mostly found on the eastern side with a small amount on the south-western side. Additionally, there is a strip down the center, close to the beaver dam - that is clear of any vegetation.

Zone 3 is largely composed sedges (genus *Carex*) and Rose Spiraea (*Spiraea douglasii*) as well as two invasive species. The invasive species in this section comprise of Yellow Iris (*Iris psewdacorus*) and Reed Canary grass (*Phalaris arundinacea*).

Figure 8: Zone 3 (left) and Zone 4 (right)

Zone 4 is 75% covered in vegetation throughout the boggy and shallow areas and is mostly composed of Watershield (*Brasenia schreberi*) with Yellow Pond-Lilies (*Nuphar polysepala*) on the edges. Rose Spiraea (*Spiraea douglasii*) and Pacific Willow (*Salix lasiandra*) are also found on the upland and southern areas around zone 4 (Figure 8).

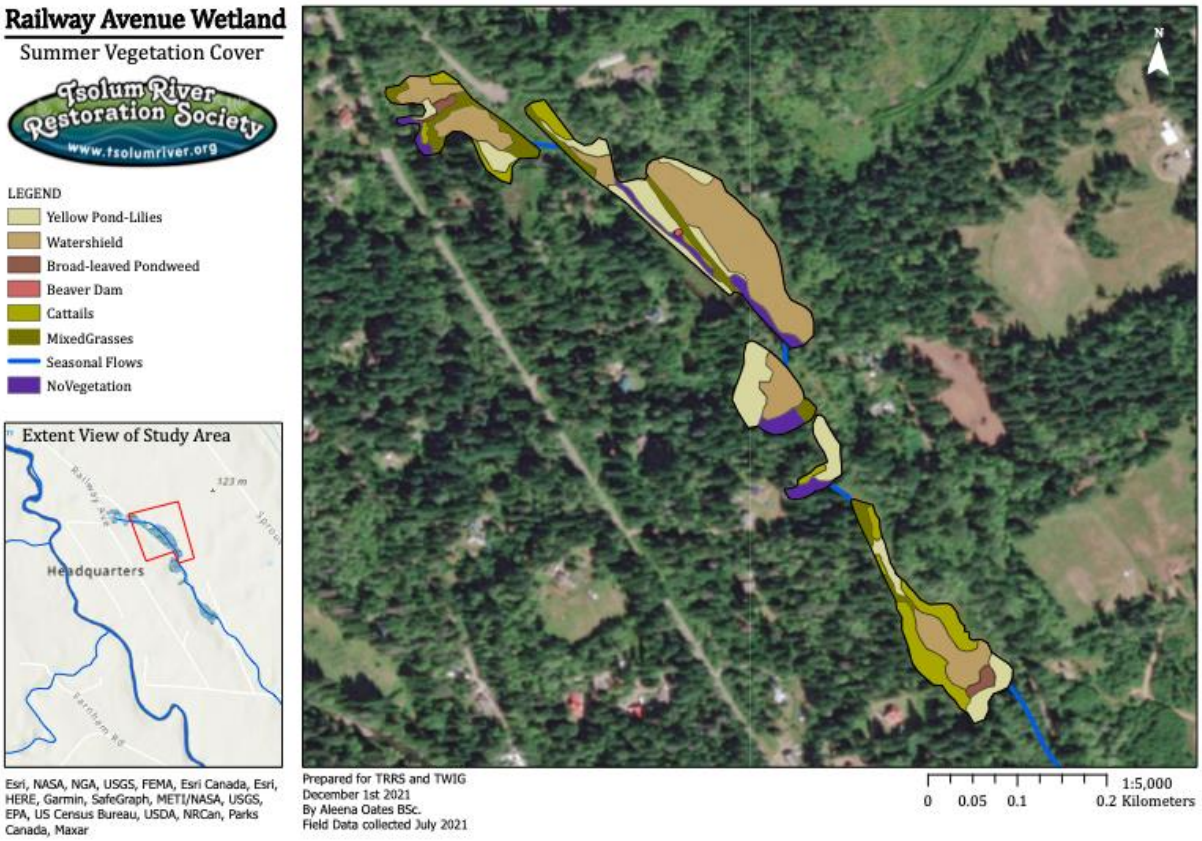

Figure 9: Railway Avenue Wetland Predominant Vegetation Cover

3.2.1 Fish and Amphibians

Summer Observations: Site 1

The minnow trapping at this site 1 showed the presence of Threespine Stickleback (Gasterosteus aculeatus) and one observation of an Adult Northern Pacific Tree Frog (Pseudacris regilla) was made close to sampling site.

Summer Observations: Site 3

The Minnow trapping at site 3 also showed the presence of Threesping Stickleback (*Gasterosteus aculeatus*) and 3 Northwestern salamanders (*Ambystoma gracile*), as well as one western toad tadpole. Additionally, in zone 4 (close to site 4), many invasive American Bullfrog (*Lithobates catesbeianus*) sightings and mating calls were seen/heard.

Fall Observations

Fall observations showed that Threesping Stickleback (*Gasterosteus Aculeatus*) and Northwestern salamanders (*Ambystoma gracile*) are still present in the pond in high waters periods (Appendix B). Six Juvenile Coho Salmonids were also found in the Railway Avenue wetland matrix from 2 different traps (Appendix B).

4.0 Discussion

From figure 4, it is noticeable that the highest average surface DO levels are found at sample sites 2 and 3 which are both free of floating vegetation and might experience more flowing water in comparison to site 1, which is less connected to other zones. For the bottom DO readings, the highest average levels are found at site 2 while the lowest are found at site 1. This might be similarly, explained by the flow/connectivity characteristics of the wetland but alternatively, a lack of microbe activity at the water-soil interface due to less decomposition from open water and lack of vegetation at site 2 is also possible (Kalff, 2002).

Figure 4 also shows that site 4 has the lowest water depth as this site is situated in a shallow, boggy area in the middle of zone 4. Due to these site characteristics and the low specific heat of soil compared to water, it was thought that this site would have the highest average surface and bottom water temperatures (Ross, 2017). However, the highest surface and bottom water temperatures were found at zone 2 in an area relatively free of floating vegetation.

Sampling error of temperature and DO could have occurred due to diurnal cycling, paired with the fact that Oates and Adebar sampled in the same order, from sites 1, 2, 3 and 4- meaning that water and vegetation surrounding site 1 had the least time to heat up and photosynthesize from that day, reducing the average temperature and DO values. Moreover, other sources of error from this monitoring could have occurred from using the Oxyguard or measurement stick in a slightly different location each time as the canoe was hard to hold completely still, especially with gusts of wind.

Water quality monitoring over the summer showed that DO levels at the surface and bottom of the wetland decreased over the twelve weeks. This was expected trend, especially with the little rain and a heat wave at the end of June. Figure 4 shows that sampling sites 1-3 had very similar average depths throughout the twelve weeks,

although the depth of water did decrease over time without replenishment from rainfall.

A temporal analysis of water quality (Figure 6) shows that DO levels also decreased in the wetland over the twelve weeks. This was expected as the water becomes more stagnant without rainfall events, sealing it off from atmospheric oxygen. Summer heat also decreased the oxygen's solubility, which further lowered DO levels. These trends are especially visible during the heat wave in June that greatly diminished DO levels. DO levels in July continued to drop due to the reasons previously mentioned, and oxygen being consumed from microbes at the water-soil interface (Kalff, 2002).

Unfortunately, DO molecules in the water is needed to sustain life and during the heat wave, Oates and Adebar observed two dead Threesping Stickleback (Gasterosteus Aculeatus) and three dead, Western Toad tadpoles (Anaxyrus boreas). Unfortunately, as fish and amphibians are ectothermic, (meaning an animal is not capable of generating internal heat), they are extremely sensitive to changes in temperature. In addition, amphibians are vulnerable to shifting summer temperature patterns as it can increase the number of disease outbreaks within waterbodies and increase the number of morphological abnormalities (Blaustein & Bancroft, 2007 ; Kupferberg et al., 2009). Western Toads are also sensitive to changes in weather patterns and dry conditions as their eggs in shallow water are sensitive to UVB radiation (Blaustein & Bancroft, 2007). With more extreme weather in the future, due to climate change, these occurrences of dry summers and heat waves might become more frequent and impact the local populations of fish and amphibians.

5.0 Recommendations

As wetlands are sensitive to climate change and are subject to changes in their hydrologic patterns due to changing summer weather patterns, Oates and Adebar propose establishing a solid baseline of wetland raster or polygon data to look at in future summers for a trend analysis of wetland size and vegetation composition as did Ducks Unlimited & Environment Canada (2013). In their study they used a 30-year timeline and similarly the Railway Avenue could be reassessed to see the changes in the wetland over the next 5, 10, 20 plus years to see any trend analysis. Furthermore, as vegetation is dependent on the hydrology, human disturbance, and impact in the area, it is advised to reassess the composition of native and invasive species in the years to come as well as assess the area of emergent and open water zones as seen in Figure 9. The use of INaturalist can also be continued to be used to identify new native or invasive species not identified in the Vegetation Classification Guide (Appendix A).

5.1 Future Monitoring Objectives

Future monitoring should include the water quality parameters of pH as this can give indication of primary productivity in the wetland. More specifically, measurements of pH indicate the relative abundance of dissolved inorganic carbon in the form of carbon dioxide (CO_2) due to a lack or occurrence photosynthetic activity in the water. Photosynthesis will deplete carbon dioxide in the water (and increase DO), causing a lowering in acidity and increasing the pH. However, like DO measurements, pH should be measured at similar time from sunrise as it shows a cyclical diurnal pattern from daily photosynthetic activity, especially in highly productive freshwater environments such as wetlands (Ducks Unlimited & Environment Canada, 2013).

Other recommendations include:

- Adding a sampling site in the south end in zone 4, closer to where the western toads emerged during summer 2021.
- Add sampling sites close to where the Juvenile coho salmonids were found in November 2021.
- The entirety of the Railway Avenue wetland should be mapped out in June as to allow more access along the wetland by canoe.
- In future years the percent of disturbance (lack of vegetation) or percent of invasive species could be estimated for subzones created within each zone in the study area.
- More estimated depth points could be added within the wetland at a certain date each year to see if the water quantity/depth is changing annually.
- In future years the percent of disturbance (lack of vegetation) or percent of invasive species could be estimated for subzones within each zone in the study area.

5.2 Conclusions

The preliminary findings from this study are suggested to be used by stakeholders and decision makers to help guide future restoration efforts, as needed. The design of this study is simple in nature, with an emphasis on making it accessible to citizen scientists. The study hopes to focus on the monitoring through temperature, depth, and DO throughout the pond. This study will hopefully be able to show changes in wetland extent or shrinkage, if any occurs in the future with climate change. The predominant vegetation of native or invasive species is also very important for understanding the health of this wetland. Furthermore, hopefully the findings from this wetland study can help indicate possible monitoring or restoration measures needed in other wetlands in the Merville area.

References

BC Wildlife Federation. (2019). Wetlands Restoration Review: an analysis of 26 sites across southern British Columbia.

Blaustein, A. R., & Bancroft, B. A. (2007). Amphibian Population Declines: Evolutionary Considerations. *BioScience*, *57*(5), 437–444. https://doi.org/10.1641/B570517

Cox, R. K., & Cullington, J. (2009). *Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia. Wetland Stewarship Partnership*. http://www.env.gov.bc.ca/wld/BMP/bmpintro.html

Harrison, B., & Moore, K. (2013). *BC Wetland Trends Project: Okanagan Valley Assessment Canadian Intermountain Joint Venture*. bc_wetland_trends_final_report_for_gnlcc_20131031_0.pdf (greatnorthernlcc.org)

Kalff, J. (2002). Limnology—Inland Water Ecosystems. *Journal of the North American Benthological Society*, *21*(2), 346–347. https://doi.org/10.2307/1468422

Kupferberg, S. J., Catenazzi, A., Lunde, K., Lind, A. J., & Palen, W. J. (2009). Parasitic Copepod (Lernaea cyprinacea) Outbreaks in Foothill Yellow-legged Frogs (Rana boylii) Linked to Unusually Warm Summers and Amphibian Malformations in Northern California. *Copeia*, *2009*(3), 529–537. https://doi.org/10.1643/CH-08-011

Ross. (2017). *Weather and Climate* (2nd ed.). Oxford University Press.

Appendix A

Vegetation Classification Guide

MERVILLE WETLAND

By Kylie Adebar BSc. & Aleena Oates BSc.

The Vegetation Classification Guide was created to improve identification of species (native and invasive) in the Railway Avenue wetland and surrounding Merville area. Species on this list were added based on observations made by Oates and Adebar. For a longer list of species, photographs from research grade citizen science were also used from the website of 'Inaturalist' (Inaturalist, 2021). The use of Inaturalist also allowed Oates and Adebar to correctly identify the species within the wetland from their observations.

This Guide includes invasive species found in wetland environments outside of the Merville area. They have been included as species of concern, that could be potentially harmful to the Railway Avenue wetland and other Merville wetlands in future as indicated by an asterisk.

Knowledge and descriptions of each species were found in the following documents and resources:

- North Shore Wetland Partners Society (2015). Reed Canary Grass Control and Restoration of Wetlands on Cypress Mountain. Accessed December 17, 2021 from: Reed-Canary-Grass.pdf (nssk.ca)

- Invasive Species Council of British Columbia. (n.d.). Identify: Alert Species. Retrieved December 17, 2021, from https://bcinvasives.ca/take-action/identify/

- iNaturalist. (n.d.). iNaturalist- British Columbia, CAN. Retrieved December 17, 2021, from: https://www.inaturalist.org/places/british-columbia

Native or Naturalized Species

YELLOW POND- LILLIES *NUPHAR POLYSEPALA*

The great yellow pond-lily is native to western North America. Commonly found in shallow and muddy wetlands and ponds.

Description: Has large, green, floating leaves and bright yellow blossoming flower that appears between spring and fall.

WATERSHIELD *BRASENIA SCHREBERI*

Watershield is the only species in the genus Brasenia. It can be found globally, typically in shallow freshwater habitats.

Description: Has bright green floating leaves and small purple flowers blossoming from June to September. The stems and underside of the leaves are covered a thick mucilage

FLOATING-LEAVED PONDWEED *POTAMOGETON NATANS*

Floating-leaved pondweed (or floating pondweed) is an aquatic species found in slow moving waterbodies across Northern regions of the world.

Description: Has opaque dark green floating leaves with pointed tips and a rounded base. Has cylindrical flower spikes 5 to 10 cm long that blossom from May to September.

BROADLEAF CATAIL *TYPHA LATIFOLIA*

The broadleaf cattail (also known as the common bulrush) is a herbaceous plant native to North America. It is found in flooded environments with a water depth of 0.75 to 1 metres.

Description: Grows 1.5 to 3 meters long, has long-flat, sword shaped leaves and brown cylindrical shaped flowers.

ROSE SPIRAEA *SPIRAEA DOUGLASII*

Rose Spiraea (or commonly known as Hardhack, Steeplebush and Douglas Spirea) is a flowering shrub native to western North America.

Description: Has long, toothed leaves and grows 3-6 feet tall. Clusters of pink flowers appear in early summer.

PACIFIC WILLOW *SALIX LASIANDRA*

Pacific Willow is a large deciduous shrub native to the northwestern region of North America and found in the upland areas of wetland environments.

Description: Pacific willow grows 4 to 11 metres tall with narrow green leaves. The flowers (catskins) are yellow and emerge in late spring and grow 1 – 9 cm long.

MARSH CINQUEFOIL *COMARUM PALUSTRE*

Marsh Cinquefoil (also known as purple marsh-locks and swamp cinquefoil) is an aquatic shrub found in northern regions of North America and Eurasia.

Description: Has 3 to 7 sharp and narrow course teeth on its oval-shaped leaves and flowers that vary in colour - from red to purple.

WILD STRAWBERRY *FRAGARIA VIRGINIANA*

Fragaria Virginiana (also known as mountain or common strawberry) is a North American strawberry grown in southern areas of Canada.

Description: Has set of 3 oval shaped leaflets with coarse teeth along the edge, has white flowers with five petals and small green sepals underneath the petals.

SEEP MONKEYFLOWER *ERYTHRANHE GUTTATA*

Seep monkeyflower (or yellow monkeyflower) is highly variable as it has both perennial and annual forms as well as more erect and non-erect forms (can grow from 10 to 80 cm tall). This flower can be found close to stream banks and wetlands throughout Western North America.

Description: Each flower has bilateral symmetry with a lower and upper lips with reddish-brown spots. The leaves are usually coarse and irregularly shaped.

TRUE SEDGES *CAREX*

The genus Carex has more than 2,000 species of perennial, grass-like plants. These plants have bladed leaves that are flat and long, extending from the stalk. The flowers usually exist in small, combined spikes. Sedges are normally found in wet forested or wetland environments, some of which are saline. The sedges below are naturalized or native to Vancouver Island:

FEW-FLOWERED SEDGE *CAREX PAUCIFLORA*

Description: Spike of each stem contains unique pointed shape - displaying its seeds.

SLOUGH SEDGE *CAREX OBNUPTA*

Description: The stems reach maximum height of 1.2 meters and the inflorescence are long and generally dark in colour.

WATER SEDGE CAREX AQUATILIS

Description: Has variable appearances as it is found in various habitats and conditions such as low-oxygen substrates. Generally, the plant doesn't grow in clumps and the inflorescence has spikes. The stems reach 0.2 to 1.5 metres in height.

Invasive Species

YELLOW FLOATING HEART * *NYMPHOIDES PELTATA*

Yellow Floating Heart is an ornamental pond species found in shallow, slow-moving waters and is native to Eurasia and invasive in North America and found in various water bodies in British Columbia.

Description: Yellow Floating Heart forms dense mats and has leaves with a 3 -15 cm diameter.

EUROPEAN WATERLILY * *NYMPHAEA ALBA*

European water lily is found in shallow water bodies as it attaches its rhizomes to the bottom of the water body. It is native to various locations in Africa, Asia, and Europe.

Description: It has glossy green leaves that get reach up to 30cm in width, and large white flowers and are sometimes seen with pink/yellow centers.

FRAGRANT WATERLILY * *NYMPHAEA ODORATO*

Fragrant water lily is found in shallow water bodies and is rooted by its rhizomes under the surface of the water. This waterlily is typically found and purchased in garden centers.

Description: The large flower is composed of white petals and yellow stamens.

SMALLFLOWER TOUCH-ME-NOT * *IMPATIENS PARVIFLORA*

Smallflower touch-me-not is found in moist soils such as riverbanks and wetlands but is tolerant to many climates and sun tolerances. This flower is native to Asia.

Description: Smallerflower touch- me-not is a branching plant with glossy leaves and pale-yellow flowers. The plant grows 20-80cm tall.

YELLOW FLAG IRIS *IRIS PSEWDACORUS*

Yellow Flag Iris is native to Europe, Western Asia and North Africa. However, it is invasive to Canada and currently invades many areas across British Columbia. Yellow Flag Iris specifically invades wet habitats such as wetlands, ditches, and shorelines.

Description: The stems grow 1-1.5 metres tall, has bright yellow flowers with three sepals, has green- sword shaped leaves.

For more information visit: Yellow-Flag-Iris.pdf (bcinvasives.ca)

REED CANARY GRASS *PHALARIS ARUNDINACEA*

Reed Canary Grass is a perennial grass that is widely distributed across the globe but is invasive in the pacific northwest area of North America.

Canary Grass easily invades disturbed areas such as roadsides, ditches and wetlands.

Description: The grass blades can grow up to 2 meters tall and flat and rough, and the inflorescences are densely clustered.

For more information visit: *Reed-Canary-Grass.pdf (nssk.ca)*

Appendix B

Railway Avenue Wetland

JUVENILE COHO SALMON REARING

Aleena Oates BSc. & Kylie Adebar BSc
TSOLUM WETLAND INTEREST GROUP | DECEMBER, 2021

Introduction:

Juvenile Coho Salmon (*Oncorhynchus kisutch*) have a wide variety of habitat needs throughout the year (Nickelson et al., 2011). In the summer months, Coho fry reside within various instream habitat types (pools, riffles, or glides). In winter, they live in quiet ponds or alcoves separated from the main channel. In some cases, the success of Coho salmon populations is restricted by the variety and quantity of adequate and accessible overwintering ponds (Nikelson et al., 2011). For these reasons, understanding and protecting overwintering habitats adjacent to larger tributaries is important for the health of Coho salmon.

In April 2021, Tsolum River Restoration Society (TRRS) and Tsolum Wetland Interest Group (TWIG) member Sally Gellard found several juvenile salmon in the Railway Avenue wetland in Merville. This finding has inspired further investigation and work of fish trapping within the Railway Avenue wetland to find out how large of a Coho fry population is using the wetland as overwintering habitat. Other remaining questions include: when and how do they successfully migrate to the Railway Avenue wetland from the Tsolum river, and do they successfully migrate back to the Tsolum River in spring? To start answering these questions, Sally Gellard and Allan Chamberlain set out traps November 2021.

Methods:

On November 19th minnow and clover traps were set at 9 locations throughout the wetland and were retrieve 24 hours later, on November 20th. These 9 locations can be found within the study area and beyond (upstream of zone 1 and downstream of zone 4) (Figure 2). If salmonid species were captured, the fork length and conditions of each fish was noted (Figure 1). The depth from the surface of the water and the habitat description of each of the 9 traps was also noted.

Figure 1: Allan Chamberlain measuring fork length of the Juvenile Coho Salmon, November 20th, 2021

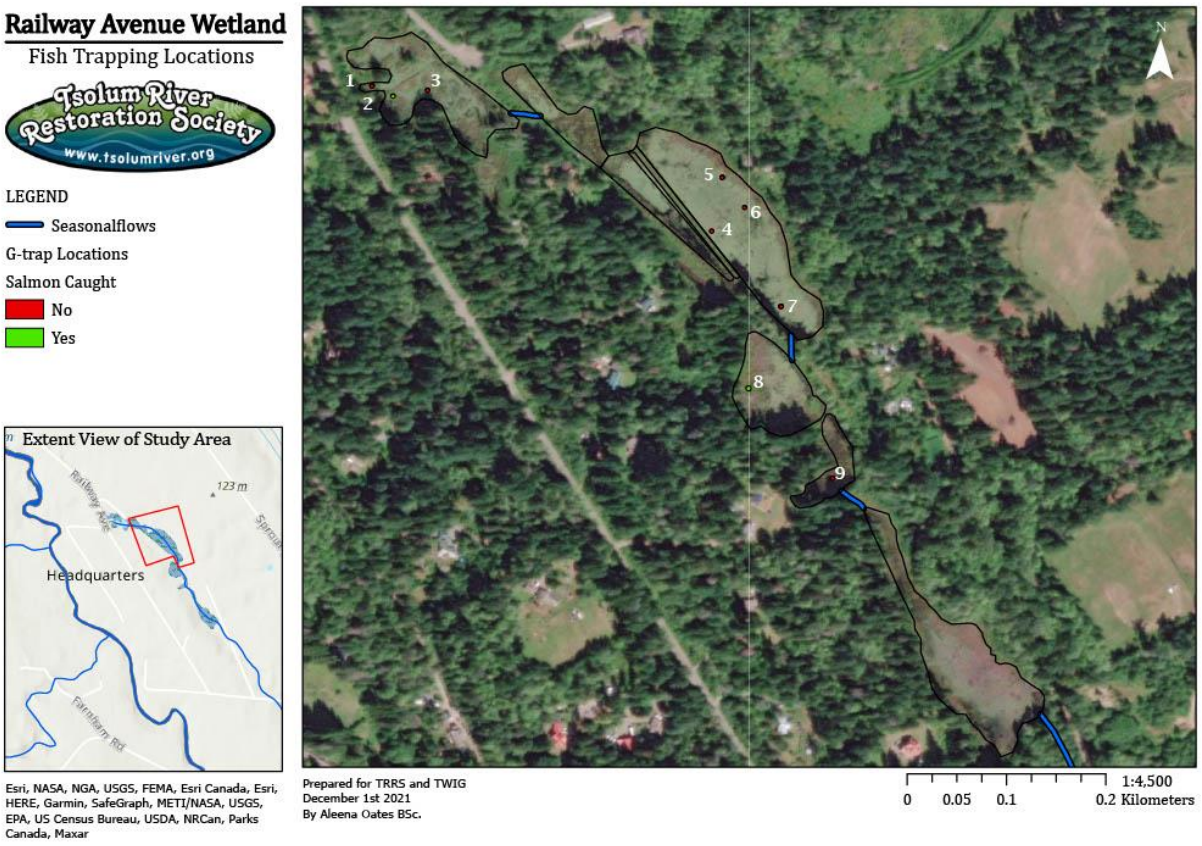

Figure 2: Fish Trapping Locations

Results:

Air temperature on November 19th and 20th are 5 degrees and 6 degrees, respectively. Below, Table 1 includes Coho salmonid trappings, Table 2 includes other fish and amphibian trappings and Table 3 includes the legend of acronyms used in Table 1 and Table 2.

Table 1: Salmonid Trap Catches in Railway Wetlands November 19 - 20, 2021

Site Number	Fish Species	Fork Length (mm)	Conditions	Depth (metre)	Type of Trap
2	3 JCS	78, 72, 77	ISV, silt	0.3	Minnow trap
8	3 JCS	109, 97, 107	OV, gravel	0.6	Clover trap

*1 JCS from site 8 had indication of blackspot

Table 2: Fish and Amphibian Trap Catches, Railway Ave. November 19 – 20, 2021

Site Number	Fish Species	Conditions	Depth
2	4 TST	ISV, silt	0.3
4	11 TST	ISV, silt	0.7
5	4 TST, 1 NWS	OV, silt	0.4
6	5 TST, 1 NWS	OV ISV, silt	0.3
8	18 TST	OV, gravel	0.6
9	27 TST	OV, silt	1.0

*Sites 1, 3, and 7 had no species observations

Table 3: Acronym Legend for Table 1 & Table 2

Acronym Legend			
Habitat Conditions for Traps		Fish and Amphibian Species	
ISV	Instream Vegetation	JCS	Juvenile Coho Salmon
OV	Overhead Vegetation	SB	Threespine Stickleback
		NWS	Northwest Salamander

Discussion:

The presence of juvenile Coho salmon (*Oncorhynchus kisutch*), Threespine Stickleback (*Gasterosteus aculeatus*) and Northwestern Salamanders (*Ambystoma gracile*), show that the Railway Avenue wetlands are an important wildlife habitat. Finding young Coho show that these waterbodies serve as important overwintering habitat for juveniles during higher water periods on the Tsolum River.

Under the provincial regulations, the Railway Avenue wetlands are defined as fish habitat as the Water Act and Fish Act state: any watercourse/stream and its riparian area are considered fish habitat if the waterbody/stream "directly or indirectly… [carries] out fish life processes, spawning grounds and the nursery, rearing, food supply and migration areas" (Ministry of Environment Water Stewardship Division, 2009).

Section 35(1) of the Fisheries Act also states that "no person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat" without the authorization from the DFO as well as an approval or notification from the Water Act (MEWSD, 2009). The prohibition of any added deleterious substance to the waterbody/stream that would degrade or alter the water quality or fish and fish habitat is also of importance in the Fisheries Act as seen in Section 36(3).

These Acts also state that it is the responsibility of the person completing the work (most likely the landowner) to determine if there is a presence of fish within the waterbody/stream and to use the provincial resource of Habitat Wizard (Habitat Wizard, n.d.). However, there are no salmonid fish observations on this map for the Railway Avenue wetlands or adjacent wetlands in the area. Meaning that private property owners in the area might assume that there is no presence of salmonids or fish within these waterbodies. Hopefully, with the use of the TRRS and TWIG, the presence of rearing salmonids will be known by landowners in the area and the no harmful alternation, disruption or destruction will occur to this wetland.

The Government of Canada has set some rational measures to follow and adhere to within the Water Act and Fisheries Act regulations, as well as local contact information to report a problem or concern in contradiction to the Water Act and Fisheries Act (Projects Near Water, n.d.): Measures to protect fish and fish habitat (dfo-mpo.gc.ca)

Courtenay (Puntledge River fish hatchery)

Contact information

38 Powerhouse Rd
P.O. Box 3111
Courtenay BC V9N 5N3

Telephone: 250-703-0907
Fax: 250-703-0905

Service hours

Monday to Friday: 8 am to 3 pm
Saturday and Sunday: 8 am to 3 pm
Holidays: 8 am to 3 pm

Services available

Take a self-guided tour or book a guided tour by calling.

Visiting hours of the fish hatchery may differ from service hours.

Campbell River (Fishing areas - 13, Region 1)

Contact information

315-940 Alder St
Campbell River BC V9W 2P8

Telephone: 250-850-5701
Fax: 250-286-5852

Service hours

Monday to Friday: 8 am to 4 pm
Saturday and Sunday: Closed
Holidays: Closed

Services available

- Fishery openings and closures
- Report a fisheries violation
- Shellfish harvesting closures

Campbell River (Quinsam River fish hatchery)

Contact information

4217 Argonaut Rd
Campbell River BC V9H 1P3

Telephone: 250-287-9564
Fax: 250-286-0261

Service hours

Monday to Friday: 8 am to 3:30 pm
Saturday and Sunday:
8 am to 3:30 pm
Holidays: Call ahead

Services available

Take a self-guided tour or book a guided tour by calling.

Visiting hours of the fish hatchery may differ from service hours.

References

Contact Fisheries and Oceans. (n.d.). Retrieved December 19, 2021, from https://www.dfo-mpo.gc.ca/contact/index-eng.htm

HabitatWizard - Province of British Columbia. (n.d.). Retrieved December 19, 2021, from https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/ecosystems/habitatwizard

One Spot Trail | Comox Valley Hikes & Walks | Comox Valley Guide. (n.d.). Retrieved December 19, 2021, from https://www.comoxvalleyguide.com/recreation/hiking/one-spot-trail/

Measures to protect fish and fish habitat. (n.d.). Retrieved December 19, 2021, from https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html

Ministry of Environment Water Stewardship Division (2009) A Users' Guide To Working In And Around Water Understanding The Regulation Under British Columbia's Water Act. From https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/working_around_water.pdf

Nickelson, T. E., Rodgers, J. D., Johnson, S. L., & Solazzi, M. F. (2011). Seasonal Changes in Habitat Use by Juvenile Coho Salmon (Oncorhynchus kisutch) in Oregon Coastal Streams. *Https://Doi.Org/10.1139/F92-088*, *49*(4), 783–789. https://doi.org/10.1139/F92-088

Projects near water. (n.d.). Retrieved December 19, 2021, from https://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html