Revelstoke Turtle Nesting Site Restoration Trial and Basking Log Habitat Development (COL-F17-W-1288)

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EXECUTIVE SUMMARY

The Western Painted Turtle (WPT) is federally recognized as a species of Special Concern and is blue-listed in the province of British Columbia (BC). The primary threats to the survival are loss or alteration of wetland habitat, and mortalities due to anthropogenic disturbances such as road development. In BC, the WPT is the only native turtle pond species. The Revelstoke area supports a sub-population of the WPT, Intermountain-Rocky Mountain Population (*Chrysemys picta bellii)*, which is near the most northerly extent of its North America range

In 2016 and 2017, the Okanagan Nation Alliance (ONA) worked in collaboration with the BC Ministry of Forests, Lands and Natural Resource Operations and Rural Development, local industries, and private volunteers to enhance WPT habitat around the Revelstoke area. The area provides excellent overwintering and feeding wetland habitats, but nesting and basking opportunities are either limited or degraded.

There were two main objectives as part of this habitat enhancement project:

1. Restore suitable nesting habitat conditions at the Red Devil Hill nesting site, the most important turtle nesting sites in the area around Revelstoke; and,
2. Create additional basking log habitat opportunities in the area by deploying and anchoring floating cedar logs in the Revelstoke Airport Marsh.

Prior to starting the nesting habitat enhancement trials at Red Devil Hill, ONA staff contacted the City of Revelstoke, the Revelstoke Airport Authority, and the North Columbia Environmental Society to advise of the project details. One of the tasks proposed included installing a pre-nesting spring exclusion fence on a portion of the Red Devil Hill. This would allow for in-situ hatchlings to exit the exclosure, but prevent nesting females from entering. The area excluded by the fence would then become the location to conduct nesting habitat modification trials such as replacing the top 30 cm of nesting material with new material, removing trees or tree limbs to allow for greater thermal exposure, and to construct a series of low-slope nesting locations on the steep bank. It was anticipated that these habitat improvements would create additional nesting terrain lost due to earlier roadway expansion, improve egg hatchling success with the addition of improved nesting material and the removal of vegetative roots, and increase nest site thermal exposure. After discussions with the city of Revelstoke representatives, it was decided that the majority of the Red Devil Hill nesting habitat enhancements would not be completed due to roadway slope stability concerns.

Other potential nesting habitat enhancement sites have been identified in the Revelstoke area. These sites are located at the base of the slope of Red Devil Hill, on the upper shoreline in front of the Airplane Club lease lands, and along upper the shoreline in front of the Forestry Fire Base centre. Several of the nesting sites, including the two near the Airplane Club and Fire base, were already identified through the BC Hydro Water Use Planning studies and are greater than 440.1 m above sea level, the normal max elevation for Arrow Lakes. The focus of any nesting habitat creation or enhancement should be targeted at elevations greater than 440.31 m above sea level, which also takes into account a BCH reservoir surcharge of 30 cm that can be applied to Arrow Lakes.

The lack of adequate turtle basking log and woody debris habitat in the Airport Marsh was previously identified as a habitat deficiency. In February 2016, nine basking logs were deployed onto the ice at Airport Marsh by use of a snow machine. These log deployments created additional basking habitat for use by the turtles for thermoregulation, while maintaining rapid access to the safety of the water for escape.

In November 2017, while conducting other project work in the Revelstoke area, ONA staff conducted visual surveys of the basking logs deployed the prior year in Airport Marsh under this FWCP program. The surveys confirmed that the basking logs had remained in place, and that they were being used by WPT as well as other wildlife species such as waterfowl, great blue heron, muskrat, and river otter.

Key recommendations include:

- Continue to engage with the city of Revelstoke on the stability status of Red Devil Hill. Look for opportunities for nesting habitat enhancements at this site that will not add risk to the stability of the slope, such as tree branch trimming to increase site thermal exposure, manual removal of smaller vegetation such as grasses, and removal of invasive species such as knapweed;
- Look at enhancement opportunities of other WPT nesting sites outside of the slope and roadway area at the Red Devil Hill location. This can include areas such as the base of the slope of Red Devil Hill, along the upper shoreline in front of the Airplane Club bunk house, and along the upper shoreline in front of the fire station. Ensure all nest site developments or enhancements are at elevations of greater than 440.31 m above seal level to eliminate the risk of inundation;
- Look at monitoring nesting success to fill data gaps regarding yearly recruitment levels. This will help determine risks to the overall WPT Revelstoke population at the recruit or juvenile stage;
- Consult with local government biologists to look for other locations in the Revelstoke area that could benefit from basking log habitat enhancements. Areas such as Williamson Lake, Montana Slough, and Cartier Bay should be assessed.
- Conduct studies that monitor basking log use and activities by WPT turtle, and other wildlife species. This would include determining key characteristics of that use such as species present, life stage, time of day, time of year, log location preferences, and activities conducted on the logs.

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Disclaimer

The participation of the *Syilx* (Okanagan) Nation in this study is without prejudice to the Indigenous rights of the *Syilx* (Okanagan) Nation. The information contained in this study is based on research by the Okanagan Nation Alliance (ONA), as well as published works and archival research, all of which was limited by available time and resources.

The information contained herein does not, and should not be used to define, limit, or otherwise constrain the Indigenous title, rights, or interests of *Syilx* (Okanagan) Nation and its member communities or other Indigenous peoples.

INTRODUCTION

The Western Painted Turtle (WPT) is federally recognized as a species of Special Concern (COSEWIC 2016) and is blue-listed in the province of BC. The primary threats to the survival are loss or alteration of wetland habitat, and mortalities due to anthropogenic disturbances such as road development (ECCC 2017). In British Columbia, the WPT is the only native turtle pond species. A population of Intermountain-Rocky Mountain WPT (*Chrysemys pieta bellii*) is supported near Revelstoke, BC, near the most northerly extent of the species' range.

The Airport Marsh, 5 km south of Revelstoke, was created as the borrow pits that were excavated for material to build up the airport lands filled back in with water. Natural regeneration into a productive wetland complex soon followed. The marsh, and surrounding area, provides excellent year-round habitat for all the life history requirements of the WPT: feeding, breeding, nesting, and over-wintering. The area also provides aquatic and riparian habitat that supports other wildlife species such as songbirds, raptors, waterfowl, and mammals such as river otter and muskrat.

In 2016 and 2017, the Okanagan Nation Alliance (ONA) worked in collaboration with the BC Ministry of Forests, Lands and Natural Resource Operations and Rural Development (MFLNRORD), and local industry, and private volunteers to enhance the turtle habitat in and around Airport Marsh. There were two main objectives as part of this habitat enhancement project:

1. Restore suitable nesting habitat conditions at the Red Devil Hill nesting site, the most important turtle nesting sites in the area around Revelstoke (Maltby, 2000); and,
2. Create additional basking log habitat opportunities in the area by deploying and anchoring floating cedar logs in the Revelstoke Airport Marsh.

WPT is identified as a "Focal" species by the Fish and Wildlife Compensation Program (FWCP). This project supports FWCP's Species of Interest Action Plan, Habitat-based Restoration action. This report presents the results of the ONA Revelstoke Western Painted Turtle nesting and basking log habitat enhancement project.

SPECIES INFORMATION

WPT is the most widespread native freshwater turtle in North America. In BC, the WPT sub-population (*Chrysemys picta bellii*) is limited to the southern region of the province (Figure 1).

The WPT subspecies located in the Revelstoke area grow larger than its south eastern counterparts, with a maximum length of 27 cm. WPT shells are oval, olive to black in colour, with grooves where the shell scutes abut. WPT has short paddle like-legs used for swimming and digging nests in typically soft, sandy soils (Ernst and Lovich 2009). WPT has claws on its front and back legs to aid climbing onto basking logs or up embankments to nesting areas.

WPT are opportunistic omnivores that feed and scavenge on a variety of food sources that include insects, frogs, tadpoles, algae, aquatic plants, and other dead animal matter. They require basking sites that will allow for body thermoregulation during their active periods, and sites that are situated in areas where the turtles are safe from predators.

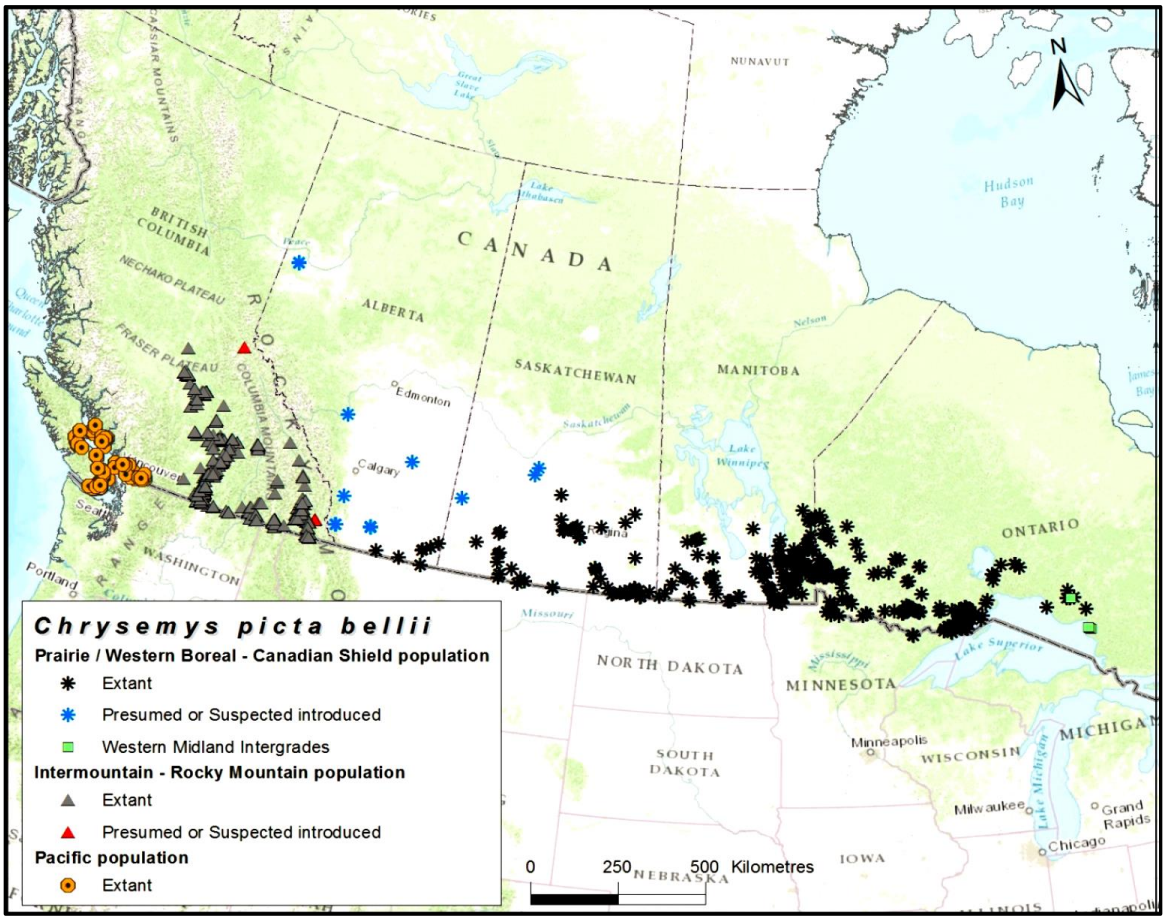

Figure 1. Painted Turtle (C. p. bellii subspecies) distribution in Canada (COSEWIC 2016)

PURPOSE AND OBJECTIVE

The purpose of this project was to enhance nesting habitat quality at the Red Devil Hill site, and to provide additional basking log habitat within the Airport Marsh wetland. The Revelstoke Airport Marsh and surrounding area provide important year-round habitat for the WPT, including excellent overwintering and feeding habitats. However, turtle nesting and basking opportunities are either limited or degraded. By enhancing the quality and quantity of basking and nesting habitat, the project would ensure that all WPT life requisites are available to support this sub-population.

Nesting Site Habitat Enhancement

The first objective of this project was to restore Western Painted Turtle nesting habitat at Red Devil Hill. The Red Devil Hill nesting site has been identified as the most important nesting habitat in the Revelstoke area (Maltby 2000). The site viability is impacted by on-going disturbances such as road construction, winter roadway sanding, vegetation encroachment, and increased human presence (Maltby, pers. comm.). Natural impacts, such as vegetation encroachment from invasive plant species (i.e. spotted knapweed)

have been found to cause direct mortality to Western Painted Turtles by growing in and around eggs and hatchlings in the nest (ECCC 2017).

Basking Log Habitat Enhancement

The second objective of the project was to provide additional basking habitat opportunities in Airport Marsh by deploying and anchoring floating cedar logs. Some shoreline basking opportunities do exist in the area, however, shoreline basking adds additional risk of predation due to easy access to turtles by ravens, coyotes, and domestic animals. An increase in overall basking habitat for Airport Marsh was proposed with the addition of floating logs anchored to the bottom in key aquatic corridor areas. The additional habitat would provide an area for turtle thermoregulation, while maintaining access to the safety of the water for escape.

STUDY AREA

The Red Devil Hill nesting site and Airport Marsh basking log habitat enhancement locations are located in southeastern British Columbia, at the north end of Arrow Lake, and approximately 5 km south of Revelstoke.

The Revelstoke study area is located within the Columbia River watershed, 15 km south of the Revelstoke Dam, at the north end of the Arrow Lakes reservoir. The Rocky, Selkirk, Columbia, and Monashee mountains dominate the physical land features in the area. Terraced benches of fluvial and glaciofluvial deposits, comprised predominantly of sand and gravel, underlay the study area (Kala Geosciences 2010). Due to its mountainous location, the climate of the Revelstoke area is cool and humid, with summer continental (dry) characteristics. Precipitation is produced from the eastern movement of moist, coastal air from the Pacific Ocean which falls predominantly as snow in the winter. Within the study area, these physical and climactic conditions support the presence of the ICHmw3 biogeoclimatic subzone: Interior Cedar Hemlock – moist warm subzone variant (Ketcheson et al. 1991).

Land use development pressure within the study area is increasing due to the demand for accommodations and other amenities to support the local industrial, recreation, and tourism industries (Urban Systems Ltd. 2017). The Red Devil Hill nesting location is located immediately beside (less than 2 m) the main and only access road for all areas south of Revelstoke. These areas include the Revelstoke Airport, Williamson's Lake campground, and other rural residential housing developments. The areas to the north and east of Red Devil Hill are comprised primarily of residential developments. The area to the west of the site is the Airport Marsh. Land use around the Airport Marsh basking log habitat enhancement location is dominated by the Revelstoke Airport, the associated industrial leases tied to the airport, and the airport runway itself. To the east and north of the marsh, the high terraced benches are used and currently being developed for housing. However, the height of the developments above the marsh prevent the developments from directly impacting the riparian areas along the marsh.

Nesting Site Habitat Enhancement

The key nesting habitat at Red Devil Hill is located 5 km south of Revelstoke, on a terraced bench about 60-70 m above the Airport Marsh. It is located on the south shoulder of Airport Way Road, approximately 300 m south of Sheil Road (Figure 2). The main nesting site is 0.05 ha in size, or approximately 130 m long and 4 m wide at its widest point, and is located on the flatter areas along the top of Red Devil Hill, next to the walking trail and the concrete highway barriers (Maltby 2000). There are two primary nesting

sites within the 0.5 ha main nesting area, both have a south or south-west orientations which provides excellent thermal exposure for egg development.

Figure 2. Key WPT Nesting Locations at Red Devil Hill site, along Airport Way Road.

Basking Log Habitat Enhancement

The Airport Marsh wetland complex is 5 km south of Revelstoke and is approximately 130 ha in size. The marsh is physically cut off from the Columbia River by the airport runway. The wetland is a mixture of open water, emergent and submergent vegetation, and is encompassed by a well developed riparian vegetation community. The Airport Marsh wetland complex was created after water filled the borrow pits used to provide fill for development of the airport lands and runway (Figure 3). Water levels can fluctuate up to 2 m, between 438-440 m above sea level (V. Hawkes, pers. com), due to fluctuations in the nearby Arrow Lakes Reservoir and due to groundwater sources (Thompson and Shearing 2017). However, the wetland is physically perched above the reservoir, which limits the marshes overall inundation at peak reservoir levels.

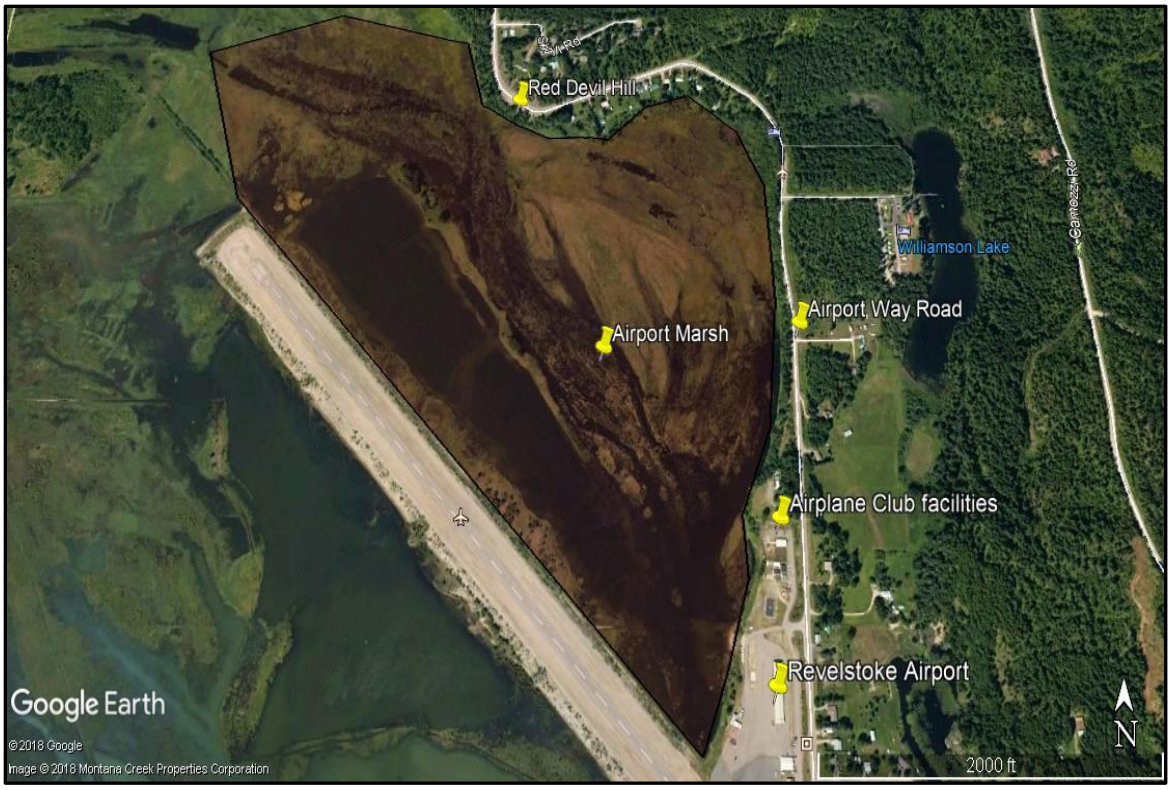

Figure 3. Airport Marsh boundaries, Revelstoke BC.

METHODS

Nesting Site Habitat Enhancement

In the original ONA proposal, nesting habitat enhancement trials were proposed for a portion (30%) of the Red Devil Hill turtle nesting site. The nesting habitat treatments were anticipated to improve egg development, improve hatchling survival success, and create an additional flat nesting terrain lost to earlier road construction.

The fall habitat treatments proposed consisted of trimming adjacent trees to reduce nest-site shading thereby increasing thermal exposure, removing dense vegetation that can impede digging for nest construction, and creating additional low-slope nesting terrain by adding infill material to artificially terraced structures. The majority of nesting activity occurs on the flat areas nearest the roadway, it is anticipated that the terraces will create increased areas of low-slope nesting habitat (0-20% slope), replacing similar sloped nesting habitat lost to earlier road construction. The majority of the slope at Red Devil Hill is in the 65-70% slope range (ONSITE 2017), where limited to no nesting activity has been documented. Relatively dense canopy cover, greatly reducing thermal exposure, may be a major factor for non-use of the higher sloped areas to the west.

On April 2016, as part of consultation for the Red Devil Hill nesting enhancement portion of the project, ONA staff contacted the City of Revelstoke, the Revelstoke Airport Authority, and the North Columbia Environmental Society to advise on the proposed tasks. The city of Revelstoke engineering staff

expressed concerns to ONA that the proposed nesting habitat improvements proposed could create a further risk to the stability of the roadway at Red Devil Hill. On May 2, 2016, ONA staff met with the city's Public Works Department and their Environmental Coordinator in response to the city's concerns and conducted a joint visit to the site. The city expressed their specific concerns which were with any weight being added to the slope by bringing in new material and with any tree or large vegetation being removed. The city did express support for installing the exclusion fencing and conducting minor vegetation removal, as long as no machinery was used and that extensive soil disturbance was not created. In September 2016, ONA hired an engineering consultant to conduct an independent assessment of the road and bank stability at the Red Devil Hill habitat enhancement locations. The engineering report suggested that the habitat enhancements as proposed posed little additional stability risk to the roadway or bank. However, the city of Revelstoke engineers did not agree with the findings and would still not support all the enhancements, especially the tasks of removal and replacement of existing nesting substrate.

On May 5, 2016, in anticipation of some portions of the project enhancement work still proceeding, a 0.06 ha nesting trial site was fenced off at Red Devil Hill. An area of approximately 4 m x 20 m (80 m^2) was fenced with a 1 m tall black nylon-mesh material, which was then secured to rebar posts with zap-straps (Figure 4). The purpose of the fence was to allow in-situ hatchlings to exit, but to prevent nesting females from entering the area to lay more eggs. Vegetation removal treatments were conducted by hand within small areas of the trial site, however, extensive vegetation removal treatments were not conducted.

Periodically, throughout the May 2016 nesting period, ONA staff monitored the exclosure area to confirm the fence was working and that no adults were becoming entrapped in the mesh (Figure 5). They also conducted minor perimeter repairs by back filling any holes created by turtles digging around the base of the exclosure.

By the end of 2017, only installation of the exclusion fencing and some minor vegetation removal had been conducted under the nesting habitat enhancement portion of this project.

Figure 4. Exclusion fencing at Red Devil Hill.

Figure 5. Fence exclosure monitoring for turtle entrapment and digging repairs.

Basking Log Habitat Enhancement

In January 2016, ONA staff reached out to local forestry companies in Revelstoke to secure a source of cedar logs that could be used as basking log habitat. On February 22, 2016, Downie Timber Mill dropped off a load of nine limbless cedar logs, approximately 40 cm in diameter and 5 m long, at the private airplane club location, next to the Revelstoke airport.

On February 23, 2016, ONA field staff used a snow machine and a tow rope to drag the nine basking logs (Figure 6) to pre-determined sites within the frozen marsh. The Revelstoke Airport Authority required that the floating logs be deployed greater than 300 m away from the Revelstoke airport and runway due to the occasional use of the marsh by floatplanes. ONA staff used the 300 m buffer criteria and deployed the logs in areas that had high sun exposure, that were surrounded by deeper water, had have plenty of vegetation cover, and that were close to large patches of cattail and bulrush beds.

Figure 6. View of snow machine and basking logs.

A concrete filled cinder block was attached to the basking logs with airline cable, and the cable was attached to lag bolts embedded in the logs (Figure 7). The cinder blocks was left beside the log to sink to the bottom in the spring when the ice melted and thereby act as an anchor for the logs. The risk of basking logs rolling in open water when turtles climbed on was mitigated by securing two eight-foot 2 x 4 stabilizing arms (donated by Cozek Custom Lumber) to the ends of each log (Figure 7). Due to the risk of winter collisions between recreational snow machines and the basking logs laying on the ice, each log location was marked with bamboo rods spray-painted fluorescent orange. The poles were installed upright next to each end of the basking logs. Final log basking site habitat enhancement structure locations, marked by the codes T1001-1009, are presented in Figure 8.

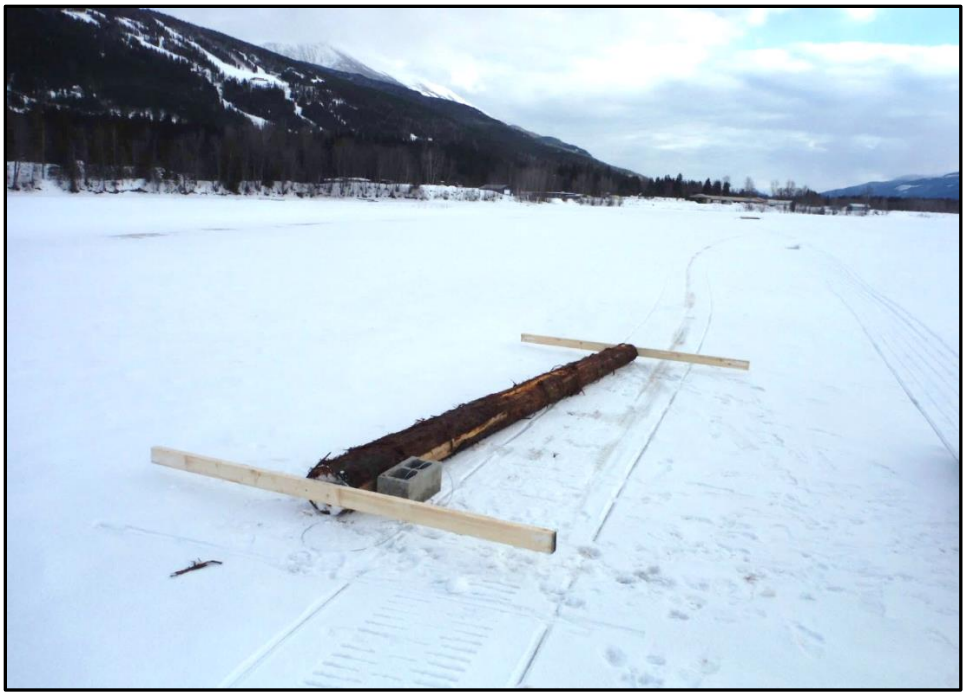

Figure 7. Cinder block anchor and stabilizing arms attached to the basking log.

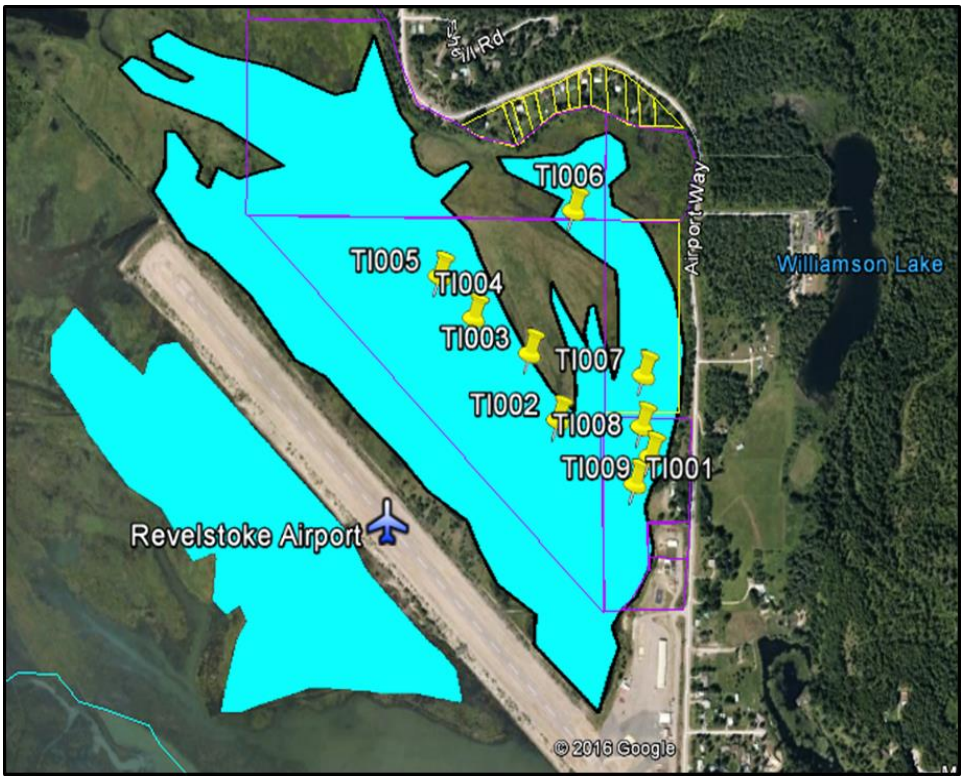

Figure 8. View of Airport Marsh and final basking log anchoring locations.

RESULTS AND DISCUSSION

Nesting Site Habitat Enhancement

As a result of the roadway stability concerns, the city of Revelstoke stated that they would not support any of the major (fall) nesting habitat enhancements proposed at the Red Devil Hill site. The city did say it would support site enhancements such as tree trimming to increase thermal exposure, and weed and small vegetation removal to enhance nest site digging efficiency. However, after the exclusion fence was constructed, no further nesting site habitat enhancements occurred. Monitoring of the exclusion fence indicated that turtles did not get entrained in the mesh, and they were observed to be able to back head and limbs out of the mesh easily.

The Red Devil Hill turtle nesting location is still considered to be the prime nesting site for the Airport Marsh and the surrounding ponds and wetlands. While monitoring the site under another project on May 24, 2018, ONA staff counted a peak of 44 turtles in one evening nesting along a 2 m x 40 m section of the Red Devil Hill site. All observed nesting activity occurred within 3-4 m of the Red Devil Hill roadway barriers, and in areas of relatively low slope (Figure 9). No nesting or attempted nesting was observed on the areas of Red Devil Hill that had slopes greater than 40%, including the extensive areas of the slope that have an incline of 65-70%. Protection and future enhancement of the Red Devil Hill site, that does not contribute to slope instability, should be considered to ensure the long-term survival of this sub-population of WPT. Activities such as small vegetation removal and tree limbing to create greater thermal exposure pose little risk to increasing slope instability. Monitoring of nesting success rates were not part of the project but should also be considered for future monitoring work.

Figure 9. Turtles nesting at Red Devil Hill site, May 24, 2018.

Basking Log Habitat Enhancement

A total of nine basking logs were anchored in Airport Marsh to add habitat complexity for WPT. Both coarse woody debris for hiding cover and adequate basking habitat are lacking. The original proposal identified six basking logs to be installed, however, nine logs were eventually deployed.

Although not part of the project, ONA staff working on other projects in the Revelstoke area conducted follow up visual surveys of the basking logs in Airport Marsh. The surveys were conducted in November 2017 and in May 2018. The surveys confirmed that the logs had remained in place and that they were being used by turtles, as well as other wildlife species such as various waterfowl, great blue heron, and river otter. Information from staff at the Airplane Club (Andrew Raymond, pers. com.) also confirmed that various species of wildlife use the logs throughout the ice-free season. Mr. Raymond identified that the turtles were using the logs anchored further away from the shore, possibly avoiding human activity. They were also observed to be on the basking logs at the same time as waterfowl were using them. Waterfowl were observed using the logs year-round with increased use in the spring. The otters were observed using the logs year-round and are first sighted using them at ice break-up in the spring. They appear to use the logs in the deeper water, further offshore for fishing but spend most of their time on a few logs closer to the east shoreline near to a possible den location (Andrew Raymond, pers. comm.).

RECOMMENDATIONS

Nesting Site Habitat Enhancement

As a result of the concerns expressed by the city of Revelstoke, WPT nesting habitat at Red Devil Hill was not enhanced as had been originally proposed. ONA recommends that discussions with the city of Revelstoke be on-going in order to keep informed about the stability status of the Red Devil Hill site and to encourage nesting enhancement opportunities that will not affect roadway stability; activities such as tree branch trimming to increase site thermal exposure, and manual removal of vegetation such as grasses and invasive species. Monitoring of vegetation in-growth of the nesting site and changes to thermal cover due to tree growth should be continued so that the information can be shared with the city and local environmental stewardship groups.

Nesting habitat is an important life requisite for this endangered species, therefore, it is recommended that additional nesting and habitat areas be created and/or enhanced. Potential areas (Figure 10) outside of the Red Devil Hill terraced bench location include sites at the base of slope of Red Devil Hill, the upper bank in front of the Airplane club lease lands, and the upper bank in front of the Forestry fire base camp.

A further description of those sites is provided below:

- The base of the slope at Red Devil Hill (Figures 10 and 11). This area is currently being used for nesting by a few individuals. The site would require some small tree removal (cottonwoods, less than 6 inch diameter) and require additional nesting material brought in from the road above. The site would provide highly suitable nesting habitat that is also relatively free of human and predator disturbance. This site would act as supplemental nesting as uphill movement to the Red Devil Hill location would not be impeded. The nesting site is set amongst terrestrial vegetation (i.e. cottonwood trees) and is considered above the marsh's high water mark. However, a survey would be required to ensure the site is above the elevation of 440.31 m above sea level so that it would not be inundated by any reservoir high water events.

- The Airplane Club lease land location (Figure 10). In the fall of 2017, this area was cleared of all riparian trees and vegetation for development of a new helicopter pad; the clearing work has created a new potential nesting site below the heli-pad, and within a few meters of the marsh, but above the normal high water mark. Nesting material could be brought in via dump truck.

- At the Forestry Fire Base Camp (Figure 10). The areas between the forestry camp and Airport Marsh. The area is already cleared of trees so this site may only require the addition of suitable nesting material which can be brought in by truck. The area is beside a cottonwood stand and is considered to be above the normal high water mark (Hawkes, pers. com.).

Figure 10. Other potential nesting habitat locations.

Figure 11. Site detail for nesting enhancement locations at base of Red Devil Hill.

Basking Log Habitat Enhancement

Basking logs provide increased habitat opportunities for both turtles and other wildlife species. Additional habitat in the Revelstoke area would greatly diversify the habitat opportunities of the area for the sub-population of the WPT. Other recommended areas for consideration to develop additional basking log habitat opportunities include the following:

- Williamson Lake (Figure 12). This is a 5 ha pond 400 m due east of Airport Marsh. The area has high recreation use: the pond is beside a busy campground; and, it recently was host to a provincial water skiing championship (2017). The pond currently offers little in the way of secure turtle basking habitat opportunities. An ideal and safe location is at the very north end of the pond where, for safety, the logs could be anchored into the bulrush beds, outside of the main lake. A secondary assessment location would be in the south end of the pond.

- Montana Slough and Cartier Bay (Figure 13). These two areas should be assessed for the possibility of basking opportunities as there are WPT documented at those sites. Reservoir elevational changes will pose the greatest risk to the anchoring stability of the logs over time.

- Although not tested under this program, ONA recommends testing two techniques for helping turtles climb onto floating basking logs: use a chain saw to cut grooves parallel with the log length to help turtles grip while climbing; and, taper the ends of the logs to create a ramp for easier egress. Cutting basking logs in half to help egress was trialed by the Habitat Acquisition Trust (www.hat.bc.ca) but was discontinued as the cut logs were quick to become water-logged.

- Conduct studies that monitor basking log use and activities by WPT turtle, and other wildlife species. This would include determining key characteristics of that use such as species present, life stage, time of day, time of year, log location preferences, and activities conducted on the logs.

Figure 12. Williamson Lake potential habitat enhancement locations.

Figure 13. Montana Slough and Cartier Bay potential habitat enhancement locations.

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