Sparwood Beaver Wetland
Site Report and Health Assessment

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SPARWOOD

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Background

Wetlands are areas where soils are water-saturated for a sufficient length of time such that excess water and resulting low soil oxygen levels are principal determinants of vegetation and soil development (MacKenzine 2004). The water-logged environment in wetlands supports unique plants called hydrophytes and associated animals that are adapted to these living conditions.

Wetland and riparian areas in the Upper Kootenay region and Elk Valley have experienced impacts from intensive land development, agricultural and grazing practices, forestry, mining, water and recreational use (UKEEP 2014). In the District of Sparwood, impacts to wetlands include loss and degradation of wetland and riparian areas due to changes in flood regimes and habitat connectivity and subsequent loss of vegetation (UKEEP 2014). Loss of wetland and riparian habitat connectivity due to stream crossing structures can inhibit or completely block fish, amphibian and reptile passage (UKEEP 2014). In addition, biological invasions of species, present threats to native species abundance, diversity and genetic integrity (UKEEP 2014). The impact of climate change on riparian/wetland ecosystems in the Plan area has not been characterized but expectations are that related changes in temperature and water flow will severely impact habitats and the species that depend on them (UKEEP 2014).

The above noted impacts in the UKEEP (2014) are present in Sparwood. Fortunately, there is a history of wetland stewardship at the site of the Sparwood wetland, also referred to locally as the 'Jewel', a name expressed by a consultant describing the beauty and value of the area at a council meeting in the 1990s (Pers. Con. G. Walker). In 2005 the Sparwood Environmental Club, under the leadership of teacher Sandy Bruderlein, hosted a BCWF Wetlandkeeper course after school hours, which resulted in a site inventory and student stewardship activities. Inspired by learning and hands-on activities during the course, students coordinated a site clean up of party sites, hauling away a huge truckload of trash.

Between 2009-2010, the District of Sparwood constructed the 'Sparwood Heritage Wetland' to passively treat stormwater runoff in an area cleared for a firebreak in the summer of 2009. Coniferous trees, some infected with mountain pine beetle, were push logged because they were considered a fire hazard. Located approximately 300 metres west of the Sparwood Leisure Centre, a wetland was constructed under the direct supervision of Gary Walker, former Community Services Director for the District of Sparwood. Utilizing a piece of recycled membrane from a District roof replacement project, a hole was dug, liner installed to prevent water seeping into the former river gravels, thus forming a small wetland. Inflow of water to the wetland is from diverting two inflow channels of stormwater off nearby Pine Avenue.

In October 2010, BCWF hosted a Wetlandkeeper Course funded by the Columbia Basin Trust, to assess the wetland and enhance the habitat around the constructed Sparwood Heritage Wetland site. After completing the mapping, plant and animal inventory and site health assessment, several participants planted native plants to enhance the emergent vegetation zone and riparian area. In total, participants planted lenticular sedge (50), beaked sedge (100), coyote willow (24), prickly rose (5), paper birch (11), and Englemann spruce (10) (Walker 2010).

In 2016, the Elk River Watershed Alliance secured funding under their Wonder of Wetlands Program (WOW) called "*Enriched Wetlands Increase Community Enjoyment*" from grants with Environment and Climate Change Canada's 'National Wetland Conservation Fund', RDEK Community Initiatives through the Columbia Basin Trust, as well as donations from the District of Sparwood, Sparwood Futures Society, and Sparwood Thrift Store Society. Other partners in this project, providing in-kind volunteer labour, have included the Sparwood Fish and Wildlife Association, Wildsight-Elk Valley Branch, and Mary Louise Poltzin PhD and RPBio with VAST Resource Solutions.

Study Area Description

The Sparwood Beaver Wetland is located at the western edge of Sparwood, B.C. in southeastern BC, a community just west of the Alberta/BC border (49.738467°, -114.897294°). This small wetland (approximately 4.71 ha in total area) is sandwiched east of the Canadian Pacific Railway Southern BC line, south of the confluence of Michel Creek and east of the Elk River. The wetland is located on District of Sparwood municipal land zoned *Parks and Recreation.* This wetland is transitional land between aquatic habitat of the Elk River, the Elk River floodplain, and the terrestrial upland ecosystems, which is a developed urban residential. The railway is a liner disturbance interrupting this natural transition and is a feature that poses risk to wildlife crossing.

Figure 1: Site location of Sparwood Beaver Wetland and zones for wetland enhancement and weed removal.

Methods

The site assessment used the British Columbia Wildlife Federation (BCWF) Wetlandkeeper protocols to gather preliminary information about the wetland (Southam and Curran, 1996). BCWF Wetlandkeeper Instructor Lee-Anne Walker, MA Environment and Management (who is also the ERA Executive Director) along with Marsha Clarke ERA Program Coordinator Restoration and Stewardship, hosted three-3 hour 'Wild About Wetland Workshops' August 3, 10 and 17.

The format of the modified modules began with a short lecture in a classroom provided by the District of Sparwood in the Curling Club Lounge, followed by hands-on inventory, ground truthing and health assessment out in the site. Select modules included: introduction to the BCWF Wetlandkeepers program, define and classify wetlands, use of maps and global information systems to understand formation of and impacts to the wetland, wetland hydrology and soils, plant and animal inventory and stewardship action required to improve the function and health of the wetland.

In the fall of 2016, ERA contractors conducted more rigorous health assessment using Alberta Cows and Fish Habitat Management (Cows and Fish) protocol for "Lotic Wetland Health Assessment for Streams and Small Rivers". It was determined from the Wetlandkeepers and Cows and Fish preliminary health assessment that an Integrated Pest Management (IPM) plan be developed to eradicate invasive plant species, most importantly the reed canary grass (RCG). Mary-Louise Polzin PhD/RP Biologist with VAST Resource Solutions, who was also the contractor who had built a small wetland in the Sparwood Mountain View trailer park in 2016, reviewed and signed the IPM plan written by the ERA contractors (Appendix A).

Four interpretive signs were written, designed and installed by the Elk River Alliance using the theme of healthy ecosystems increase community health and well-being by comparing human health with ecological health assessment. Grade 4 students from Frank J. Mitchell Elementary School contributed artwork and quotes to the interpretive signs highlighting their experiences at the wetland as part of the Know your Watershed mentorship program. Grade 8 students from Sparwood Secondary School through the Wildsight Know Your Watershed program and ERA, mentored the Grade 4's increasing their understanding of the wetland and its role in the watershed.

Two community educators from the East Kootenay Invasive Species Council (EKISC) presented information about noxious weeds. Along with ERA and Wildsight, the two EKISC contractors worked along side of both grades on a stewardship day at the wetland to pull noxious weeds, plant native vegetation and conduct a benthic invertebrate survey.

ERA contractors, along with volunteers from Sparwood and Fernie carried out the IPM plan in two zones treating the RCG using two methods in July 2017. The first method was occlusion or cutting down and removing the plant and covering it up with a tarp to kill the RCG. In two years the tarp will be removed and native plants reestablished on site. The second method removed the RCG, planted native shrubs to increase the density of native shrubs, covered the ground with landscape fabric and landscape mulch. This second method is intended to shade the understory over time allowing native vegetation to out compete the RCG.

Along the Elk River Trail, ERA installed four interpretive signs to educate the community about the form and function of the watershed, floodplain, riparian and wetlands areas and help them make the connection with their health benefits. LA Walker, who is also a Wild Schools facilitator, is working with Frank J. Mitchell Elementary School to use this site as an outdoor classroom for students over 2017-2019.

Results and Discussion

Hydrology

The Sparwood Beaver Wetland is located in the floodplain of the Elk River along a former stream channel that was dammed up by beaver. The beavers have long since left the wetland for undetermined reasons. The site can flood for a short time during the spring freshet flooding into the adjacent riparian area adjacent, as experienced during this project in June 2017. Flooding in this wetland is not typically from overblowing banks of the Elk River or Michel Creek but rather from rising watertable as water moves through floodplain river gravels.

It is possible that the construction of the pedestrian bridge to the Sparwood Heights, and the raising of the land for access to the bridge, may have isolated surface flow into the channel directing flow into this wetland. Fortunately, there is a culvert under the trail. Flow to the Sparwood Beaver Wetland should be monitored over the long term to ensure adequate water flow and groundwater recharge maintains an appropriate water level in the wetland.

Water quality

This wetland is associated with a fluvial system of flowing water and is subject to flooding, erosion and sedimentation. Water is slightly alkaline and stagnant to very gradual moving water.

On August 10th participants from the *Wild about Wetlands Workshops* conducted three water quality tests: chemical, physical and biological. Chemical water quality tests showed a pH of 8.3, slightly alkaline, which is in keeping with the pH of other ERA water bodies sampled, due to limestone eroded sediments. Dissolved oxygen was 7 ppm with % saturation of dissolved oxygen 98% saturation. From a physical water quality perspective, temperature was 15C and water appearance had no unusual colour or smell. In the benthic invertebrate survey, the species sensitive to pollution (i.e. those that require good water quality in order to survive) identified included mayflies and caddisflies. Species less sensitive to pollution identified were dragonflies, damselflies, beetles and scuds. Tolerant to pollutions species identified were midges, aquatic worms and snails. ERA contractors took additional water quality tests on October 13, 2016 and noted a temperature of 11.5 C and pH 7.86.

The Sparwood Beaver Wetland water quality is in good condition and the biodiversity of the aquatic invertebrates indicates a good cross section of predator and prey organisms.

Wetland Classification

This site is in the freshwater reaches of the Elk River, which keeps the site wet due to a high water table. The wetland is dominated with mineral soils and emergent grass-like species.

The Sparwood Beaver Wetland is classified a marsh. According to MacKenzie and Moran (2004) a marsh wetland is a shallow, seasonally flooded, mineral, and non-tidal wetland dominated by emergent grass-like vegetation. The water table fluctuates dropping through the growing season and can be quite dry in the late season. The substrate is mineral, but may have an organic layer from well-decomposed marsh emergent plants. Nutrient availability is high due to near neutral pH, water movement and aeration of the substrate.

In the riparian or transition zone around the wetland, shrubs emerge to mineral wetland dominated deciduous black cottonwood trees. Beaver ponds associated with a river are part of the lotic wetland.

According to the Lotic Wetland Health Assessment for Streams and Small Rivers (2017 User Manual and Survey), lotic wetlands are associated with rivers, streams and drainage ways and are contained in a channel in a floodplain. The channel where the Sparwood Beaver Wetland is situated is a conduit that carries flowing water southwest toward the Elk River.

Vegetation Inventory

Vegetation is a measure of biodiversity, and in general, the higher the biodiversity the healthier the ecosystem. Wetland plants are hydrophytes or tolerant of water. Many wetland plants have special air or pore spaces in their roots and stems through that oxygen can enter the plant and be transported to its roots.

A diversity of plants establish in various wetland zones, each with unique characteristics for survival. These zones are: submerged, floating, emergent, and riparian.

Submerged plants have air spaces within their tissues that keep a plant buoyant to maximize sunlight. There is no strength tissue allowing the plant flexibility to move in changes of water level. Submerged leaves are often highly divided to minimize water resistance and potential damage to the leaves.

Floating plants have stomata on the upper side of the leaf only and gasses are carried to the roots below. Waxy upper surface repels the water and keeps the stomata clear. Plant hairs trap air to keep it floating and to reduce evaporation of water. Floating plants are tough to withstand water and air movement.

Emergent plants prefer seasonally saturated soils and generally have dense rhizomes and like to grow tall so that they are never completely submerged during

flooding. Stems have tough internal fibers to hold up the shoots and narrow leaves offer little resistance to fluctuating water or high winds making them less likely to be damaged.

Herbaceous plants adjacent to the wetland in the drier riparian are the largest group of wetland plants. These include forbs, which are broad-leaved and non-woody plants that completely die back in the fall. Grass (jointed with hollow stems), rush (round with spongy hollow stems), and sedges (with triangular sharp edges) are the most common plants along marsh wetlands.

Away from the water in the drier upland, plants transition to woody species like shrubs. Shrubs are plants with many woody stems from a single base, differing from trees, woody plants with one main stem.

The Sparwood Beaver Wetland is located in the Southern Interior Mountains Ecoprovince, in the valley bottom of the Montane Spruce dry cool (MSdk) biogeoclimatic zone.

Based on the *Wetlands of British Columbia: a guide to identification* (MacKenzie) this wetland is specifically located in the wetland realm, site class marsh, with environmental features of mineral soils with protracted shallow flooding, graminoid or forb cover with emergent sedges, grass and forb species. Adjacent to the wetland is the riparian flood zone with benches above normal waterflow resulting in coniferous forests of upland species like Englemann spruce and lodgepole pine and mid-bench sites flooded less than 21 days dominated by flood-tolerant deciduous trees and shrubs.

Table 1: Inventory of vegetation found on-site in the Sparwood Beaver Wetland

Common name	Latin name	Wildlife use potential
Trees		
Black cottonwood	*Populus balsimifera ssp. trichocarpa*	Good browse value
Englemann spruce	*Picea engelmannii*	
Lodgepole pine	*Pinus contorta var. latifolia*	
Trembling aspen	*Populus tremuloides*	Good browse value
Shrubs		
Buffalo berry	*Shepherdia canadensis*	Fair browse value
Common juniper	*Juniperus communis*	
Red-osier dogwood	*Cornus stolonifera*	Excellent browse value
Saskatoon	*Amelanchier alnifolia*	Excellent browse value
Snowberry	*Symphoricarpos albus*	Fair browse value
Twinberry	*Lonicera involucrate*	
Wild rose	*Rosa woodsii*	Good browse value
Willow	*Salix spp.*	Excellent browse value
Wolf willow	*Elaeagnus commutata*	Poor browse value
Forbs		
American vetch	*Vicia americana*	
Canada Goldenrod	*Solidago canadensis*	
Canada thistle	*Cirsium arvense*	Invasive weed species
Common toadflax	*Lineria genistifolia*	Noxious weed
Douglas water-hemlock	*Cicuta douglasii*	Poisonous
Field mint	*Mentha arvensis*	
Great burdock	*Arctium lappa*	Noxious weed
Mullein	*Verbascum thapsus*	
Narrow-leaved hawkweed	*Hieracium umbellatum*	
Oxeye daisy	*Leucanthemum vulgare*	Invasive weed species
Palmate coltsfoot	*Petasites frigidus var. palmatus*	
Perennial sow-thistle	*Sonchus arvensis*	
Showy aster	*Aster conspicuus*	
Spotted knapweed	*Centaurea maculosa*	Noxious weed
Star-flowered solomon seal	*Smilacina stellata*	

White sweet clover	*Melilotus alba*	
Wild strawberry	*Frageria virginiana*	
Yarrow	*Achillea millefolium*	
Grass		
Bluejoint	*Calamagrostis Canadensis*	Very aggressive colonizer after disturbances
Canada bluegrass		
Redgrass	*Agrostis gigantea*	Widespread turfgrass
Reed canary grass	*Phalaris arundinacea*	Invasive weed species
Smooth brome	*Bromus inermis*	Well established in disturbed sites and is an important component of haycrops
Timothy grass	*Phleum pratense*	
Rush		
Drummond's rush	*Juncus drummondi*	
Sedge		
Carex spp.		
Green Sedge	*Carex viridula*	
Small-flowered bullrush	*Scirpus microcarpus*	
Aquatic emergent		
Coon's tail	*Ceratophyllum demersum*	
Yellow water buttercup	*Ranunculus flabellaris*	
Aquatic submergent		
Mare's tail	*Hippuris vulgaris*	
Water milfoil	*Myriophyllum spicatum*	

Animal Inventory

Marshes are the most heavily used wetlands due to their high productivity and adjacency to open water (MacKenzie 2004). In general, wetlands have variable wildlife values that are associated with some basic features that may influence a wetlands wildlife habitat value. These include:

1. Presence of water – obvious for aquatic invertebrates, fish and amphibians, water is important for drinking water.
2. Structural diversity and cover by providing nesting cover and foraging habitat.
3. Abundant forage or food.
4. High prey densities like aquatic insects, the food base for larger animals like birds and bats.
5. Unique habitat especially niches used by invertebrates.
6. Rarity in the landscape during drier climatic conditions and areas of urban development.

This animal survey was conducted on August 17, 2016 and was a presence/not-detected analysis. There is bias in this survey due to effort, only observed one season/time of day/weather condition and limited variation in the animal activity observed.

Table 2: Inventory of wildlife species found on-site in the Sparwood Beaver Wetland

Species	Notes
Invertebrates	
Aquatic worms	Tolerant to pollution
Beetles – predacious diving beetle, backswimmer	Less sensitive to pollution
Caddisfly	Sensitive to pollution
Damselfly	Less sensitive to pollution
Dragonfly	Less sensitive to pollution
Mayfly	Sensitive to pollution
Midges	Tolerant to pollution
Scuds	Less sensitive to pollution
Snails	Tolerant to pollution
True fly larvae	Tolerant to pollution
Water mites	Tolerant to pollution
Water strider	Tolerant to pollution
Vertebrates	
Amphibians – Wood frog, Western toad	Observed animals
Reptile – Common garter snake	Observed animals
Bird – Blue jay, American crow, Great blue heron	Observed birds, heard vocalizations, observed feathers
Mammal - red squirrel, deer spp., beaver	Heard chatter in the trees, saw bedding down sites in grass and browsing on shrubs. Sign of beaver was very old (approx. 10 years ago)

Site disturbance around the Sparwood Beaver Wetland consists of rip-rapped section to the east, south east along the Elk River. There is evidence of off road vehicle damage from the past (i.e. deep tire tracks), but fortunately the District of Sparwood now has gates to restrict vehicle access. There has been no active sign of beaver at the wetland for approximately 10 years, indicating they have abandoned the initial dam and lodge on-site.

Wetland Health Assessment

Using the Lotic Wetland Health Assessment for Streams and Small Rivers (2017 user manual and survey) downloaded from Alberta Cows and Fish Habitat Management Society (Cows and Fish), ERA was able to determine the health of the wetland by

defining the vegetative characteristics because plants are more visible than soil or hydrologic characteristics.

Health of a wetland is reflected in the types of plants present, but also their characteristics in stabilizing soil and providing wildlife habitat (Alberta Cows and Fish, 2017). Also the utilization of types of vegetation by animals may indicate the current condition of the wetland and trends toward or away from the potential natural community. Wildlife signs of use (e.g. nests) and browsing were observed.

The health assessment survey used the Cows and Fish Habitat Management protocol for lotic wetlands. It is a method for rapidly addressing what is the site's overall health or condition. An actual score is divided by the possible score and assigned a percentage. The percent rating puts the wetland in a health category: proper functioning condition or healthy (80-100%); functional at risk or healthy but with problems (60-less than 80%) or nonfunctional or unhealthy (less than 60%). The questions and subsequent ratings can then be used to set management priorities for remedial action, determining wise investment of the valuable and limited resources of money, time and effort, to the best use.

Below are the relevant questions for the Sparwood Beaver Wetland asked along with actual and possible scores and the final score/health rating:

Table 3: Results of the health assessment conducted on the Sparwood Beaver Wetland

Question	Score Range	Possible Score	Actual Site Score
1. Vegetative cover of the area?	6 4 2 0 Scored 6 because more than 95% of the reach soil surface is covered by rooted plant material (live or dead)	6	6
2a. Invasive plant species canopy cover	3 2 1 0 Scored 0 because invasive species present with total canopy cover more than 15% of the area	3	0
2b. Density/distribution pattern of invasive plant species	3 2 1 0 Scored 0 because invasive plats present with density/distribution more than a few patches plus several	3	0

	sporadically occurring plants to continuous dense occurence		
3. Disturbance-caused undesirable herbaceous species	3 2 1 0 Scored 0 because more than 50% of the site covered by disturbance-increaser undesirable herbaceous species	3	0
4. Preferred tree and shrub establishment and regeneration	6 4 2 0 5-15% of the total canopy cover of preferred trees/shrubs is seedling and saplings	6	4
5a. Use of trees and shrubs are of the preferred browse	3 2 1 0 Moderate or 25-50% of the available second year and old leaders of preferred species are browsed	3	1
5b. Live woody vegetation removal other than browsing	3 2 1 0 None or 0-5% of the live woody vegetation expected on the site is lacking due to cutting	3	3
6. Human alteration of the vegetation (root mass protection)	6 4 2 0 65-85% of the wetland streambank has deep, binding root mass	6	4
7. Human alteration of the physical area	12 8 4 0 5-15% of the area is structurally altered by human activity	12	8
8. Human caused bare ground	6 4 2 0 5-15% of the area is human-caused bare ground	6	4
TOTAL The Sparwood Beaver Wetland health rating = Total		51	30

Actual Score/Total Possible Score X 100%. This puts the wetland at 58% at the high end of health rating of unhealthy and border edge of functional at risk - healthy, but with problems.

Conservation Issues

Marshes are the most heavily used wetland type for most wetland-using wildlife species because they support a large standing crop of palatable vegetation and aquatic invertebrates – organisms that form a food base for larger animals (MacKenzie 2004). They are most favoured for waterfowl, amphibians and semi-aquatic mammals as they provide good cover, open water and a food source for young animals (MacKenzie 2004).

Invasive plants are a problem for wetlands. As is the case with RCG, the plant was a monoculture mat impairing the movement of benthic invertebrates, amphibians and reptiles to the upland. It had also outcompeted native sedges, rushes and shrubs. See Appendix A for the Integrated Pest Management (IPM) plan for the stewardship action conducted on the site in an attempt to remedy this issue.

Another conservation issue was lack of community awareness and education. Awareness leads to improved education and understanding of why this wetland is important and what community can do collectively to care for this place into the future. This was achieved through: 1) Know Your Watershed Grade 8/Frank J. Mitchell Elementary School Grade 4 mentorship presentations, EKISC weed pull and native planting activity; 2) Three Wild about Wetlands Workshops engaging 35 participants; 3) implementing the IPM plan (Appendix A) using two pilot approaches to eradicate and out compete reed canary grass to improve habitat function with community volunteers; and 4) hundreds of residents and visitors reading the four interpretive signs.

Monitoring Plan

It was difficult to determine a monitoring plan before the site assessment and stewardship priority action was determined. From the site assessment, given the constraints of time, money and community effort, the biggest investment for wetland improvement was on habitat enhancement and connectivity.

The widespread community support at the Wild About Wetland Workshops and the implementation of the IPM prescription, demonstrated widespread interest and dedication to wetland conservation in Sparwood. ERA provided diverse stewardship and volunteer opportunities to Sparwood and Elk Valley youth, families, adults and seniors.

By adding the interpretive signs to the Elk River trail, ERA achieved the benefit of enhanced recreational use and public education of the wetland and adjacent upland areas.

From the involvement with youth from Sparwood Grade 4 and Grade 8 classes, students were able to transition in-class curriculum-based learning to stewardship action increasing their environmental citizenship capacity and empowering youth to make a difference in their community. ERA hopes to engage more youth in ongoing activities in the future.

By eradicating the invasive weeds, and increasing beneficial plant numbers, this will increase wildlife use thus enhancing the landscape aesthetics for community.

ERA will continue to monitor the effectiveness of the IPM. In the short-term, the focus will be on watering the newly planted vegetation and maintaining the exclusion fence until native shrubs and trees are established. The tarping installed to smother and cook the roots of the reed canary grass will require biannual maintenance and eventual removal. When it is time to remove the tarp, native vegetation will need to be planted.

Resources:

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Appendix A

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Reed Canary Grass (RCG)
Integrated Pest Management (IPM)
Sparwood Beaver Wetland

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Introduction

The Beaver Wetland in Sparwood, BC is a small (approximately 0.06 km^2) wetland marsh located at the western edge of Sparwood (49.738467°, -114.897294°) west of the Canadian Pacific Railway line and south of the confluence of Michel Creek east of the Elk River. Reed canary grass has cultivated large sections of the wetland, forming dense monocultures along the shore and is spreading between shrubs further inland (Figure 1).

Reed canary grass (*Phalaris arundinacea* L.*;* RCG) may be considered an invasive grass species that grows rapidly and can severely inhibit the form and function of wetlands (Maurer *et al.*, 2003). RCG is a rhizomatous perennial that is very robust, has thick stems and can grow over 2 meters in height. It is well adapted to wet, inundated soils, and as such is a common invasive grass found in wetlands (Lavergne and Molofsky, 2004).

There are many concerns with RCG in wetlands. RCG outcompetes most native plants and forms tall dense stands that overshadow shorter species, reducing biodiversity (Apfelbaum and Sams, 1987). It has minimal grazing and habitat value, and thus can affect the wildlife populations that inhabit wetlands. RCG can also impair wetland functions and increase the risk of flooding by clogging waterways. (Anderson, 2012)

Because RCG produces large quantities of pollen, has rhizomes that grow under the ground, and can produce shoots from severed nodes, eradicating this invasive species is difficult. There are a number of methods that have been tested on RCG, to varying levels of success, as outlined below.

Figure 1. View from the southern edge of the Sparwood Beaver Wetland looking north at the RCG monoculture along the berm. Photo was taken in the spring.

The purpose of the Elk River Alliance beaver wetland enhancement project is to examine the different methods that have been used to remove RCG from wetlands, and to test the most suitable ones for use in other areas where this is also a concern in the Elk Valley. To this end, two Integrated Pest Management (IMP) plans were developed based on what would be the most likely approach to successfully eradicate the RCG in the Sparwood Beaver Wetland. IPMs are developed to be multifaceted and to maximize the effectiveness of the control methods with minimal environmental, economic and social impacts.

The two IPMs are developed to address the two distinct problem locations: the area near the water, where the RCG has formed a dense monoculture and is growing on a slope up from the water's edge and over the berm, and the area further away from the water where the RCG is competing with shrubs for resources. These two areas will be referred to as Area 1 and Area 2, respectively.

Study Site

The study site for this project is located along the southern end of the wetland marsh, and has a total area of approximately 850 m^2, with approximately 700 m^2 in Area 1 and 150 m^2 in Area 2 (Figure 2). This site is separate from the other RCG problem areas in the Sparwood Beaver Wetland and thus will be used as a pilot project location to assess the success of eradicating RCG using the selected methods.

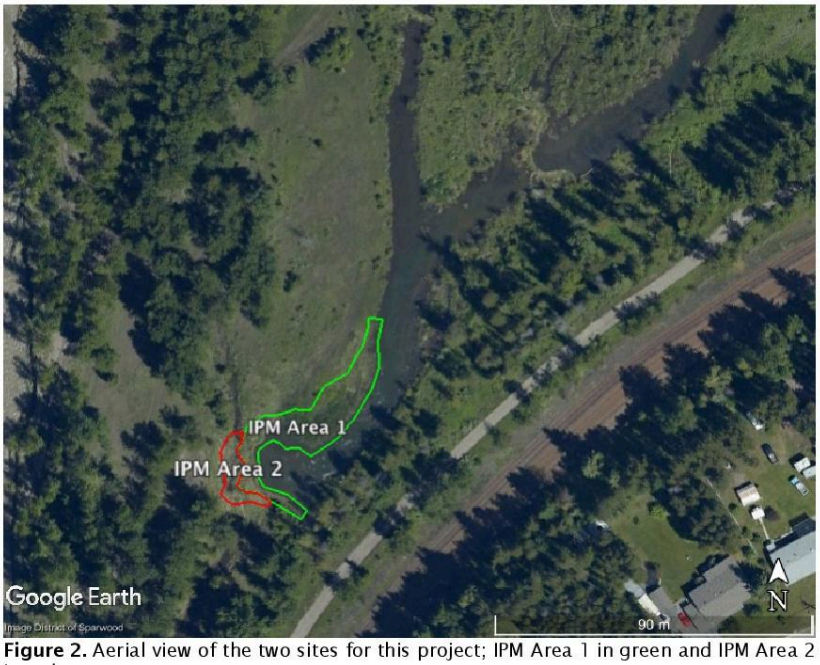

Figure 2. Aerial view of the two sites for this project; IPM Area 1 in green and IPM Area 2 in red.

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Literature Review Summary: Common Methods to remove Reed Canary Grass:

1. Mechanical:
   - Removing the aboveground mass by mowing or use of a scythe can be effective in preventing seed dispersal if continuously done. This method will not effectively eradicate the grass. To effectively control the grass and allow other species a chance to compete, mowing must be completed 5 times a season. If done too infrequently, mowing will actually stimulate regrowth from the severed nodes. As such, mowing is a method best used in conjunction with other practices (Tu, 2004).
   - Mechanical excavation of RCG with heavy machinery (such as digging with a back hoe) is generally unsuccessful and not recommended. Rapid regrowth from the rhizomes and seedbank occurs soon after the disturbance. Using this method in conjunction with other methods, such as occultation or shading (see below) will yield better results. Clean tools and machinery before and after use to minimize risk of spread (Anderson, 2012).
   - Pulling out the grass is effective in small clusters, but is unlikely to be productive in medium to large, well-established populations, as the rhizomes tend to go deep into the ground and re-sprout (Wisconsin Reed Canary Grass Management Working Group, 2009).
   - Digging with hand tools allows for a better chance of removing rhizomes, but in and of itself is not always effective and is very time consuming.
   - Goats and other livestock grazing can be useful in agricultural settings but are not recommended in wetlands. (Tu, 2009; Anderson, 2012).
   - If removing RCG, the organic material should not be composted. It can be burned or dried in a garbage bag in the sun for at least a week and then brought to a landfill (Anderson, 2012).

2. Burning:
   - Burning can be an effective control method if done correctly and early in the season (later season burning will only encourage reed canary grass regrowth). (Tu, 2004; Anderson 2012)
   - Requires special permits and can be unsafe. Not recommended.

3. **Chemical control:**
   - Reed Canary Grass will also respond to 2% glycophosphate (i.e. Roundup) application (Miller *et al.*, 2006; Apfelbaum and Sams, 1987).
   - Herbicides needs to be applied very carefully, such as by a short-range spray or by being wicked on with a sponge. These methods can be very time consuming. The applicator must take care to avoid contact with the solution and must wear proper Personal Protective Equipment (PPE).
   - Permits will likely be required, especially near water. A licensed applicator may be required (Anderson 2012; Wisconsin Reed Canary Grass Management Working Group, 2009).
   - This technique is not ideal near water as chemicals may run into the water and be carried away from site (Apfelbaum and Sams, 1987).

4. **Occultation (e.g. tarping or mulching):**
   - Occultation is a form of weed removal where you cut the soil off from sunlight, often done with an opaque tarp or mulch.
   - Tarps create a dark, hot, humid environment for any growing or germinating vegetation underneath. Left long enough, it will effectively cook the plants and seedbank (Anderson, 2012).
   - Because everything under the tarp will be smothered, this is best done where there is a thick RCG monoculture (Tu, 2009).
   - For best results, the tarp should be applied in late spring, and prior to applying the tarps the grass should be mowed short in order to reduce airflow. The tarps will need to be staked or weighted down, and care should be taken in places where flooding could displace the tarps.
   - The ends of the tarps should be overlapped by at least 10 cm, and the edge of the tarp should extend by at least 50 cm beyond the last reed canary grass. Lateral rhizome growth may result in shoots at the edges and seams so ongoing monitoring is necessary.
   - The tarp should be left in place for at least one full growing season, preferably two to five years, before being removed.
   - This method also results damage to the mycorrhizae and bacteria in the soil as they are also cooked by the heat. As a result, adding myrorrhizae back to the soil and replanting with native vegetation or native grass seed once the tarp is removed will yield the best results.

5. **Shading**:
   - Reed canary grass prefers sunny, open areas so planting larger, overshadowing native vegetation can be an effective way to eradicate RCG (Kima *et al.*, 2006; Tu, 2009).
   - This method is unlikely to work on its own, as RCG may outcompete young planted trees. Other forms of control are necessary until the overstory becomes established. Shading using overlapped cardboard or coir matting with wood mulch (approx. 10 cm deep) or mowing can work effectively when used in conjunction with planting.
   - Species selection may include alder, willows, cottonwood, red-osier dogwood, and conifer species (e.g. Englemann spruce).
   - The major benefit of this technique is it will result in a more biologically diverse and resilient wetland.

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Recommended Integrated Pest Management Plans (IPM) for the Sparwood Beaver Wetland:

The recommended rehabilitation objective for the Sparwood Beaver Wetland is to remove the invasive RCG and attempt to establish native vegetation along the southern end of the wetland. This will be done using a multifaceted approach designed specifically to eradicate and control RCG in the Sparwood Beaver Wetland given the current resources available. As this is a pilot project, it will test the effectiveness of these approaches against each other.

The IPM plans takes into account the wetland's complex terrain and multiple problem areas. The primary approach is to test various occultation and shading practices that are available. They will also assess the effectiveness of occultation alone compared to mechanical removal followed by occultation for each material type used. If successful, these approaches may be used elsewhere in the Sparwood Beaver Wetland or in nearby wetlands that similarly have a RCG infestation.

The two primary approaches have been developed in respect to the two distinct problem areas in the wetland. The first area affected by RCG runs from the water up the sloping riparian zone adjacent to the pond (area A) where the RCG has formed dense monocultures, and second is for the upper riparian zone further from the water that is affected by RCG but still has shrubs interspersed amongst the RCG (Area B). Both IPM plans will occur in mid May to late June after the risk of flooding has decreased.

The first step in both plans will be to cut the RCG as close to the ground as possible using a weed whacker; this will be done several days in advance of any engagement with the community. The RCG cuttings will be bagged and left in the sun for a week prior to disposal at the landfill. Cutting the RCG short will help to stop air circulation under the tarps and remove any remaining seeds.

IPM for Area 1 – RCG in water and along lower riparian zone

After the RCG has been mowed, this area will undergo occultation for the remainder of the growing season and at least one full year following. This method is ideal for this location because the RCG exists in a monoculture. Following occultation, the site will be reseeded and revegetated using a native grass seed blend in drier locations and native germinoids closer to the water's edge.

Strips of silage tarp will be used to cover the C-shaped southern edge along the water, approximately 700 m^2. The tarp will extend into the water to cover the RCG growing there, and landscape staples will be used every meter to hold the tarp in place. Half a meter will be added to the end of each tarp section so that the sheets overlap. The edges will be reinforced with dirt and rocks to ensure no air can transfer under the tarp.

A small section within this area will be dug to a depth of 10 – 20 cm to remove the rhizomes left in the ground. This will be done to compare the effectiveness of using the silage tarp to kill the remaining rhizomes that have not been removed.

This site will be left for the remainder of the season and for one full growing season after, and will be monitored frequently to ensure the tarps have not moved and there is no lateral rhizome growth resulting in shoots along the edges of the tarp. If this occurs the RCG will be pulled or mowed and the tarp will be expanded past the edge by an additional 2 m.

Following a minimum of two years of occultation, the tarps will be removed and the site will be revegetated using a native grass seed blend. Soil and soil amenities, such as mycorrhiza and fertilizer, will likely be needed to provide nutrients lost through the occultation process. The site must be monitored for several years to ensure no RCG regrowth. If there is any regrowth, the grass should be pulled or cut down several times that season to allow the natural vegetation to outcompete the RCG.

Materials:

- Silage tarp
- Landscape staples
- Native grass seed
- Soil amenities

- Large black garbage bags (to remove RCG cuttings)

Equipment:
- Tape measure
- Sheers
- Waders
- Hammer/mallet
- Work gloves

IPM for Area 2 - Upper riparian zone away from water

After this area has been mowed, the RCG will undergo occultation and shading by use of Prospun Weedbarrier, mulch and native vegetation. Prospun Weedbarrier allows moisture to travel to the soil while still blocking sunlight from reaching the vegetation underneath. It therefor does not cook the bacteria and fungi in the soil beneath it. For this reason, it will be good to compare its effectiveness to that of a silage tarp, which does more damage to the soil.

Native vegetation will be planted within and along the perimeter of area B, approximately spaced between 1 and 2 m apart from each other. The native vegetation will be between 2 and 5 years old, as they will have a better chance of growing quickly and overshadowing the RCG when it attempts to regrow. Excess soil and soil amenities (e.g. mycorrhizae) will likely need to be added with the plants. Plant species may include: willow species, trembling aspen, black cottonwood (*Populus trichocarpa* Torr. & Gray), red osier dogwood, snowberry, Saskatoon berry, prickly rose, choke cherry and soopolallie.

Within a 30 cm radius of each shrub/tree the ground will be cleared of RCG and covered with mulch. Between each of these plants, strips of Prospun Weedbarrier will be placed over the ground. The material will be held in place using landscape staples every meter. The use of occultation will allow the native vegetation to grow and develop a competitive advantage over the RCG.

In some areas, the RCG will be removed to a depth of 10 – 20 cm using shovels prior to placing the Prospun Weedbarrier. This will allow us to examine how effective the use of the material alone is compared to being used in conjunction with the mechanical removal of the rhizomes. The

rhizomatous material will be bagged and left in the sun for a week prior to disposal at the landfill.

The site must be monitored for several years to ensure no RCG regrowth. If there is, the grass should be pulled out by the roots or at the very least cut down several times that season to allow the natural vegetation to outcompete it. Once the native vegetation has been established and the RCG appears to be eradicated under the tarp, a minimum of two years, the Prospun Weedbarrier can be removed and the area seeded with a native grass seed blend.

Materials:

- Prospun Weedbarrier
- 500 Landscape Stapes
- Mulch
- Native grass seed
- Soil amenities
- Native plants (2 – 5 years of age)
- Large black garbage bags

Equipment:

- Tape measure
- Scissors/sheers
- Hammer/mallet
- Work gloves
- Posthole digger
- Renting gas-powered weed whacker (FR Rentals, Sparwood)

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I *certify that I am a qualified registered professional and that I personally reviewed this report and support the suggested field experiment proposed.*

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