

# Master Plan for the development of Selkirk College, Castlegar Campus

Riparian Ecosystem Assessment and Site Restoration Prescription

prepared by
Newmoon Environmental Consulting
Riparian Restoration Specialists

submitted to Peter Holton, MCP, AICP IEP251

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#### **EXECUTIVE SUMMARY**

The focus of this portion of the Selkirk College Master Plan is the riparian area component of the Castlegar campus. This report includes an assessment of the present health status of the riparian ecosystem, identification of human impacts on the riparian areas, identification of a priority area for restoration, and a riparian ecosystem restoration prescription for a specific site on the college property. It also identifies existing and potential education opportunities for students at the college and for the larger community.

Riparian areas, which are transition zones between the aquatic ecosystem in a stream or river and the adjoining upland, are diverse and vulnerable ecosystems and provide habitat for many species of birds, animals and plants. They have an impact on, and are affected by, the health of these adjoining ecosystems. Riparian areas support high biodiversity and sustain an abundance of plant and animal life. In British Columbia, 253 species of vertebrates, including 72 that are endangered, use or are dependent upon riparian areas. Therefore, restoration and protection of these areas are of high ecological importance.

The riparian area surrounding the Castlegar campus of Selkirk College could be a model of riparian ecosystem management for optimal health and integrity. The college has the opportunity to be a regional leader in demonstrating the value and effectiveness of best practices in riparian area restoration. The policies, goals, objectives and implementation steps laid out in this management plan are designed to improve the health status and ecosystem integrity of the college riparian areas through integrating educational opportunities for students with specific assessment, restoration and monitoring projects within the riparian area.

Recommended implementation steps include establishing of a riparian management task group, having riparian area management be an integral component of all Renewable Resources (RRS) program curricula, creating a database for the compilation and comparison of data collected through regular assessments of the riparian area, working with local organizations to create a regional riparian area management plan, completing some portion of riparian area restoration each year as a component of RRS field school, and establishing protection strategies for restored areas.

Selkirk College is challenged with the opportunity to do valuable ecological restoration work. Restoring the natural beauty and integrity of the riparian ecosystem on the college property is a laudable and achievable goal.

# Acknowledgments

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- and to everyone who believes that we can make the world a better place. Let's get at it!

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#### 1.0 Introduction

This Riparian Area Management Plan is a component of the Selkirk College Castlegar Campus Master Plan.

#### Mission

The Selkirk College Castlegar Campus Master Plan is designed to promote environmental stewardship integrated with educational opportunities through responsible development and preservation of land and community.

#### Focus

The focus of this portion of the Master Plan is on the riparian area surrounding the Castlegar campus. This report includes an assessment of the present health status of the riparian ecosystem, identification of priority areas for restoration, and a riparian ecosystem restoration prescription for a specific site on the college property. It also identifies existing and potential education opportunities for students at the college and for the larger community.

# 1.1 Value of Riparian Areas

Riparian areas are areas adjacent to streams and rivers. They form an ecotone (a transition zone) between the upland and the aquatic ecosystems and have characteristics distinct from both of these. The integrity of a riparian ecosystem has a significant effect on the health of the adjoining upland and aquatic areas, as well as being affected by the health status of these zones.

Because riparian areas sustain an abundance of plant and animal life, they are areas of high biodiversity (Jamieson 2000). In British Columbia, 253 vertebrates use or are dependent upon riparian areas. Of these, 44 (17%) are red listed as endangered, with an additional 28 (11%) blue-listed as vulnerable (Anonymous 2000). Therefore, restoration and protection of riparian areas to provide habitat for these species are of high ecological importance.

# 1.2 Vision for the Selkirk College Riparian Area

The riparian area surrounding the Castlegar campus of Selkirk College could be a model of riparian ecosystem management for optimal health and integrity. The area is diverse and contains valuable habitat for birds, waterfowl and a variety of mammals. The college is in a unique position to be a leader in the region and to demonstrate the value and effectiveness of best practices in local riparian ecosystem restoration and management.

Utilizing the time and energy of students to restore the riparian areas - while providing them with practical, hands-on skill development in a real-life situation - benefits both the ecosystem and the students. Experiencing the transformation of a degraded site into a healthy and functioning ecosystem can inspire and motivate students, staff, faculty and the broader community.

Because this area includes publicly accessed hiking trails, it has the potential for public education about the value of riparian areas, and for community involvement in riparian restoration and enhancement. Interpretive signs identifying and describing the value of native vegetation, cottonwood stands, wildlife trees and biodiversity could be posted along the trails, so that people could learn about their environment as they enjoy a stroll through the natural beauty of the river valley.

# 1.3 What is Riparian Restoration?

Riparian restoration is the attempt to restore natural vegetation, slope, soil stability, and function to an area that has sustained damage from human use or activities. It could also be done in an area that has sustained damage from natural disasters such as major destructive storms or floods. The Society for Ecological Restoration defines restoration as: "the process of assisting the recovery and management of ecological integrity." (SER 2002). An ecosystem has ecological integrity when the natural organisms and processes are present, functional and in balance and there are no introduced species. Restoration is a cooperative effort between humans and nature, in that humans replace (restore) the components that were removed or damaged and then trust to nature to resume functioning in a healthy manner. Generally, the components that are within human

ability to restore are physical (topographical, hydrological) and vegetative. The animals will come if the habitat is there, provided there is no continuous disturbance through ongoing human presence.

#### 1.4 Methods of Riparian Restoration

Techniques of restoration vary widely and, to some extent, are site specific. However, most restoration plans share the following common elements:

- reference conditions are researched (historical what the area was like prior to the disturbance, or contemporary - what similar undisturbed areas are like) to establish restoration goals.
- soil stability is ensured.
- surface erosion potential is reduced through ground cover such as native grasses and other native vegetation.
- hydrologic stability (natural drainage patterns) is re-established.
- native vegetation is replanted.

These components are extremely interconnected and interdependent, as soil stability is fundamentally a combination of re-contouring (low slopes are more stable), appropriate drainage patterns, and re-vegetation. Vegetation depends on water flows and regimes, and natural drainage is partially a function of vegetation status. The need for proper planting of native vegetation is essential to prevent overgrowth of invasive species, which tend to flourish in disturbed areas. Vegetation also performs essential functions in the filtration of water (e.g. cattails: *Typha latifolia*), so both flow regulation and water quality are beneficially affected by healthy vegetation.

Riparian restoration techniques may include the following techniques:

- bank stabilization through the use of rip rap, gabions, etc.
- re-creation of channels when there has been major disruption of natural flows
   (e.g. channelization)
- recontouring of slopes that have been disturbed or changed through the building of roads or trails

- hydrologic work to create / restore non-damaging drainage patterns. This may require significant work in the adjacent upland areas, as large drainage areas, and many factors within that area, affect drainage patterns and flows. For instance, on the college property, amount and location of runoff from impermeable surfaces (building roofs and parking lots) has an impact on drainage patterns in the riparian areas. (CM Management 2002).
- managed flooding in areas where periodic floods were integral to the natural succession patterns and vegetation types
- replanting of native vegetation

Some or all of these may be used, as well as other techniques appropriate to the specific conditions of the area to be restored.

It is important to be aware that the process of restoration may sometimes require significant disturbance to a site, in an effort to achieve a healthier state. Ecosystem integrity does not mean that a site is manicured or park-like; it means that the required components are present for natural processes to take place. An intact ecosystem is an interdependency of many natural processes and components, not a static product.

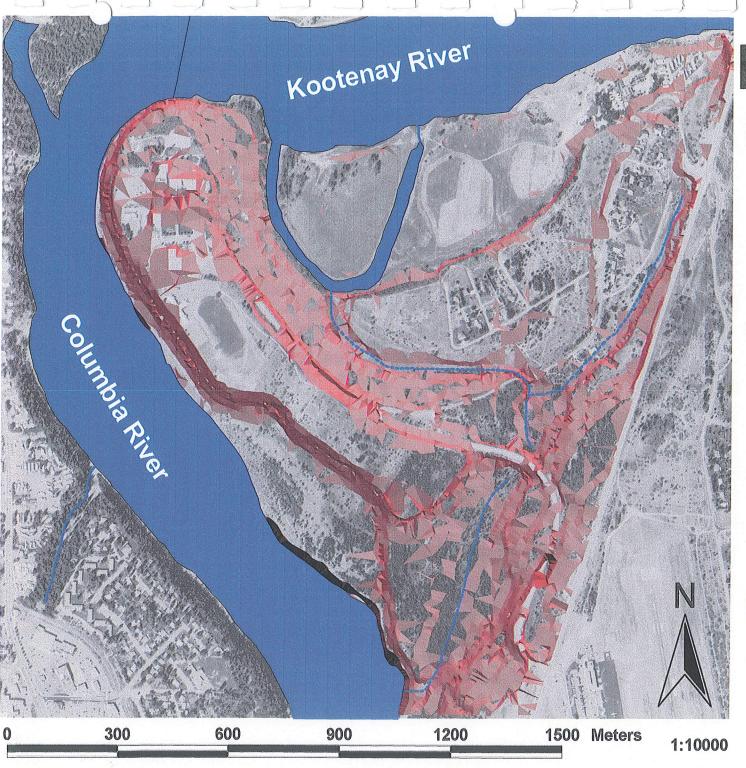
# 2.0 Description of Study Area

Selkirk College, Castlegar campus, includes a large proportion of riparian area. Located at the confluence of the Kootenay and Columbia Rivers, the campus covers an area of almost 66 hectares (659,860 m²) (Figure 1). Of this, there is approximately 3 km of Columbia and Kootenay River shoreline on the campus property, which represents a minimum of 15 hectares of riparian area - almost one-quarter of the campus grounds. There is an additional 3 km of Kootenay River shoreline in the adjoining Special Management Area, representing an even larger amount of riparian area because much of it is lower and flatter (floodplain) and includes a wetland (wet meadow) area, as well as the chute (commonly called the oxbow) and the oxbow island, which are entirely riparian. There is also an intermittent stream on the campus grounds, with its attendant riparian area. (Figure 2). The college is in the biogeoclimatic (BEC) zone ICHxw: very dry, warm interior cedar-hemlock (Graeme Pers. comm.).



Photo by Peter Holton

Figure 1: Selkirk College, Castlegar Campus



# Figure 3: Campus Slopes



14 - 21 21 - 30 30 - 40

40 - 60



Drawn by Karen Newmoon Integrated Environmental Planning Technology April 11, 2002

#### 2.1 Assessment of Study Area

The ecological integrity and health of the riparian ecosystem on the college property are compromised by human activity throughout the area. This will continue to be the case, as the area is and will continue to be used by college students, staff and faculty, and community residents. Also, the entire campus riparian area has been affected by the upstream impoundment of water behind various dams. The high water line has changed; it is now lower than prior to impoundment and it also fluctuates markedly depending upon flow rates over the dams. The zone between the original riparian area (adjacent to the original high water mark) and the new lower water level needs assistance if it is to reestablish vegetation, as the fluctuations in water level make it difficult for vegetation to get established. A combination of other factors, including site sensitivity and type and intensity of human use (e.g. ATV and dirt-bike tracks, etc.) has led to some areas being more degraded than others. Some areas are also more vulnerable to degradation than others, depending upon the steepness of slope, moisture regime of soil, run-off patterns, soil texture, erosion hazard, etc.

#### 2.1.1 Geology / soil types in the riparian area

Most of the campus is Brunisol, shallow silty loam soil (SiL) with gravel and cobbles below. Regosols (immature soils) are found between present high water and historic high water levels, where there is predominantly gravel and cobbles, with some sandy areas. All the fines were washed away when the river used to cover that area, and they will not be replaced because they settle out in the reservoirs. Soil is slow to form here and is hindered by the fluctuations in water level as the amount of spill over the dams varies with power demand.

#### 2.1.2 Slopes and aspects in the riparian area

Some parts of the riparian zone have very steep slopes, with a range of 0 - 47% (Figure 3). Aspects on the Kootenay River side are north facing, while those on the Columbia River side face southwest. Both steepness and aspect have an effect on the soil moisture and drainage of these slopes.

All of these factors (type and intensity of use, presence and status of vegetation, geology, hydrology, and topography) must be taken into consideration when setting priorities for restoration projects. The low-elevation flat areas close to the water are one priority because they form wetland (wet meadow), which has high habitat value. Steep areas are more severely affected by runoff; therefore, erosion is significant, but they comprise a smaller portion of the total riparian area.

# 3.0 Impacts to Study Area

The entire riparian area on the college grounds has been significantly affected by human activity over an extended period of time. These impacts may be divided into direct presence impacts and downstream impacts of water impoundment behind dams on both the Columbia and Kootenay Rivers.

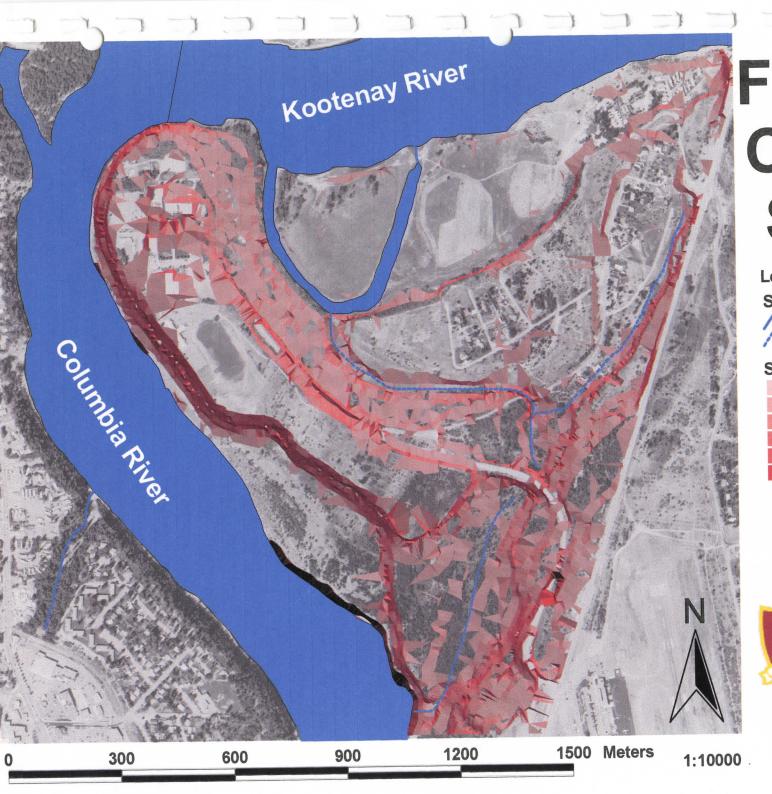
#### 3.1 Human Presence and Use

Within the riparian area along the chute, including the oxbow island, various items of garbage were found. These included beer bottles, cans, and food wrappers. ATV tracks and their associated compacted soil areas were noted at the river edge, at the southern end of the oxbow island, and throughout the flatter areas adjacent to the chute. People hike along the trails, sometimes ride mountain bikes on them, and often walk their dogs along them. Human presence disrupts wildlife and appears to be limiting the use of this valuable habitat. Limited wildlife use is indicated by the presence of spider webs and debris in holes, cracks, and crevices, which could potentially be used by secondary cavity-nesting species.

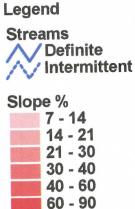
# 3.2 Hydrologic Impacts

The damming of the Kootenay and Columbia Rivers has had significant impact on the riparian areas at the confluence of the two rivers. The major impacts come from the control of flooding and the changes in water levels and flow regimes.

Prior to the building of the dams, the riparian area at the confluence probably flooded annually at high water (Fowler Pers. comm.), allowing the natural riparian cottonwood



# Figure 3: Campus Slopes





Drawn by Karen Newmoon Integrated Environmental Planning Technology April 11, 2002 ecosystem to regenerate as the water slowly subsided. Cottonwoods require saturated soil to germinate and slow subsidence of water levels (less than 1.5 cm/day) to survive, as more rapid subsidence results in drought stress (Jamieson 2000). The loss of this natural flooding cycle has changed the riparian ecosystem in this area.

For example, the oxbow island is comprised of fine sediments deposited over time. It is quite sandy, and the roots of grasses and other plants provide soil stability. The loss of flooding and the settling out of sediments in the reservoirs behind the dams have meant that there is no deposition of new sediment, nor replacement of nutrients from new sediments. This decrease in nutrients available to plants may, over time, result in more areas of exposed soil with an attendant increase in erosion. The loss of native plants allows the growth of invasive species and decreases the health of the ecosystem.

Another major impact of the upstream impoundment of water is the changes to water level. There is approximately 3-3.5 meters vertical difference between historic highwater marks and present-day high-water marks. This zone shows signs of some degree of succession in places, depending upon the steepness of the shore. Mosses, lichens, kinnikinnick (*Arctostaphylos uva-ursi*), grasses (*Phalaris arundinacea*, others), curly dock (*Rumex crispus*), etc., are beginning to be present in some areas. Restoration projects in this zone could speed the regeneration of natural vegetation and improve the health of these areas.

Water levels also vary significantly both daily and annually. Flow regulation at the dams can result in water level changes of several meters in a few hours. This has a negative impact on shore-nesting birds, leaving their nests too far from water, flooding them, or washing them away. It also exposes, and leaves to die, bottom-dwelling insect larvae (benthic invertebrates), which are an important food source for many fish. This decreases the overall population of benthic invertebrates and thereby reduces the abundance of food supply for fish. Rapid drops in water level also expose fish eggs, which has a negative impact on fish populations. These rapid changes to water levels make it harder for a natural riparian ecosystem to evolve, because the water's edge is always shifting.

# 3.3 Storm Water Runoff Impacts

Runoff from the impermeable surfaces on campus (such as roofs and parking lots) has an impact on the health of the riparian ecosystem. Please see "Erosion, Impermeable Surface, and Surface Water Run-off Management Plan" prepared by CM Management for an assessment of these impacts.

# 4.0 Identification of Priority Area

The area recommended as the first restoration site, and for which a restoration prescription has been written, is the area adjacent to the oxbow, where the hiking trail is in the riparian area and also, at one point, in the flow of the intermittent stream (Figure 4). This location is high priority because this section of riparian area is heavily impacted by human presence. Use of the trail has resulted in soil compaction. Another factor that makes it suitable for restoration is that it is adjacent to the oxbow, and not the main channel of either river; therefore, restoration undertaken in this area is not subject to ongoing impacts from river level fluctuations (i.e., it has a chance of staying intact). Further, because it is located on the college grounds proper, rather than in the Special Management Area, it is within the jurisdiction of the college.

Based on the Hazard Assessment Keys for Evaluating Site Sensitivity to Soil Degrading Processes Guidebook (FPC 1999), this site is rated high for soil compaction hazard, moderate to high for erosion hazard, and moderate for risk of sediment delivery to stream.

Ideally, the trail should be re-routed, the slope re-contoured, and the area re-vegetated; and community members should be informed of why this area needs protection. This last objective could be accomplished by interpretive signage, indicating the value of the riparian ecosystem and the intent of the restoration project.

#### 5.0 Recommendations

The following goals, objectives, policies, action steps, and evaluation methods are offered as a means of working toward the vision of the Selkirk College riparian areas as a healthy and normally-functioning ecosystem. These are not comprehensive, and further studies may be necessary to establish best practices for the specific circumstances of this area.

### 5.1 Goals and Objectives

The overall goal for this plan is to raise awareness of the value of riparian ecotones and the condition of the riparian area surrounding the college grounds. It is designed to improve the health status / ecosystem integrity of the college riparian areas through integrating educational opportunities for students in the Renewable Resources department (and others) with specific assessment, restoration, and monitoring projects within the riparian area. It also presents educational opportunities for the broader community.

Goals	Objectives
To increase awareness of 1) the role and importance of healthy riparian areas in general, and 2) the status of the riparian areas surrounding the college in particular	<ul> <li>assess ecosystem health in the riparian area of the college property (gather baseline data)</li> <li>create a database to document current conditions in the Selkirk College riparian areas and to allow for tracking changes over time</li> <li>identify priority areas for restoration (degraded sites)</li> </ul>
To improve the integrity and health status of the riparian areas on Selkirk College property	<ul> <li>reduce erosion potential</li> <li>minimize water pollution from runoff</li> <li>maximize protection of aquatic environment</li> <li>increase ground cover of native vegetation</li> <li>maximize soil stability</li> <li>maximize habitat potential in riparian area for riparian-dependent species and other riparian area users</li> </ul>

To lay out a restoration prescription for a specific site on the college property	<ul> <li>restore the components necessary for ecosystem health at this site</li> <li>increase % ground cover of native vegetation species</li> <li>reduce impact of invasive plants</li> <li>maximize site biodiversity and, thereby, habitat potential</li> <li>increase soil stability of site through recontouring and revegetating</li> <li>provide a model for development of future site prescriptions</li> </ul>
To identify existing and potential educational opportunities for Selkirk College students in the area of best practices in riparian ecosystem restoration and management  To educate the students, faculty and staff of Selkirk College, as well as the broader community, about the value of riparian ecosystems and the threats to these areas	<ul> <li>provide learning opportunities both in class and in the field</li> <li>involve students in hands-on, real-life restoration projects where the progress over time is noticeable</li> <li>increase awareness of the role of riparian ecotones in healthy aquatic and upland ecosystems</li> <li>provide opportunities for community involvement in riparian restoration</li> </ul>
To provide natural interpretation / environmental education signs along the Selkirk trail system	<ul> <li>increase awareness of natural systems and native vegetation</li> <li>increase awareness of human impact on fragile ecosystems</li> </ul>
To make recommendations for further work and regional involvement in riparian management issues	<ul> <li>provide perspective on the scope of the issue, given the constraints around riparian management in this area (i.e. because of impoundment and fluctuating water levels)</li> <li>highlight opportunities for further learning and work in the area of riparian ecosystem health</li> </ul>

#### 5.1.1 Educational opportunities

Many opportunities exist for Selkirk students (particularly in the Renewable Resources department) to learn and practice field skills while completing components of riparian restoration on the campus grounds. These skills and components would include the following items:

- 1) collection of field data
- 2) conducting assessments
- 3) creating a of data base
- 4) planning site specific restoration projects
- 5) implementing site restoration projects
- 6) monitoring of riparian ecosystem health
- 7) researching best practices in riparian restoration and management
- 8) gathering historical data for this area and information on other similar ecosystems in order to formulate appropriate long-range restoration goals and strategies.
- 9) working with other agencies (such as BC Hydro, the Columbia Power Corporation, the Columbia Basin Fish and Wildlife Compensation program, the City of Castlegar, etc.) to create a regional riparian area management plan and to implement best practices in riparian area management. Cooperation with other groups is necessary in order to implement some aspects of riparian area restoration, such as managed flooding.
- 10) providing field school opportunities for Integrated Environmental Planning Technology (IEPT) and Recreation, Fish and Wildlife (RFW) students.

# 5.2 Recommended Policies

Policies are decisions made in advance; they set out how to deal with various situations that may arise. Policies get implemented in order to achieve goals. They are documented guidelines designed to ensure that goals are met.

This report recommends that Selkirk College adopt policies that are intended to aid the college to:

- 1) restore and protect the riparian areas surrounding the Castlegar campus.
- 2) manage the riparian areas on the college property in such a way that ecosystem health and integrity are enhanced.
- 3) ensure that the management of the riparian ecosystem is part of the educational experience for students and that students actively participate in the creation of a restoration plan as a real-life learning experience.

For example, appropriate policies could be worded in the following manner:

- 1. It is the policy of Selkirk College to protect the riparian areas surrounding the Castlegar campus and to manage them in such a way that ecosystem health and integrity are enhanced, restored and preserved.
- 2. All proposed development and grounds management shall take into consideration any impacts on the college riparian areas.
- 3. Riparian area management shall be included as a component of all Renewable Resources program curricula.

Wording and policy formulation must be done in accordance with Selkirk College policy development standards.

# 5.3 Implementation Steps

This section includes both general steps toward putting a riparian management plan into effect and a specific restoration prescription for the selected priority area.

#### 5.3.1 General

- Establish a riparian management task group. This could be a sub-committee of the Grounds Committee and could include faculty members, staff (maintenance personnel), and student representatives.
- 2. Include riparian area management as a component of all Renewable Resources program curricula.
- 3. Collect baseline data to document the current status of the college riparian areas.

4. Create a database that includes the baseline data and is designed in such a way that future data collection and assessment can be added to the database and compared with the existing data to monitor progress over time.

- 5. Establish a regular assessment of the status of mature and regenerating cottonwood trees, and other riparian ecosystem health indicators, on the Castlegar campus. (This can readily be achieved by having IEPT students perform the assessment as part of their ecology courses.)
- 6. Provide ongoing education to the community regarding the value of and threats to the local riparian ecosystem. This education may take a variety of forms and may be offered in cooperation with other interested groups or organizations. It could include interpretive signage and Continuing Education courses, as well as volunteer monitoring programs. (For instance, Environment Canada has a volunteer ecosystem monitoring program called EMAN: Ecological Monitoring and Assessment Network, which involves citizens in monitoring ecosystem health in their own regions.)
  (EMAN 2002).
- 7. Undertake a review of historic data for the area, and for other similar riparian areas, in order to establish appropriate restoration goals. (Again, this can be accomplished as a portion of Renewable Resources Department curricula, especially in the IEPT program.)
- 8. Work with the Columbia Power Corporation, BC Hydro, Columbia Basin Fish & Wildlife Compensation Program, the City of Castlegar, and local community groups to create a regional riparian area management plan.
- 9. Use the data from the assessment to establish priorities and time frames for restoration sites, and to aid in setting annual percentage targets for restoration.
- 10. Complete some portion (a specific site or annual % target) of riparian area restoration each year as a component of IEPT, RFW, and Forestry field school.
- 11. Plant native vegetation in degraded areas to improve the health of these areas. (See Appendix 1 for a list of beneficial native plants for the campus.)
- 12. Establish protection strategies for restored areas, in order to prevent re-degradation of these areas. For example, planting native vegetation that is dense and prickly (e.g.

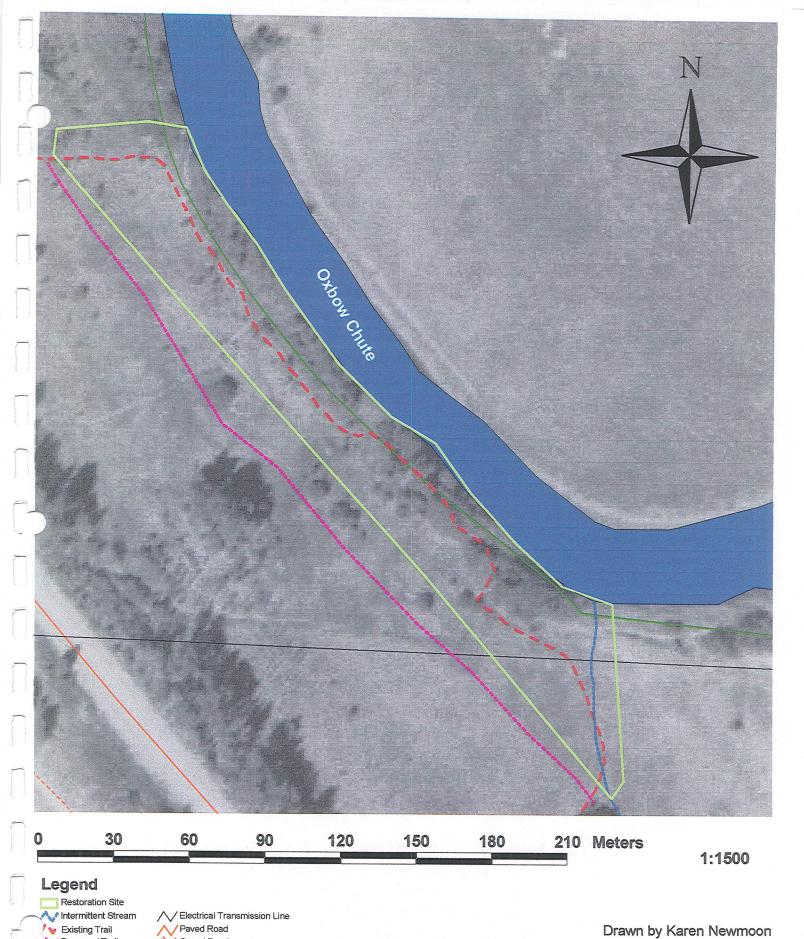
- roses, hawthorn, thimbleberry, blackberry, etc.) discourages human use of the area while providing cover and food sources for wildlife.
- 13. Dredge the chute deeper to reduce human access to the oxbow island. This would also help the riparian areas adjacent to the chute, as the water supply in that area would be year round, rather than intermittent.

#### 5.3.2 Site Restoration Prescription

The area recommended as the first restoration site is located along the east side of the college grounds, adjacent to the oxbow, where the hiking trail is in the riparian area and also, at one point, in the flow of the intermittent stream (Figure 4). It is 1.5 hectares in size. Soil disturbance must be kept to a minimum to reduce the chance of silt entering the water in the chute, as well as to avoid infestation with invasive plants, since these are adapted to exploit disturbed soil. Off-road vehicles, including dirt bikes, also encourage the spread of invasive plant species; therefore, good signage is necessary to encourage riders to stay out of the restoration area. In some cases, one-time herbicide application as a part of integrated pest management can be useful to give newly planted native species opportunity to get established.

### Outline of work to be done at this site:

- build a new trail in the grassy area 20 meters higher up the bank from, and parallel to, the existing trail, so that it is out of the riparian area.
- close, recontour, and restore native vegetation along the existing trail.
- dig up, cut or otherwise remove invasive plants to the greatest possible extent. Invasive species present in this area include knapweed (*Centauria spp*), yellow dock (a.k.a. curly dock) (*Rumex crispus*), and bracken fern (*Pteridium aquilinum*).
- plant native vegetation. Native plants are plants that occur naturally in healthy, undisturbed sites similar to the one that is to be restored. Native plant species commonly used for restoration include species that enhance soil stability and nutrient cycling. The following plants are recommended for use in restoring this site:



# Proposed Trail Proposed Trail Gravel Road Proposed Trail Proposed

#### TREES

- ♦ black cottonwood (*Populus balsamifera*) (important in riparian ecosystem)
- paper birch (Betula papyrifera)
- western white pine (Pinus monticola)
- ♦ grand fir (Abies grandis)
- Douglas fir (Pseudotsuga menziesii)

#### **SHRUBS**

- ♦ Pacific willow (Salix lucida ssp. lasiandra) (easy to propagate)
- pussy willow (Salix discolor) (easy to propagate)
- ♦ Sitka alder (*Alnus sitchensis*) (nitrogen fixer; enriches soil)
- hawthorn (*Crataegus douglasii*) (birds like it for nesting and eat fruits)
- western yew (Taxus brevifolia) (present on oxbow island and Zuckerman Island)
- ♦ red osier dogwood (*Cornus stolonifera*) (important winter browse)
- hazelnut (Corylus cornuta) (nuts are food source for squirrels and birds)
- ♦ thimbleberry (*Rubus parviflorus*) (grows well on disturbed sites)
- ♦ blue elderberry (Sambucus caerula) (present in area)
- Saskatoon berry (Amelanchier alnifolia) (good wildlife food source)
- nootka rose (*Rosa nutkana*) (present in area)
- ♦ baldhip rose (*Rosa gymnocarpa*) (present in area)

#### **FORBS**

- ♦ lupines (Lupinus spp.) (nitrogen fixer; enriches soil)
- vetches (Vicias spp.) (nitrogen fixer; enriches soil)
- common horsetail (*Equisetum arvense*) (present in area; grow easily; rhizomes support soil stability)
- other horsetail species (*Equisetum spp.*) (present in area; grow easily; rhizomes support soil stability)
- ♦ yarrow (*Achillea millefolium*) (grows easily)
- cattails (Typha latifolia) (good habitat for re-winged blackbirds)

#### **GRASSES**

- spike bentgrass (Agrostis exarata) (good for wildlife & good soil stabilizer)
- ♦ redtop (Agrostis gigantea) (present on oxbow island)
- ♦ sloughgrass (Beckmannia syzigachne) (present)
- ♦ fringed brome (*Bromus ciliatus*) (easy to seed)
- ♦ Columbia brome (*Bromus vulgaris*) (easy to seed)
- bluejoint (Calamagrostis canadensis) (present. Likes moist open meadows)
- green bristlegrass (*Ceteria veridis*) (annual; seed is likely present and will sprout when ground is tilled)
- ♦ slender hairgrass (Deschampsia elongata) (can be propagated by seed)
- ♦ Canada wildrye (*Elymus canadensis*) (good soil stabilizer; present in the area)
- ♦ slender wheatgrass (*Elymus trachycaulus*) (good soil stabilizer)

- red fescue (Festuca rubra) (present in area; beneficial; sod forming)
- reed mannagrass (Glyceria grandis) (for really wet areas close to water line)
- ♦ giant wildrye (*Leymus cinereus*) (uncommon, but can be propagated from seed, which could be gathered locally. It is spectacular, ~2m tall and blue.)
- common witchgrass (*Panicum capillare*) (annual; good for fast green-up)
- reed canary grass (*Phalaris arundinacea*) (present on the oxbow island)

Trees and shrubs should be planted in clusters with an overall density of one tree or shrub per square meter. A mosaic planting pattern is most beneficial in terms of creating diverse structure for habitat (Marcoux Pers. comm.). Cattails, sedges and willows should be concentrated near the water's edge in the wettest area, and cottonwood interspersed with hawthorn just above them. Grassy plots can be located in the central region and conifers and Saskatoon berry are best situated in the driest part of the site. Tall shrubs should dominate approximately 40 - 50% of the area, with the remaining 50 - 60% divided evenly between open grassy areas and trees. (Figure 4).

Some plants, such as cottonwood and willow cuttings, may be obtained from the college property, as these species grow easily from cuttings. Conifers are available from the PRT-Harrop Nursery. A competitive bidding process could be initiated to find a supplier

# 5.4 Monitoring and Evaluation

for the shrub seedlings and the native grass seed.

Baseline data collection is essential for creating a management plan because the information is needed to monitor progress regarding any implemented measures for enhancement, restoration, protection and preservation. Researching and reviewing historical data from the Castlegar area and/or information about other similar riparian ecosystems is necessary for the formulation of restoration goals.

Selkirk College could monitor the status of the riparian area on the Castlegar campus annually by having students learn how to do riparian ecosystem assessment and input their data into the database for comparison with the baseline data. After a few years there should be a noticeable difference. Also, when an assessment is real and the data gets recorded, students are likely to do a more careful job and to really learn something. Working on an actual project benefits the ecosystem and the students. This work can

have positive effects for the riparian area and its inhabitants, for the students, and for the community.

#### 5.5 Public Consultation Process

Consultation with the college population, as well as with the broader community, would provide opportunities both to inform people of the restoration projects and their underlying philosophy and intent, and to solicit input from interested individuals and groups. The following methods of public consultation would be useful for this project:

- 1. Hold an open house for the community, particularly inviting local residents to attend.
- 2. Include a brief information session, perhaps including a campus tour, as part of college orientation.
- 3. Solicit ongoing input by having interpretive signs that include a contact name and number for comments and/or a suggestion box at the trailhead.
- 4. Establish a public advisory committee, including representatives from local naturalist groups.
- 5. Produce a newsletter and brochures. This could be called "Friends of Riparian Areas" or some similar appealing title.

# 5.6 For Further Study

Two topics are priorities for further research:

- 1. A feasibility study for dredging the chute deeper so that it has water on a year round basis.
- 2. A feasibility study regarding the establishment of a local supply for native plants. This may involve seed collection, building a greenhouse and nursery, etc. Native plant stock is difficult to obtain and could potentially be self-supporting if the college set itself up to meet the need for these plants.

# 6.0 Summary

Selkirk College is challenged with an opportunity for doing important ecological restoration work. Restoring the natural beauty and integrity of the riparian ecosystem on the college property, while providing educational opportunities, is a laudable and achievable goal. The health of the riparian areas, the learning opportunities for students, and the chance for the larger public to be involved in restoring and maintaining the riparian ecosystem make this project worthwhile and achievable.

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# 8.0 Appendices

# **Appendix 1: Vegetation list**

Native plant species recommended for restoration projects in this region.

Native plants are plants that occur naturally in healthy, undisturbed sites similar to the one that is to be restored. Revegetation in the wet West Kootenay region is not really a problem. Most of the time the problem is keeping the vegetation out. Species such as thimbleberry are excellent ground cover; they inhibit the movement of people due to the density and grow back readily if you disturb the soil and chop the rhizomes just right.

To avoid infestation with invasive plants, soil disturbance must be kept to a minimum when planting native species, since invasive species are adapted to exploit disturbed soil. Off-road vehicles (dirt-bikes, etc.) also encourage the spread of invasive plants, so it is important to restrict their access to the site. In some cases, one-time herbicide application as a part of integrated pest management can be useful to give newly planted native species opportunity to get established. Native plant species commonly used for restoration include species that enhance soil stability and nutrient cycling. These include:

#### TREES

- black poplar (Populus balsamifera)
- ♦ aspen (Populus tremuloides)
- paper birch (Betula papyrifera)
- Douglas fir (Psuedotsuga heterophylla)
- ♦ western white pine (*Pinus monticola*)
- western red cedar (Thuja plicata)
- western hemlock (Tsuga heterophylla)

#### **SHRUBS**

- ♦ Pacific willow (Salix lucida ssp. lasiandra)
- pussy willow (Salix discolor)
- ♦ Douglas maple (Acer glabrum)
- ♦ hawthorn (Crataegus douglasii)
- pin cherry (Prunus pensylvanica)
- choke cherry (Prunus virginiana)
- mountain ash (Sorbus aucuparia)
- ♦ Pacific crabapple (Malus diversifolia)
- soopolallie (Shepherdia canadensis)
- ♦ ceanothus (Ceanothus velutinus and C. sanguineus)
- western yew (Taxus brevifolia)
- red osier dogwood (Cornus stolonifera)
- ♦ hazelnut (Corylus cornuta)

- ♦ thimbleberry (Rubus parviflorus)
- ♦ Oregon grape (Mahonia aquifolium)
- ♦ elderberry (Sambucus racemosa)
- ♦ Saskatoon berry (*Amelanchier alnifolia*)
- ocean spray (Holodiscus discolor)
- mock orange (a.k.a. syringa Philadelphus lewisii)
- snowberry (Symphoricarpus albus)
- falsebox (Paxistima myrsinites)
- ♦ kinnikinnick (Arctostaphylos uva-ursi)
- ♦ twinflower (*Linnaea borealis*)
- prince's pine (Chimaphila umbellata)
- nootka rose (Rosa nutkana)
- ♦ baldhip rose (*Rosa gymnocarpa*)

#### **FORBS**

- ♦ lupines (Lupinus spp.)
- ♦ vetches (Vicia spp.)
- queen's cup (Clintonia uniflora)
- common horsetail (Equisetum arvense)
- other horsetail species (Equisetum spp.)
- ♦ Hooker's fairybells (Disporum hookeri)
- ♦ yarrow (Achillea millefolium)
- one-leaf foamflower (Tiarella unifoliata)

#### GRASSES

- ♦ spike bentgrass (Agrostis exarata)
- ♦ little meadow foxtail (Alopecurus aequalis)
- ♦ fringed brome (Bromus ciliatus)
- pumpelly brome (Bromus pumpellianus)
- Alaska brome (Bromus sitchensis)
- ♦ water hairgrass (Catabrosa aquatica)
- nodding woodreed (Cinna latifolia)
- ♦ slender hairgrass (Deschampsia elongata)
- ♦ Canada wildrye (Elymus canadensis)
- hairy wildrye (Elymus hirsutus)
- blue wildrye (*Elymus glaucus*)
- slender wheatgrass (Elymus trachycaulus)
- ♦ bluebunch wheatgrass (*Elymus spicatum or Agropyron spicatum*)
- ♦ red fescue (Festuca rubra)
- ♦ tall mannagrass (Glyceria elata)
- reed mannagrass (Glyceria grandis)
- slender mannagrass (Glyceria pulchella)
- meadow barley (Hordeum brachyantherum)

- giant wildrye (Leymus cinereus)
- ♦ fuzzy-spiked wildrye (*Leymus innovatus*)
- ♦ foxtail muhly (Muhlenbergia andina)
- ♦ slender muhly (Muhlenbergia filiformis)
- reed canary grass (Phalaris arundinacea)
- alpine timothy (Phleum alpinum)
- ♦ Arctic bluegrass (*Poa arctica*)
- rivergrass (Scolochloa festucacea)
- prairie wedgegrass (Sphenopholis obtusata var. major & var. obtusata)
- mountain hairgrass (Vahlodea atropurpurea)

# Appendix 2: Re-vegetation Layout for Priority Restoration Site

