



**Weaselhead Grade 8 Field Trip Teachers Guide  
Package Biodiversity and Ecosystems: Freshwater  
Systems**

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*Thank you for your participation in our Grade 8 Weaselhead Education Program!*

The following items have been enclosed in this Teachers Guide package:

- o A map of the Weaselhead.
- o Field trip program outline.
- o Behavioural expectations.
- o Background information on the Weaselhead Area.



**Pre field-trip preparations:**

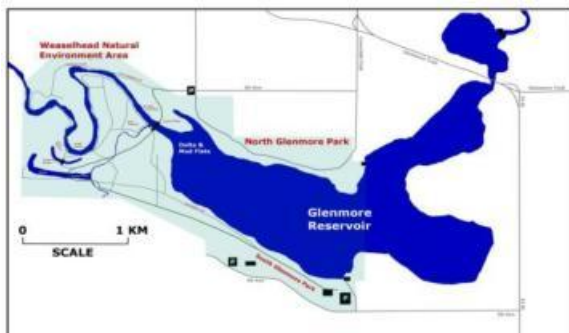
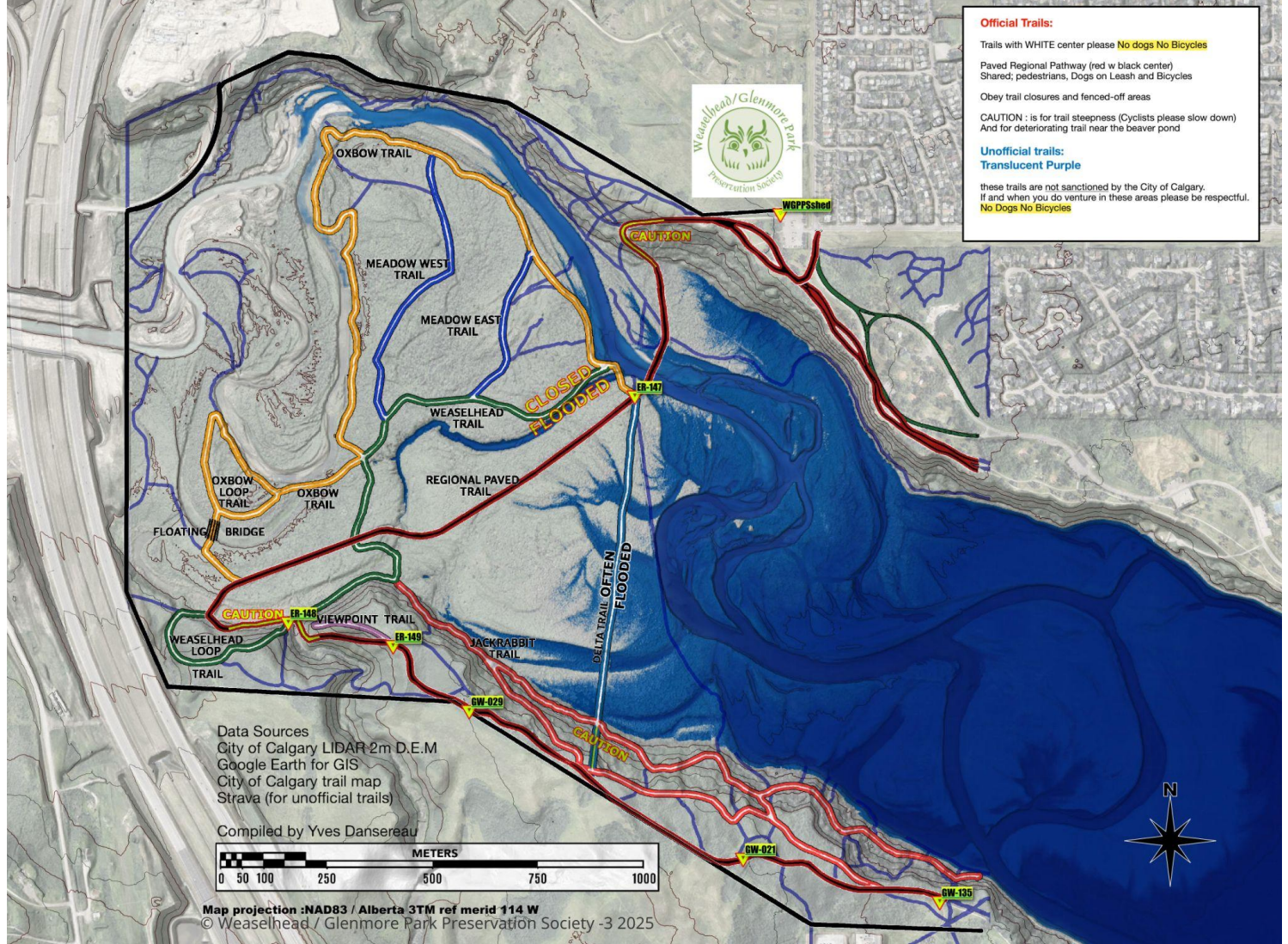
- Please have the students broken into 4 or 5 groups per class prior to the field trip.
- Students should bring their field journals or set up a field trip journal with scrap paper including the worksheets provided on our website.
- If possible, have one adult leader (parent volunteer) per student group.
- View the Weaselhead Field Trip Introduction PowerPoint presentation found on our website.
- The first few pages of the worksheets may be completed at school.

**Participants should bring:**

- o **Appropriate clothing for the weather. Dress in layers.**
- o Water bottle.
- o A snack and a waste free lunch for a full day field trip.
- o Pencils (pencil crayons, crayons, markers or paint is optional).
- o Field Journal
- o Something hard to write on if your Journal is scrap paper stapled together (cardboard stapled to paper or clipboard etc.).
- o If uncomfortable with sitting on the ground, then something to sit on (for example: A grocery bag with newspaper in it and taped shut). Lunch is held outside with no benches. Students will be sitting on the ground.

**NOTE: This entire program is held outside with no indoor facilities, students must be prepared for all weather and conditions. They will be hiking approximately 5km on dirt trails and should be wearing appropriate footwear.**





Your group will be starting their hike at the North parking lot (P). We will discover how plant diversity changes as we hike down into the valley, crossing the Green Bridge .We will explore approximately 5-7 km of trails, visiting multiple wetlands and comparing ecosystems.

## Field Trip Program Outline: *Full-Day*

| <i>Time</i>                                           | <i>Activity</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9:30                                                  | <ul style="list-style-type: none"> <li>● School arrives at site</li> <li>● Introduction of Naturalists and Helpers</li> <li>● Land acknowledgement and behavioral expectations</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 9:40-10:20                                            | <ul style="list-style-type: none"> <li>● Naturalists will go over the outline and the day's activities</li> <li>● Journal observation at lookout (Students               <ul style="list-style-type: none"> <li>○ will be writing notes to describe the watershed of the Glenmore reservoir and</li> <li>○ sketching the layout of the valley)</li> </ul> </li> <li>● Discuss Challenges to the Elbow River's Water Quality</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 10:30-10:50<br><i>Snack Break around 10:30ish</i>     | <ul style="list-style-type: none"> <li>● Walk down into valley</li> <li>● Stop on the bridge spanning the Elbow River and discuss:               <ul style="list-style-type: none"> <li>-Where the river comes from and where it ends up</li> <li>-Why the condition of the river is important to Calgarians</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 10:50-11:50                                           | <ul style="list-style-type: none"> <li>● First wetland study               <ul style="list-style-type: none"> <li>-Look for unique characteristics that define this wetland</li> <li>-Note any signs of human interaction with the area including the negative and positive impacts ex. bridges</li> </ul> </li> <li>● The students will do the study of the abiotic factors of the water.               <ul style="list-style-type: none"> <li>-measure turbidity, temperature</li> <li>-perform water quality tests</li> </ul> </li> <li>● Next they will look at the biotic water quality factors in the water               <ul style="list-style-type: none"> <li>-sketch different wetland plants</li> <li>-sketch and identify invertebrate species</li> </ul> </li> <li>● Study of the animal life found in and around the wetland.               <ul style="list-style-type: none"> <li>-larger species may not be visible (ex. Muskrat) but look for signs</li> <li>-record identification of the animal as well as the number seen.</li> </ul> </li> </ul> |
| 11:50-12:30<br><i>Lunch approximately at 12:00 pm</i> | <ul style="list-style-type: none"> <li>● Half hour for lunch (outside)</li> <li>● Walk to second wetland</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |



|            |                                                                                                                                                                                       |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12:30-1:30 | <ul style="list-style-type: none"> <li>Students do a biotic study and make inferences based on findings at both wetlands.</li> </ul>                                                  |
| 1:30-2:00  | <ul style="list-style-type: none"> <li>Hike back towards the bus learning about different plants and animals in the Weaselhead</li> </ul>                                             |
| 2:00-2:30  | <ul style="list-style-type: none"> <li>Wrap up at top of the hill including review of the day and a game if time permits (times will be adjusted based on bus pickup time)</li> </ul> |

***Please note: this outline is adjusted by each Naturalist leader to accommodate spacing out of classes. If there are 2 or 3 classes coming we will be visiting different places at different times. The above is just a typical outline.***



### Post Field Trip Activities:

- o **Contribute to water quality data in Alberta!** Visit:  
[http://beta.albertatomorrow.ca/info/for\\_teachers](http://beta.albertatomorrow.ca/info/for_teachers)
  - o Sign Up – Students can Sign up too! Visit  
[http://beta.albertatomorrow.ca/GIS\\_Simulator/Auth/Signup](http://beta.albertatomorrow.ca/GIS_Simulator/Auth/Signup)
  - o Login and Set Your Location then go to “Field Studies”
  - o Click on “New Observations” And enter your water quality results.

### Behavioural Expectations of ALL Group Members:

- o Remain in the assigned group and keep in sight of supervisors at all times.
- o There is always an adult leader in the lead and at the end of the group.
- o NEVER remove natural items from the area. Vegetation, insect, mammal, bird and amphibian life is to be respected and left in the natural habitat.
- o Leave no trace of our visit. All litter must be brought out by you.
- o Unsafe behaviour such as tripping, wrestling, and teasing is unacceptable and may result in withdrawal from the activity.
- o Cooperation by listening, participating in group discussions, observing and recording is expected during the learning experience.
- o Each adult is expected to participate in the activities and to provide due safety and care for each of the students.



### **Weaselhead History:**

It is unknown exactly how the Weaselhead area received its name. It is however known that it has nothing to do with weasels, nor a weasel's head. Some say the area is named after the Chief of the T'suu Tina First Nations people holding authority at the time of early European contact. Sam Livingston, whose house is now part of Calgary's Heritage Park, was the original European settler to the Elbow River valley in the region now known as the Weaselhead.

Today, the Weaselhead Natural Environment Area covers approximately 404 hectares or 989 Acres and receives the highest level of protection available to a Calgary Natural Area. The area consists of the Elbow River, the north and south escarpments of the river valley, the river floodplains and delta. A walk through the area will give the keen observer insight into the geological, anthropological and natural history of the area.

The river was formed by the melt waters from the glaciers at the end of the last glaciation period approximately 10 thousand years ago. Today's floodplains hold many clues to the past. We can see previous routes taken by the river by looking at the cutbanks, pointbars, and oxbow wetlands.

Fossils dating back 35 million years can be seen in the sandstone deposits along the cliffs of the river valley. There are numerous indigenous archaeological sites, including buffalo kills and hunting campsites that can be dated as recently as the buffalo runs that existed in 1887.

The natural history of the area is extensive. Coniferous forests of White spruce can be found next to deciduous riverine forests of Balsam poplar mixed with shrubs such as Red-osier dogwood and wolf willow (silver-berry) and stands of Trembling aspen. During the warm seasons wildflowers bloom in the grassland areas. There are numerous aquatic habitats ranging from riverine wetlands, to beaver ponds, to the river itself; all supporting a variety of aquatic plant life. The flora of the area is made up of some 480+ species. Some of these species are endangered or threatened such as the Western wood lily.

The varied plant life supports a variety of wildlife forms. There are untold numbers of invertebrates both aquatic and terrestrial. At least ten species of fish are known, with several being sought by sport fishers. Although there have been no recent recorded sightings of the endangered northern leopard frog it was once found in this area. Amphibians are found in the area such as the tiger salamander, the boreal chorus frog and the wood frog. Few reptiles inhabit Alberta, but the garter snake is sometimes seen here. Over 200 species of birds, from waterfowl, to song birds, to raptor use the park. Some of these use the region as a stopover during fall and spring migrations, others nest in the Weaselhead during the summer months, still others live here all year round. For mammals like the shrews, hares, deer, and beaver, the Weaselhead Natural Area provides a permanent home. Other species, including moose, black bear, and lynx are known to use the region on a seasonal basis.

*REMEMBER: Never remove anything from the area. Fossils and certain plant species are protected in Alberta*



## Aquatic Ecosystems

- The aquatic ecosystems of the planet carry the greatest biodiversity. We still know little about many of the species that inhabit these ecosystems.
- Aquatic ecosystems include rivers, lakes and wetlands. They all contain water at the surface or near the surface.
- Aquatic life is influenced by the temperature of the water, the depth to which light penetrates, the nutrients found in the water, the pH level of the water, the amount of dissolved oxygen, and the soil substrate.
- If we were to look at the food web of aquatic invertebrates we would find primary producers in the form of phytoplankton, algae, aquatic mosses, and vascular plants (water lilies).
- Primary consumers in the form of zooplankton, invertebrates, fish, birds, and mammals (beaver).
- Secondary consumers in the form of invertebrates (dragonfly nymphs) and vertebrates (fish and coyotes). There are also scavengers (invertebrates and fish) and decomposers (microorganisms) present.
- Management of our aquatic ecosystems can be seen in the allocating of water for different uses, the monitoring of water quality, the monitoring of flow rates, the regulating of discharges into bodies of water and research on aquatic ecosystems.

## Fresh Water Cycles

### The Nitrogen Cycle:

- Nitrogen gets washed into the rivers, lakes and oceans. This may be from natural sources or from pollution.
- The blue-green algae that is found in aquatic habitats plays an important role in Nitrogen Fixation, which is the conversion of atmospheric nitrogen into a form that plants are able to use.

### The Carbon Cycle:

- In aquatic ecosystems we find photosynthesis taking place in the surface water. This is the depth to which the sun can reach.
- Many carbon stores from decomposition end up in streams, rivers and lakes from runoff.
- The carbon in the cycle moves back and forth between the atmosphere and the water.

### The Sulfur Cycle:

- The production of hydrogen sulfide and sulfate occurs in marshes, ponds, lakes, and oceans.
- This can be noticed in the form of “swamp gas” rotten egg smell.
- “Acid Rain” occurs when there is too much sulfur in the atmosphere.

### The Phosphorus Cycle:

- Small amounts of this nutrient enter the aquatic environment.
- It may be used by aquatic plants.
- If it settles to the bottom it may become part of newly formed rocks.
- Seabirds in coastal areas supply a rich source of phosphorus in the form of Guano.



### The Water Cycle:

- Water constantly changes form. It is this constant change that limits the amount of water available in the fresh water form.
- Pollution build up in the cycle also affects the amount of fresh water in a usable form.

### **Introduction to Alberta's Fresh Water**

- Alberta contains 2.2% of Canada's fresh water. We have one of the lowest percentages in all of Canada. This freshwater can be found in 5 major river systems, several thousand lakes and numerous wetlands.
- This 2.2% supplies drinking water, water for crops, water for industrial processes and generation of electricity.
- Precipitation in the mountains or lack of can have an effect on the water supply to Calgarians as our water needs are supplied by the bow and the Elbow, both of which are dependent on annual rain and snowfall.
- The primary sources of water for human use in Alberta are our rivers. Unfortunately we also use these same rivers for the discharge of waste.
- Groundwater is an important water resource. Many of the people in Alberta are dependent on groundwater of their water supply.

### **Freshwater of the Weaselhead Area**

- The Weaselhead area is found along the Elbow River watershed at the mouth of the river leading into the Glenmore reservoir. The area of the valley making up the Weaselhead has been a part of the river valley, although the mouth of the river was formed with the flooding of the river valley by the completion of the dam.
- There are a number of wetland ecosystems found within this area. All of these ecosystems help in keeping the quality of the water in the reservoir high. In the valley, groundwater is pushed through the glacial scree, helping to filter it. The wetland plants absorb pollutants, assisting with the filtration of the water.

### **The Elbow River Watershed**

- A watershed is the region that drains into a particular body of water. It includes both the aquatic and terrestrial components.
- The Elbow River Watershed is found within a larger watershed. The Elbow River flows from the Kananaskis through the Weaselhead where it empties into the Glenmore Reservoir. The water then flows through the dam and links up with the Elbow again.
- The Elbow River flows through downtown Calgary where it drains into the Bow River just west of the Calgary Zoo at a place known as the confluence or traditionally for the Blackfoot, Mohkinstsis. The Bow River then flows south down towards Medicine Hat where it drains into the South Saskatchewan River
- From here the water flows through Saskatchewan where it meets up with the North Saskatchewan. This flows into the lakes in Manitoba and through the Nelson River until It ends its fresh water travels in the Hudson Bay.
- The Elbow River is part of what is known as the Hudson Bay Drainage Basin.
- 75% of the water in the Elbow River Watershed comes from mountain snow melt. This leads to seasonal fluctuation in the flow rate. The highest flow rate is seen in mid May to mid July.



- The Elbow River is the source of nearly half of Calgary's water supply.
- The watershed covers an area of 1210km<sup>2</sup>. It flows from Kananaskis country through Bragg Creek and drains into the Glenmore Reservoir. Before it reaches the Reservoir, it travels 120km through 4 eco-regions.
- The 4 eco-regions consist of: Prairie Farmland directly to the west of the reservoir, although in the last few years much of this farmland has been turned into residential areas. Further west it rises 150 feet into the foothills. The foothills are covered with Aspen Parkland and Spruce Groves. On the western edge of the watershed there is a mixture of Sub-Alpine and Alpine Valleys. The Sub-Alpine is mostly made up of Spruce and Pine forests. While in the Alpine Region the mountains rise up 1000 meters above the valley and only dwarf shrub vegetation is found there.

### **The Elbow River**

- The green clear water of the Elbow is due to the glacial lake that feeds it. The Elbow River once meandered through the river valley. Now it is the water source for the Glenmore Reservoir. The river runs along the north side of the valley through the Weaselhead area. The delta where the river and the reservoir meet is found at the east end of the area.

### **Beaver Lagoon**

- This lagoon feeds off the Elbow River just west of the pedestrian bridge. It is home to muskrats and a number of nesting ducks and geese. Surrounded by the Spruce Forest this sheltered spot is a great place to sit and watch wetland birds.
- Emergent plants are found more to the south end of the lagoon where there is less water movement. The level of water does not fluctuate as much as the other wetlands during the year, except in times of flooding and drought when the river level is affected.

### **Oxbow**

- Found in the centre of the natural area this wetland was formed when a bend in the river was cut off and the river changed course. This now becomes an overflow area for water when the runoff is very high. Water levels fluctuate over the year depending on the water table and the amount of precipitation.
- Boreal Chorus Frogs and Wood Frogs are found here. The pond is full of emergent plants, made up mostly of Common Scouring Rush and Mares-tails. This oxbow is home to a number of invertebrates. This is a good area to carry out a pond study due to the floating bridge.
- Owls often frequent the trees along the shore and a number of songbirds can be found here, especially in the spring when the birds are migrating north.

### **Beaver Pond**

- Home to our beavers, this pond was formed through the hard labor of this native species. The dam was built at the east end of the pond a number of years ago and is hard to distinguish from the other vegetation as the dam is now covered in plant life.
- The level of this pond fluctuates with the climate and the amount of precipitation, but there is usually some water in it. Beavers also monitor the water levels, sometimes opening the dam to allow it to drain to a certain level.



- You can see where the beaver had been busy on the hill on the south side of the pathway. The beaver will usually use the Balsam Poplar to repair its dam and lodge. The Trembling Aspen bark is used as its main food source.
- The Wood Frog calls this pond its home; you can hear the males, at dusk, in the spring.

### **Delta Mud Flats**

- This is the area where the river flows into the reservoir. This area of marsh plays an important role as a nesting site for many species of waterfowl. Because most waterfowl nest on the ground, this area is closed to recreational activities.
- The Delta Mud Flats was formed as a result of the construction of the Glenmore Dam. Over the years sediment settled at the mouth of the river and wetland plants and habitat established.
- Settlement has continued upstream of the Delta Mud Flats and the Weaselhead area has experienced a loss of fish spawning habitat as a result.

## **Wetlands: Important to a Healthy Environment**

### **Definition of a Wetland**

- A wetland is an area where the land is saturated with water long enough to have poorly drained soil, water loving plants and biological processes associated with wet areas. Generally the soils are low in oxygen and plant life in these areas is specifically adapted to these conditions. They are water tolerant plants equipped with special air chambers in their stems that carry oxygen from above the water level down to the roots. Water pools in these areas either permanently or seasonally. They are characterized by alternating periods of flooding followed by periods of drying.
- The edges of the wetland usually have a very healthy plant population. In the wetland itself there are submerged plants. These plants are totally underwater (ex. Algae). Emergent plants are partially in water and partially out of the water (ex. Cattails).

### **Importance of Wetlands**

- When looking at wetlands it is not just the wetland itself that is important and vital but the surrounding margins as well. They are dynamic and ever changing. They are not stagnant environments. They are at the mercy of the hydrological cycle and are affected by whatever happens upstream.
- Wetlands are natural purifiers of water. They trap sediments absorbing the excess nutrients and heavy metals.
- Wetlands are highly productive and play an active role in hydrological function, life support, water quality, economics and our society and heritage:

Hydrological Functions- Wetlands act as a natural reservoir by slowing the water flow in times of flooding and help to maintain the water table at other times. Evaporation from plants is a source of water to the atmosphere and helps to contribute to rain. They reduce erosion as they slow down the flow of water. They increase the soil moisture in the border areas. When one wetland in an area is disrupted it may affect all others in the area due to the transportation of water underground.

Life Support- Wetlands provide food, water and shelter for a number of species. They support many endangered, threatened species. In Alberta 158 species of birds are dependant



on wetlands for some part of their life cycle. The Boreal wetlands of the province are highly important to waterfowl. Along with birds, wetlands support a number of mammals, amphibians and reptiles either directly or indirectly. There is also support for a great diversity of plant life. Amphibians are important to the wetland as they act as ecological indicators. For birds the wetlands supply nesting areas and a high invertebrate food source. Benthic invertebrates, those found on the bottom of the pond, are good indicators of pollution. Stonefly and Mayfly nymphs are highly sensitive to pollution, caddis fly and chironmids can tolerate pollution moderately, and worms are highly tolerant. Invertebrates may live through their whole life cycle in a wetland or for just a part. Fish use wetlands as breeding grounds.

Water Quality- Wetlands act as giant filters removing sediment, absorbing nutrients, removing chemical residues and treating water waste. They are known as “Nature’s Kidneys”. They decrease the nutrient contamination. There are often cases where there is too much nutrient in the water which causes an algal bloom decreasing the level of oxygen in the water. With the wetlands absorbing much of the excess, the rivers are kept clean of algal blooms that can affect the native habitat species. Vegetation in the wetlands helps to remove chemicals and cleanses and purifies the water.

Effluent from pulp and paper mills, if filtered through a wetland first, does not destroy the river ecosystem. An old myth that was the cause of many wetlands being filled in on the prairies was that they gave off gases causing death. Often the high level of gases in a wetland occurred when the farmers were dumping their raw sewage into them. In Calgary we are now experimenting with building Wetlands to act as water purifiers and hydrological storage areas. These help to clean water from storm sewers and to store water to help with drought conditions. It is important when they design these wetlands that they include wildlife habitat into the design.

Economic- Wetlands are important for tourism, fishing, hunting and peat extraction in this province. They are also starting to be used for forage crops like wild rice.

Social and Heritage- They create stimulating natural experiences like bird watching. They have educational value through field trip experiences. Scientific research takes place on and around wetlands. An example of this is research in the decline of frog populations.

- Wetlands are not only threatened by human activity but by pollution and climate change.
- In Alberta, wetlands cover 21% of the province with most of these found in the northern part of the province. The most northerly wetlands tend to be permanent while the more southerly ones tend to be more temporary.

### **Life in Wetlands**

- There are insects in a wetland that need to breath from the air while others are able to extract the oxygen from the water.
- There are a number of ways that invertebrates get their food. Some are herbivores eating the plant life, which helps to keep the levels of algae under control. Carnivores are also present. These feed on invertebrates, fish, microorganisms, and tadpoles. There are a few invertebrates that are omnivores and tend to feed on what is available.
- The invertebrates in the water tend to move in a number of ways as well. Some tumble through the water; these are usually from the fly family. Some are able to stride along



- the water surface without breaking the water tension. Some get around by propulsion and others take a leisurely row. Some even carry their houses around on their backs.
- Purple Loosestrife is an introduced species from Eurasia. It crowds out the native wetland species. Eventually the whole food web of the wetland is affected by the invasion of this species.

### **Two Types of Wetlands**

- The wetlands of Alberta can be divided into two categories; either Peat Lands or Non-Peat Lands. 93% of all the wetlands in Alberta are Peat Lands.
- Peat Lands are made of peat, which is the partially decomposed sedges, rushes, grasses and mosses that pile up over the years. Peat Lands can be either Bogs or Fens.
- Non-Peat Lands are all other types of wetlands, swamps, marshes and ponds. They are not common in Alberta.
- Marshes may also be referred to as sloughs and are found in depressions. Water collects in these depressions usually seasonally. There are many emergent plants in a marsh and they are where water collects from run-off, snow and rain. Beavers build ponds by damming up one end of flowing water.
- The Oxbow and the Lagoon in the Weaselhead are known as Bottomland/Riverine wetlands. These wetlands are found along the floodplains of rivers and streams. They fill with spring melt water or seepage from the slopes of the river valley embankment. These areas were created by river scoring during floods or by old river scars and oxbows.

### **Wetlands and Climate Change**

- Evapotranspiration- Wetland plants take up water and release it into the atmosphere. Two thirds of the annual water in a wetland is cycled into the atmosphere.
- Cloud Seeding- Wetlands give off sulfide which helps to seed clouds.
- Modulate Temperature- Wetlands modulate the temperature of the adjacent uplands (the higher area around a wetland).
- Carbon Cycle- Wetlands play a role in the carbon cycle acting as “carbon sinks”.
- Hydrological cycle- Wetlands play an important role in the hydrological cycle. Especially in times of major hydrological events like flooding.
- Water Volume- Low water volume in a wetland increases the concentration of pollution in the area. Wetlands are sinks for heavy metal pollutants.
- Wetland Life Forms- Small changes in the temperature could have a significant effect on the wetland life forms (biota).

### **The Protection of Wetlands**

- The decline in wetlands in some places is as much as 60%. We are just starting to realize their value in a healthy environment. Where are starting to see the importance of them in urban settings as well as rural.
- In urban areas the main loss is due to urban spread. In rural areas the main loss is due to drainage to increase the amount of farmable land.
- Around the Calgary area 75% of our wetlands had been eliminated by 1966.
- We must remember though that when protecting wetlands the adjacent land must be considered as well. There needs to be a “buffer” of protection around the wetland.
- We can protect for the future through education.



**Biotic and Abiotic factors affecting the fresh water of the Weaselhead Natural Area.**

| Aquatic Environment |                               | Beaver Lagoon            | Elbow River              | Oxbow                |
|---------------------|-------------------------------|--------------------------|--------------------------|----------------------|
| Abiotic Factors     |                               |                          |                          |                      |
|                     | <b>Turbidity</b>              | Clear                    | Cloudy                   | Clear                |
|                     | <b>Surface Temperature</b>    | 5°C                      | 6°C                      | 1°C                  |
|                     | <b>Middle Temperature</b>     | 5°C                      | 5°C                      | 2°C                  |
|                     | <b>Bottom Temperature</b>     | 5°C                      | 4°C                      | 3°C                  |
|                     | <b>Velocity</b>               | 0.7 m/s                  | 10 m/s                   | 0 m/s                |
|                     | <b>Dissolved Oxygen</b>       | 5 ppm                    | 6 ppm                    | 4 ppm                |
|                     | <b>pH</b>                     | 7                        | 7.5                      | 6                    |
|                     | <b>Nitrate</b>                | <2.5 mg/L                | <2.5 mg/L                | <2.5 mg/L            |
|                     | <b>Nitrite</b>                | 0 mg/L                   | 0 mg/L                   | 0 mg/L               |
|                     | <b>Ammonia</b>                | 0 mg/L                   | 0 mg/L                   | 0 mg/L               |
| Biotic Factors      |                               |                          |                          |                      |
|                     | <b>aquatic plant life</b>     | pondweed                 | algae                    | mare's tail          |
|                     |                               | rush                     |                          | waterbuttercup       |
|                     |                               | algae                    |                          | coontail             |
|                     | <b>terrestrial plant life</b> | white spruce             | wolf-willow(silverberry) | labrador tea         |
|                     |                               | pussy willow             | pussy willow             | bog willow           |
|                     |                               | red-osier dogwood        | white spruce             | white spruce         |
|                     | <b>animals</b>                | wood frog                | white tailed deer        | red winged blackbird |
|                     |                               | muskrat                  | canada goose             | boreal chorus frog   |
|                     |                               | coyote                   | northern pike            | tiger salamander     |
|                     | <b>aquatic invertebrates</b>  | predacious diving beetle | stonefly nymph           | horsehair worm       |
|                     |                               | water strider            | caddisfly larva          | snail                |
|                     |                               | fairy shrimp             | mayfly nymph             | water mite           |



| Location                         | Temperature | Dissolved Oxygen Concentration |
|----------------------------------|-------------|--------------------------------|
|                                  | (° C)       | (ppm)                          |
| Kananaskis                       | 2.5         | 6                              |
| After Elbow Falls                | 2           | 7                              |
| Bragg Creek                      | 4           | 4                              |
| Elbow Valley Estates             | 5.5         | 5                              |
| Above storm sewer outlet in W.H. | 6           | 5                              |
| Class Data                       | 6           | 5 to 6                         |
| Glenmore Reservoir               | 6           | 3                              |
| Sandy Beach                      | 6.5         | 5                              |
| By Ft. Calgary                   | 9           | 4 to 5                         |

### Biological Water Quality Indicators

There are many species found in the aquatic environments that are good indicators of water quality.

We can divide the organisms into two groups:

Pollutant Tolerant Species: these are able to survive in both clean water and in dirty water.

Pollutant Intolerant Species: these are able to survive only in clean water.

Examples:

Mayfly Larvae

Stonefly Larvae

Dragon Fly Larvae

True Bug Larvae

Beetle Larvae

Caddisfly Larvae

Freshwater Sponges

Trout

Frogs

Toads

Salamanders

If you are looking for information on bioindicators this is a good website to visit:

<http://lakes.chebucto.org/ZOOBENTH/BENTHOS/benthos.html>



