Bigstone

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5.13 BIGSTONE SUBWATERSHED

The Bigstone Subwatershed is covered by the Dry Mixed Wood and Central Parkland natural subregions. The Bigstone Subwatershed is the headwaters of the Battle River watershed, which originates from Battle Lake. The Battle River watershed in Alberta includes the Subwatersheds of Bigstone, Paintearth, Iron, Ribstone and Blackfoot. The Battle River flows out of Alberta eastward to meet the North Saskatchewan River at North Battleford, Saskatchewan.

The Bigstone Subwatershed encompasses 727,714 hectares including 41,558 hectares (5.7%) of natural and artificial water bodies. The 16,471 acre Medicine Lake Provincial Grazing Reserve is in the Subwatershed. The Bigstone Subwatershed includes the Counties of Camrose, Flagstaff, Lacombe, Leduc, Ponoka and Wetaskiwin. Settlements in the Subwatershed include Argentia Beach, Armena, Bawlf, Bittern Lake, Blackfalds, Camrose, Crystal Springs, Daysland, Edberg, Falun, Golden Days, Grandview, Gwynne, Hay Lakes, Heisler, Hobbema, Itaska Beach, Kelsey, Lacombe, Ma-Me-O Beach, Millet, Morningside, Mulhurst Bay, New Norway, Norris Beach, Ohaton, Pipestone, Ponoka, Poplar Bay, Rosalind, Silver Beach, Westerose, Wetaskiwin, and the First Nations' reserves of Louis Bull 138B, Samson 137, Samson 137A, Ermineskin 138, Montana (Bobtail) 139, and Pigeon Lake 138A.

Soils types in the Subwatershed are among the most fertile in Alberta and the primary economic base is agriculture. In addition, oil and gas operations are common.

Recreational activities are common in the region and are concentrated in areas such as Pigeon Lake and Ma-Me-O Provincial Parks.

Many of the indicators described below are referenced from the "Bigstone Hydrological Overview" map located in the adjacent map pocket, or as a separate Adobe Acrobat file on the CD-ROM.

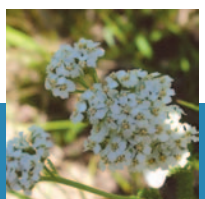
5.13.1 Land Use

Changes in land use patterns reflect major trends in development. Land use changes and subsequent changes in land use practices may impact both the quantity and quality of water in the Subwatershed and in the North Saskatchewan Watershed. Five metrics are used to indicate changes in land use and land use practices: riparian health, linear development, land use, livestock density, and wetland inventory.

5.13.1.1 Riparian Health

The health of the riparian area around water bodies and along rivers and streams is an indicator of the overall health of a watershed and the impact of changes in land use and management practices. Riparian inventory data were collected for Pipestone Creek in 1999 (ARHMP Cows and Fish, unpublished data). Of the 33 quadrats sampled, 79% were considered healthy, 18% were healthy with problems, and 3% scored in the unhealthy range. Noxious weeds like Canada Thistle and Common Tansy were serious issues, as was the over-utilization of trees and shrubs. Insufficient rootmass and high percentages of bare ground were other major problems, as was the presence of pugging and hummocking in wet areas.

Riparian inventory data were collected for Bigstone Creek in 1999 (ARHMP Cows and Fish, unpublished data). Of the 24 quadrats sampled, 50% were considered healthy, 25% were healthy with problems, and 25%




scored in the unhealthy range. Noxious weeds like Canada Thistle and Common Tansy were serious issues, as was the over-utilization of trees and shrubs. Insufficient rootmass and high percentages of bare ground were other major problems, as was the presence of pugging and hummocking in wet areas.

Riparian inventory data were collected for the Battle River in 2000 (ARHMP Cows and Fish, unpublished data). Of the 47 quadrats sampled, 72% were considered healthy, 26% were healthy with problems, and 2% scored in the unhealthy range. The presence of noxious weeds, especially Canada Thistle and Common Tansy was a major problem. The over-utilization of trees and shrubs, insufficient rootmass, and bare ground were other important issues.

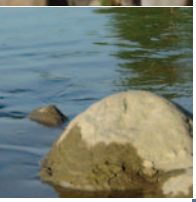
Riparian inventory data were collected for Pigeon Lake Creek in 2000 (ARHMP Cows and Fish, unpublished data). Of the 9 quadrats sampled, 33% were considered healthy, 45% were healthy with problems, and 22% scored in the unhealthy range. Canada Thistle was a major problem, as was the over-utilization of trees and shrubs. Insufficient rootmass that contributes to bank slumping was another identified concern, as was the presence of bare ground.

Riparian assessment data were collected for Mink Creek in 2001 (ARHMP Cows and Fish, unpublished data). Of the 6 quadrats sampled, 50% were considered healthy, 50% were healthy with problems. The major problems noted were the presence of the noxious weed Canada Thistle and the regeneration of trees and shrubs.

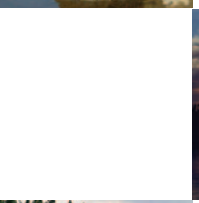
Riparian assessment data were collected for Poplar Creek in 2001 (ARHMP Cows and Fish, unpublished data). Of the 22 quadrats sampled, 77% were considered healthy, 18% were healthy with problems, and 5% scored in the unhealthy range. The major problem noted was the presence of the noxious weeds Canada Thistle and Scentless Chamomile.

Riparian assessment data were collected for Sun Creek in 2001 (ARHMP Cows and Fish, unpublished data). Of the 4 quadrats sampled, 25% were considered healthy and 75% were healthy with problems. Canada Thistle was identified as a major problem, as was over-utilization of trees and shrubs.

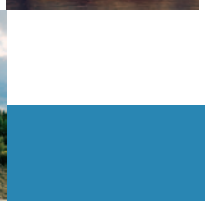
Riparian assessment data were collected for Modeste Creek in 2001 (ARHMP Cows and Fish, unpublished data). Of the 6 quadrats sampled, 67% were considered healthy and 33% were healthy with problems. Noxious weeds like Canada Thistle were a major problem, along with the over-utilization of trees and shrubs.



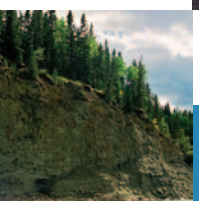
Riparian assessment data were collected for Muskeg Creek in 2001 (ARHMP Cows and Fish, unpublished data). Of the 10 quadrats sampled, 30% were considered healthy, 50% were healthy with problems and 20% scored in the unhealthy range. The over-utilization of trees and shrubs was found to be a major problem, as was the presence of pugging and hummocking in wet areas.



Riparian assessment data were collected for Lloyd Creek in 2001 (ARHMP Cows and Fish, unpublished data). Of the 8 quadrats sampled, 100% were considered healthy. The over-utilization of trees and shrubs was found to be the major problem, along with the presence of Canada Thistle.



Riparian assessment data were collected for Rose Creek in 2001 (ARHMP Cows and Fish, unpublished data). Of the 8 quadrats sampled, 88% were considered healthy and 12% were healthy with problems. The over-utilization of trees and shrubs was found to be a major problem, as was a high percentage of bare ground in some areas and presence of Canada Thistle and Tall Buttercup in the riparian area.






Riparian assessment data were collected for Elk Creek in 2001 (ARHMP Cows and Fish, unpublished data). Only 1 quadrat was sampled and that parcel was considered to be healthy. The over-utilization of trees and shrubs, and the presence of Canada Thistle were problems.

Riparian assessment data were collected for Horseshoe Creek in 2001 (ARHMP Cows and Fish, unpublished data). Of the 8 quadrats sampled, 75% were considered healthy and 25% were healthy with problems. Canada Thistle and Common Tansy in the riparian area were found to be a major problem, as were the over-utilization of trees and shrubs, and high percentages of bare ground.

Riparian assessment data were collected for Washout Creek in 2001 (ARHMP Cows and Fish, unpublished data). Of the 17 quadrats sampled, 71% were considered healthy, 23% were healthy with problems, and 6% scored in the unhealthy range. The presence of Canada Thistle and the over-utilization of trees and shrubs were found to be major problems.

Riparian inventory data were collected for the County of Camrose on the Battle River and at Driedmeat Lake in 2001 (ARHMP Cows and Fish, 2002a). A total of 25.4 kilometres of shoreline along the Battle River and 1.8 kilometres of shoreline around Driedmeat Lake were assessed. Two-thirds of the quadrats sampled on both the Battle River and Driedmeat Lake were assessed as 'healthy, but with problems', with another 10% assessed as 'healthy'. The remaining 24% of the shorelines were considered 'unhealthy'. Major problems included the presence of invasive and disturbance-caused vegetation, utilization of preferred trees and shrubs and human alteration of shore vegetation, bank vegetation and shore structure.

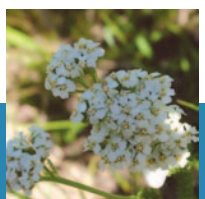
5.13.1.2 Linear Development

Quantifying linear development in the Subwatershed helps us understand potential changes in water quality and quantity, fish and wildlife populations, and riparian health. Linear development affects about 2.6% (18,655 ha) of the land in the Bigstone Subwatershed. The majority of linear developments (68%) are roads of one form or another. Approximately 76% of roads are gravel and unimproved. Paved roads account for about 21% of road development. Other linear developments include pipeline rights of way, (14% of the area of linear developments), cutlines (8%), power lines (6%) and used or abandoned rail lines (4%).

5.13.1.3 Land Use Inventory

An inventory of land uses quantifies natural landscape types and uses and may be used to explore changes in water quality and quantity, fish and wildlife populations, and riparian health. Water bodies, both natural and constructed, including lakes, rivers, streams, wetlands, dugouts and reservoirs cover 6% of the Subwatershed. The vast majority of the Subwatershed overlaps various land uses related to agricultural production: forage, 37%; cropland, 32%; and grassland, 22%. Only about 3% of the Subwatershed is treed.

Including those areas affected by linear development, about 9% of the land area in the Subwatershed has been disturbed by various forms of development. Municipalities of various sizes, including the City of Camrose and Town of Lacombe, affect about 1.4% of the Subwatershed; six First Nations' reserves cover 4.4% of the Subwatershed. The remainder of the land disturbance is related to linear developments (2.5%), wellsites (1%), and industrial sites (0.1%).




5.13.1.4 Livestock Density

Areas of higher livestock density may be expected to have greater impacts on downstream aquatic systems. Manure production was used as a surrogate for livestock density. Manure production information was available only on the basis of soil polygons. These polygons do not correspond to the Subwatershed boundaries and provide only a rough estimate of manure production within the actual watershed. Based on the available information, livestock densities in the Bigstone Subwatershed are among the highest in the North Saskatchewan Watershed especially in the southern part of the Subwatershed along the Highway 2 corridor. In that area, manure production ranges from 1,768,000 to 10,570,000 tonnes. Based on findings from Alberta Agriculture, surface water in this Subwatershed is more susceptible to enrichment from phosphorus, and contamination from pesticides and fecal coliforms (CAESA 1998).

5.13.1.5 Wetland Inventory

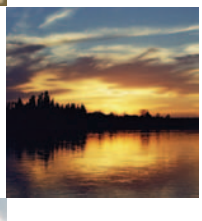
Wetlands serve many functions in the natural landscape. The loss of wetlands to development can have impacts on water quantity and quality to downstream habitats. The available hydrology data showed that wetlands accounted for less than one-tenth of a percent (514 ha) of the land area in the Bigstone Subwatershed. However, an inventory completed by Ducks Unlimited Canada for the Subwatershed found a total of 54,111 hectares of wetlands (7.4% of the Subwatershed area). The inventory included both permanent and temporary wetlands.

5.13.2 Water Quality and Quantity

Water bodies in the Subwatershed include the Battle River, and the Maskwa, Bigstone, and Pipestone Creeks. Some of the larger lakes in this Subwatershed include Pigeon, Bittern, Red Deer, Driedmeat, Coal, Miquelon, Samson, and Battle. Many of the lakes and wetlands in the Subwatershed are somewhat saline. Lakewatch data for Driedmeat Lake (1999), Battle Lake (2001) and Pigeon Lake (2001) are available from ALMS. The Battle River Riparian Partnership in Camrose and the Community Riparian Program in Westaskiwin are active community watershed groups in the Bigstone Subwatershed. Check with Alberta Watersheds site.

Most towns and cities in the Subwatershed have wastewater treatment lagoons that discharge directly into the Battle River or one of its tributaries. Camrose discharges into Camrose Creek, Wetaskiwin and Millet into Pipestone Creek, Lacombe into Wolf Creek, and Ponoka into the Battle River.

No LTRN water quality stations exist in this Subwatershed, therefore no long term water quality data has been summarized. Two stations on Bigstone Creek were sampled for fecal coliforms and TP during the years 2000-2002. The 20 fecal coliform samples ranged from <10 to 680 counts/100 mL, and averaged 115 counts/100 mL. Some of these samples were above the CCME Surface Water Quality Guidelines for Contact Recreation. The 20 TP samples ranged from 0.095 to 0.305 mg/L, and averaged 0.169 mg/L. Pesticide detections in this Subwatershed included 2,4-D, MCPA, MCPP, Dicamba and Picloram, all of which were below the CCME Surface Water Quality Guidelines for the Protection of Aquatic Life. Clopyralid and Triclopyr were detected but there currently are no water quality guidelines regarding these compounds.



Unlike most systems in Alberta, the Battle River system does not derive its base flow from mountain snowpack or glacial meltwater but depends on limited groundwater sources and runoff. Therefore, land use practices have a much higher capacity to impact surface water quality.




Water quantity is measured at seventeen HYDEX stations (05FA001-05FA002, 05FA007-05FA008, 05FA010-05FA012, 05FA014-05FA015, 05FA017-05FA019, 05FA021-05FA024, and 05FA912). One station has real-time online data (05FA001). Figure 22 shows the Pipestone Creek hydrograph, which is typical of a non-glacial fed stream. Flow contributions are from spring runoff and summer storms only.

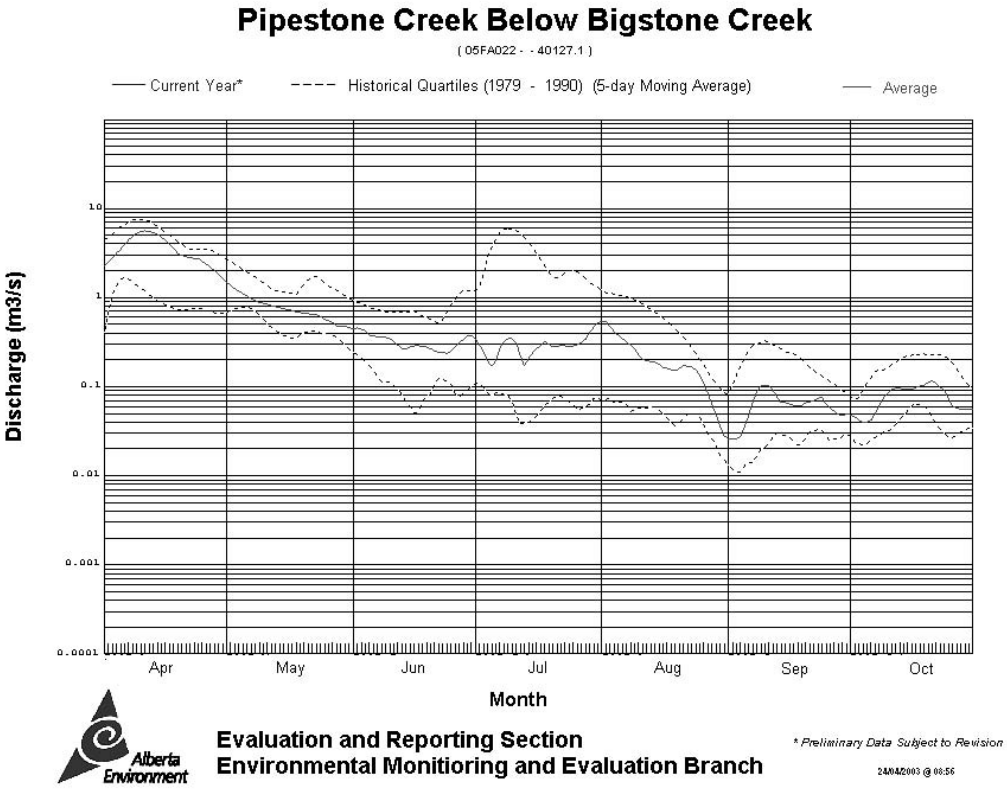


Figure 22: Pipestone Creek below Bigstone Creek mean monthly discharge for the open water season (Station 05FA022).

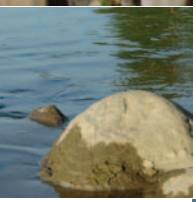
5.13.3 Biological Indicators

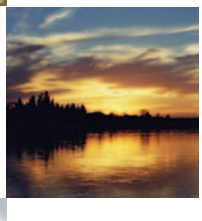
Biological indicators include information on plant and animal species from which various aspects of ecosystem health can be determined or inferred by linking this information to information on water quality and quantity, land use and management practices.

5.13.3.1 Aquatic Macrophytes

The growth of aquatic macrophytes is directly related to the availability of the nutrient phosphorus in the water in which they are growing. Excessive growth may indicate decreased water quality, which, in turn, may be linked to various point (wastewater outfalls) or non-point (general run-off) sources related to municipal development or land use practices.


No published assessment of aquatic macrophytes was found for the lakes, wetlands, rivers or creeks in the Bigstone Subwatershed, so we cannot make any inferences about ecosystem health for this Subwatershed using this indicator. This data gap could be addressed in future research within the Bigstone Subwatershed.





5.13.3.2 Fish Population Estimates

Inventories of selected fish populations may show changes in the presence and abundance of species that may be related to environmental factors including changes in water quality or quantity. Fish species in the Bigstone Subwatershed are similar to those in the Modeste Subwatershed. White suckers and pike are widely distributed and lake whitefish, burbot and yellow perch occur in Battle and Pigeon lakes. Walleye were indigenous to Pigeon Lake and have been reintroduced. The upper portion of the Battle River provides cool water fish habitat. Northern pike are the only sport fish and are limited in distribution and numbers because of low flows and barriers to movement (Allan 1984).

5.13.3.3 Vegetation Types

Inventories of flora populations may show changes in abundance that may be related to environmental factors including changes in land use practices. The Bigstone Subwatershed is located in both the Dry Mixedwood and Central Parkland ecological subregions. The Dry Mixedwood Subregion includes tree species such as aspen, balsam poplar, white spruce, balsam fir and jack pine, and is host to many peatland areas. The Central Parkland is composed mainly of grassland with aspen, to aspen parkland to closed aspen forest. Species include trembling aspen and balsam poplar.

5.13.3.4 Benthic Invertebrates

Inventories of benthic invertebrate populations may show changes the presence and abundance of species that may be related to changes in water quality. No published assessment of benthic invertebrates was found for the lakes, wetlands, rivers or creeks in the Bigstone Subwatershed, so we cannot make any conclusions about ecosystem health using this indicator. This data gap could be addressed in future research within the Bigstone Subwatershed.

5.13.4 Bigstone Summary

The Bigstone is a Subwatershed of the Battle River watershed. It includes several towns and First Nation's Reserves. Soils types are among the most fertile in Alberta and the vast majority of the Subwatershed is under high agricultural intensity. Only 3% of the Subwatershed is treed. Livestock densities in the Bigstone Subwatershed are among the highest in the North Saskatchewan Watershed especially along the Highway 2 corridor. Oil and gas operations are common. Water bodies cover 6% of the Subwatershed and larger lakes are used for recreation.

Riparian health has been assessed for 25.4 kilometres along the Battle River and 1.8 kilometres around Driedmeat Lake. These assessments indicate that most of the habitat is either "healthy but with problems" or "unhealthy". Major problems included the presence of invasive and disturbance-causing plants, preferred grazing, and human alteration of shore vegetation, bank vegetation and shore structure. It is not known if these assessments reflect general conditions in the Subwatershed or localized conditions. Further assessments should be conducted to determine the need for remedial action.




Linear developments affect about 2.6% of the Subwatershed. This is mostly roads, but also includes pipeline rights of way, cutlines, power lines, and rail lines. Another 7% of the land area is affected by development including municipalities, First Nations' reserves, well sites and industrial sites.

The hydrology data showed that wetlands accounted for less than 0.1% of the land area in the Subwatershed. In contrast, Ducks Unlimited Canada inventory data show wetlands as covering 7.4% of the area. This variance should be resolved prior to developing management plans for the Subwatershed.

Most municipalities in the Subwatershed have wastewater treatment lagoons that discharge into the Battle River or one of its tributaries; however, no long-term river water quality information exists for this Subwatershed. A long-term river network station could be established on the Battle River downstream of Camrose.

Water quantity is measured at seventeen stations: one station has real-time online data. Unlike many systems in Alberta, the Battle River system depends on limited groundwater sources and rain and snowmelt runoff.

Except in the larger lakes, sport fish are limited in distribution and numbers because of low flows and barriers to movement in the Battle River. No assessment of fish populations was found. Nor has a systematic examination been conducted of water plants, or benthic invertebrates in the Bigstone Subwatershed. These data gaps should be addressed in future research of the Bigstone Subwatershed.

In summary, the Subwatershed supports extensive agriculture and high levels of livestock production. The impact of these activities on water resources needs to be examined further. Riparian habitat assessments suggest that improvement is needed in the management of these areas. Furthermore, there are limited flows in the Battle River and other streams in the Subwatershed, and these flows depend on groundwater sources and local snow melt. Thus water quality is more directly affected by local land use practices and activities. No long-term water quality data exists for the Subwatershed and no assessment has been made of aquatic plants or benthic invertebrates. However, of the nine indicators assessed, one was good, four were fair, and four were poor, yielding an overall subjective rating of poor. It is important to address these data gaps and assess the impact of various land uses on the water resources of the Subwatershed.