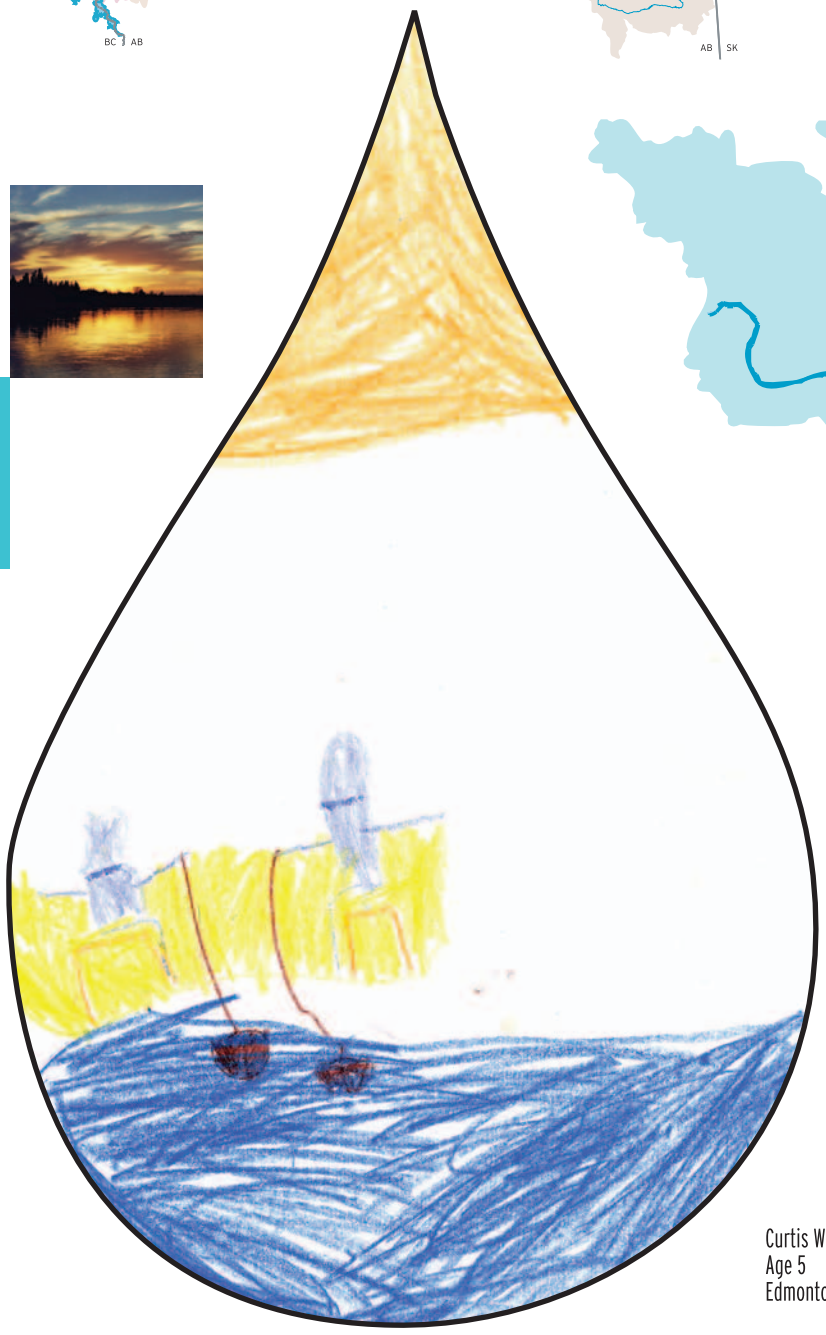
Frog



Curtis Ward
Age 5
Edmonton




5.11 FROG SUBWATERSHED

The Frog Subwatershed is located in the Dry Mixedwood Natural Subregion with a small portion near the North Saskatchewan River overlapping in the Central Parkland Natural Subregion. The Frog Subwatershed encompasses 562,622 hectares including 41,229 hectares of natural and artificial water bodies. The Rannach and St. Paul Provincial Grazing Reserves lie in the Subwatershed. The Rannach Provincial Grazing Reserve lies along the south bank of the North Saskatchewan River. The St. Paul Provincial Grazing Reserve is located 19 kilometres southwest of St. Paul on the north side of the North Saskatchewan River. The geology and soil types of the Subwatershed are similar to the surrounding Subwatersheds and provide for a viable agricultural industry.

The Frog Subwatershed includes the municipal boundaries of Bonnyville, Improvement District 18, Smoky Lake, St. Paul, Two Hills, and Vermilion River Counties. The Subwatershed also includes the settlements of Ashmont, Derwent, Duvernay, Elk Point, Heinsberg, Horseshoe Bay, Lafond, Lindbergh, Myrnam, Riverview, Spedden, St. Edouard, St. Paul, St. Vincent, Vilna and the First Nation's Reserves of Puskiakiwenin 122, Saddle Lake 125, Unipouheous 121, Makaoo 120, and the Fishing Lake Métis Settlement. Total population in the Subwatershed is about 8,500.

Whitney Lakes Provincial Park provides an abundance of recreational activities including camping, canoeing, kayaking, cycling, fishing, hiking, swimming, water skiing, and bird watching. Camping is a popular summertime activity in the St. Paul Grazing Reserve, particularly around Lac Bellevue and Perch Lake.

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

5.11.1 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.

5.11.1.1 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 4.8 kilometres of Bonnie Lake shoreline in 2001 (ARHMP Cows and Fish, 2002c). Of the 13 quadrats sampled on Bonnie Lake, 46% were considered 'healthy' and another 46% were considered 'healthy but with problems'. The final 8% (one quadrat) was considered 'unhealthy' due to shoreline modifications for recreational purposes. The only major problem noted was the presence of invasive plants.

Riparian inventory data were also collected for Vincent Lake in 2000 and 2001 by Cows and Fish (Norine Ambrose, pers. comm.). These data were based on one sample site and do not represent the entire lake area. The Vincent Lake Working Model group, in partnership with the Alberta Conservation Association, has developed a new tool called Riparian Health Assessment using Aerial Videography. This tool can be used by groups to complete a quick overview of a lake's riparian health and determine if problems exist. This tool will be linked to a GIS database. The Vincent Lake Working Model group can be contacted directly for more information


(www.healthyshorelines.com). Their assessment found that the riparian area around Vincent Lake in 2001 was 20% healthy, 66% moderately impaired and 14% highly impaired.

5.11.1.2 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. Over 2% (12,599 hectares) of land in the Frog Subwatershed is affected by linear developments. The majority of this (43%) is in roads of one form or another, including gravel and unimproved roads (32% of the linear development) and paved roads (8% of linear developments). Other linear developments include cutlines (24% of the area of linear development), pipeline rights of way (22%), transmission line rights of way (8%), and active or abandoned rail lines (3%).

5.11.1.3 Land Use Inventory

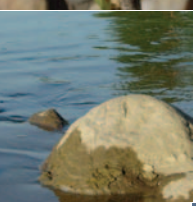
An inventory of land uses quantifies natural landscape types and land uses and may be used to explore changes in water quality and quantity, fish and wildlife populations, and riparian health. Water bodies, both natural and constructed, and including lakes, rivers, streams, wetlands, dugouts and reservoirs cover 7% of the Subwatershed. The vast majority of the Subwatershed is classified in various land uses related to agricultural production: grassland, 41%; cropland, 28%; and forage, 1%. About 18% (103,316 ha) of the Subwatershed is covered with trees.

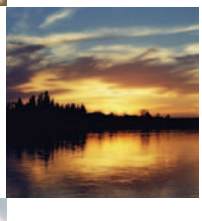
About 14.5% of the land area in the Subwatershed has been disturbed by various land uses including the linear development described above. The greatest area of disturbance following linear development is the area encompassed by First Nations' reserves representing almost 11% of the Subwatershed. Well sites affect about 1% of the Subwatershed (4,717 ha). Disturbance due to municipalities of various sizes including Ashmont, Elk Point, St. Paul and Vilna affects about 0.3% of the Subwatershed (1,888 ha). The remainder of the land disturbance is related to linear developments (2.2%), and industrial facilities including oil and gas plants, runways, and sand and gravel pits (169 ha).

Water bodies including rivers, lakes and dugouts cover about 41,229 hectares; about 7% of the area of the Subwatershed.

5.11.1.4 Livestock Density

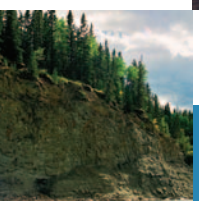
Areas of higher livestock density may be expected to have greater impacts on downstream aquatic systems. Manure production was used as a surrogate for livestock density. Manure production information was available only on the basis of soil polygons. These polygons do not correspond to the Subwatershed boundaries and provide only a rough estimate of manure production within the actual Subwatershed. Based on the available information, livestock densities in the Frog Subwatershed are moderate to low in the northeast with higher densities near St. Paul in a soil polygon that extends into the White Earth and Vermilion Subwatersheds. Manure production in the soil polygons that cover the Frog Subwatershed was estimated at between 0 and 5,422,000 tonnes.





5.11.1.5 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. Both the Alberta Sustainable Resource Development base features hydrology data and the PFRA Land Classification data failed



to identify wetlands in the Frog Subwatershed. However, an inventory completed by Ducks Unlimited Canada found a total of 42,523 hectares of wetlands (7.6% of the Subwatershed area). Their inventory included both permanent and temporary wetlands.

5.11.2 Water Quality and Quantity

Water bodies in the Frog Subwatershed include the North Saskatchewan River, and Slawa and Atimoswe Creeks. Larger lakes include Lac Sante, as well as Frog, Upper and Lower Therien, Cache, Vincent, Fishing, Laurier, Saddle, Bonnie, Eliza, Two Hills, Prairie, Rock Island, Christopher, Tulabi and Lac St. Cyr. ALMS Lakewatch data are available for Vincent (2000, 2001), Laurier (2002) and Bonnie (2002) Lakes. Water quality for Bonnie Lake and Lac St. Cyr can be found in the Atlas of Alberta Lakes (Mitchell and Prepas 1990). The Bonnie Lake Sustainability Association is an active regional watershed group in this Subwatershed.

No LTRN water quality stations exist in this Subwatershed, therefore no long term water quality data has been summarized. This data gap should be addressed in future studies. The Town of St. Paul takes its water supply from Lac St. Cyr, supplemented from the North Saskatchewan River. Wastewater treatment for St. Paul is provided through aeration ponds. Water is pumped from the North Saskatchewan River to offset St.Paul's withdrawals from the lake. The Town of Elk Point's drinking water source is the North Saskatchewan River.

Water quantity is measured at three HYDEX stations (05ED001-05ED003): none has real-time online data. Figure 20 shows the Atimoswe Creek hydrograph for the open water season. This hydrograph is typical of a non-glacial, non-groundwater fed stream, with flow contributions from spring runoff and summer storms only and drying in late summer.

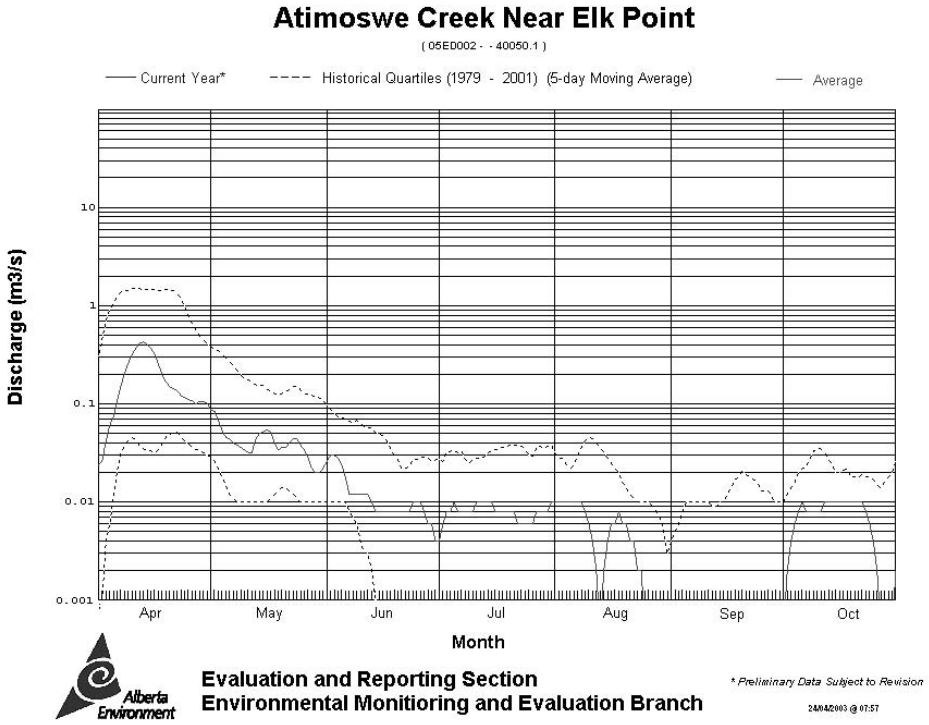


Figure 20: Atimoswe Creek near Elk Point mean monthly discharge for the open water season (Station 05ED002).

5.11.3 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.

5.11.3.1 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 Frog 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 Frog Subwatershed.

5.11.3.2 Fish Population Estimates

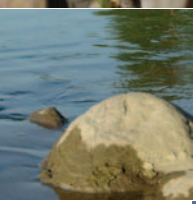
Inventories of selected fish populations may show changes in the presence and abundance of species that may be related to environmental factors including changes in water quality or quantity. Fish species found in the Subwatershed are the same as those in the White Earth and Vermilion Subwatersheds. Because of turbulent flow patterns, warmer temperatures, increased turbidity and substrate, the section of the North Saskatchewan River in this Subwatershed provides good quality habitat for walleye, sauger, and goldeye. Goldeye is the most abundant species and the main stem of the North Saskatchewan River is an important migratory corridor for this species between upstream spawning areas and downstream rearing areas. The river also supports other cool water fish species including northern pike, mooneye and yellow perch (Allan 1984).

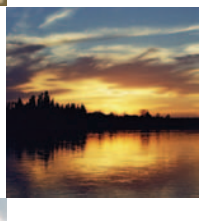
5.11.3.3 Vegetation Types

Inventories of flora populations may show changes in abundance that may be related to environmental factors including changes in land use practices. The Frog Subwatershed is located mainly in the Dry Mixedwood Natural Subregion, with some Central Parkland Natural Subregion. The Dry Mixedwood Subregion includes species such as aspen, balsam poplar, white spruce, balsam fir and jack pine, and has several peatlands. The Central Parkland is composed mainly of grassland with aspen, aspen parkland and closed aspen forest.

5.11.3.4 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. Between 1973 and 1977, Alberta Environment surveyed of benthic invertebrates in the North Saskatchewan River. Data were summarized in a report published by Reynoldson and Exner (1978). The study included a sampling site at Elk Point. At sites downstream of Edmonton, including as far downstream as Elk Point, there was a major increase in numbers and a slight decline in species diversity. The nature of the change in the biological community suggested major impacts due to organic rather than inorganic or toxic effluents.





The main invertebrate groups in the river upstream of Edmonton were Chironomidae, which made up 38.4% of the samples, Ephemeroptera (Mayflies), 31.7% and Plecoptera (Stoneflies), 20.0%. The remainder of the sample was Trichoptera (Caddisflies), 4.9% and Oligochaeta (Earthworms), 0.5%.




At sites downstream of Edmonton, Oligochaeta made up 43.3% of the samples, Chironomidae, 40.8%, Ephemeroptera, 6.3%, Plecoptera, 4.8% and Trichoptera, 0.4%.

There have been major changes in Edmonton in the 30 years since these studies were undertaken. In particular, stormwater management and wastewater treatment have been significantly improved. *Edmonton's Environment: A Snapshot 2002* (City of Edmonton, 2003) states that between 1996 and 2001, the City's impact on the North Saskatchewan River was reduced by 84%. This was due mainly to upgrades at the Gold Bar Wastewater Treatment Plant including biological nutrient removal, enhanced primary treatment and ultra-violet disinfection.

5.11.4 Frog Summary

The geology and soil types of the Frog Subwatershed provide a viable agricultural industry. The majority of the Subwatershed is in land uses related to agricultural production: about 18% is treed. Water bodies cover about 7% of the land area. Livestock densities are moderate with low densities in the northeast and somewhat higher densities being indicated in areas near St. Paul.

Riparian inventory data were collected for 4.8 kilometres of Bonnie Lake shoreline in 2001. Of the 13 quadrats sampled, 46% were considered 'healthy', 46% were considered 'healthy but with problems' and 8% were considered 'unhealthy' due to shoreline modifications for recreational purposes. The only major problem noted was the presence of invasive plants.

Over 2% of land in the Subwatershed is affected by linear developments including roads, cutlines, pipeline rights of way, transmission line rights of way, and rail lines. Another 12% has been disturbed by land uses including First Nations' Reserves, well sites, municipalities, and industrial facilities.

The available PFRA Land Classification shows no areas classified as wetlands; however, Ducks Unlimited Canada data show wetlands on 7.6% of the Subwatershed area. This discrepancy should be resolved.

Water quantity is measured at three stations: none has real-time online data. No long-term river water quality information, information on water plants, fish population estimates or riparian habitat assessments was found for the Subwatershed.

Surveys of benthic invertebrates at Elk Point found an increase in numbers and a slight decline in species diversity as compared to sites upstream of Edmonton. The nature of the changes suggested impacts due to organic rather than inorganic or toxic effluents. There have been improvements in stormwater management and wastewater treatment in Edmonton since the surveys were conducted. Further studies of the benthic invertebrate populations are needed to determine the current level of impacts.

Goldeye is the most abundant fish species and the main stem of the North Saskatchewan River is an important migratory corridor for this species between upstream spawning areas and downstream rearing areas.

In summary, there has been little systematic assessment of the Frog Subwatershed and there are significant data gaps for the area. However, of the seven indicators assessed, one was good, six were fair, and none were poor, yielding an overall subjective rating of fair. These data gaps should be addressed; in particular the impacts of various land uses on riparian health, and the state of the aquatic ecosystem including water quality, water plants, and fish habitat and populations.