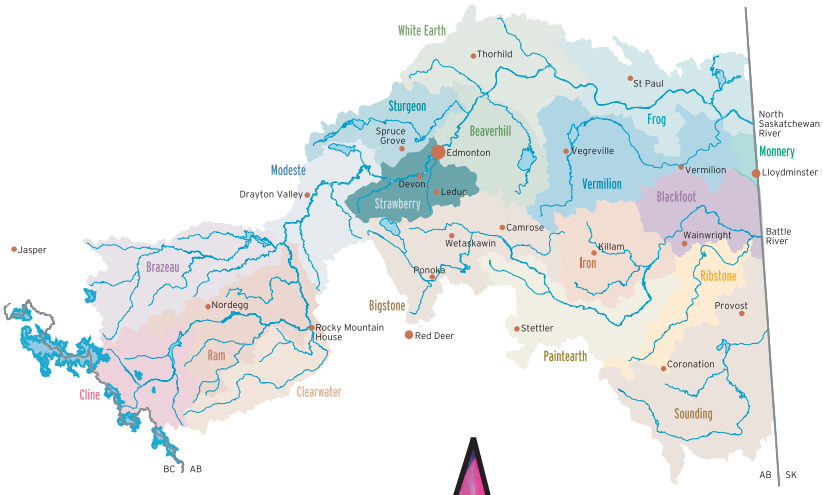
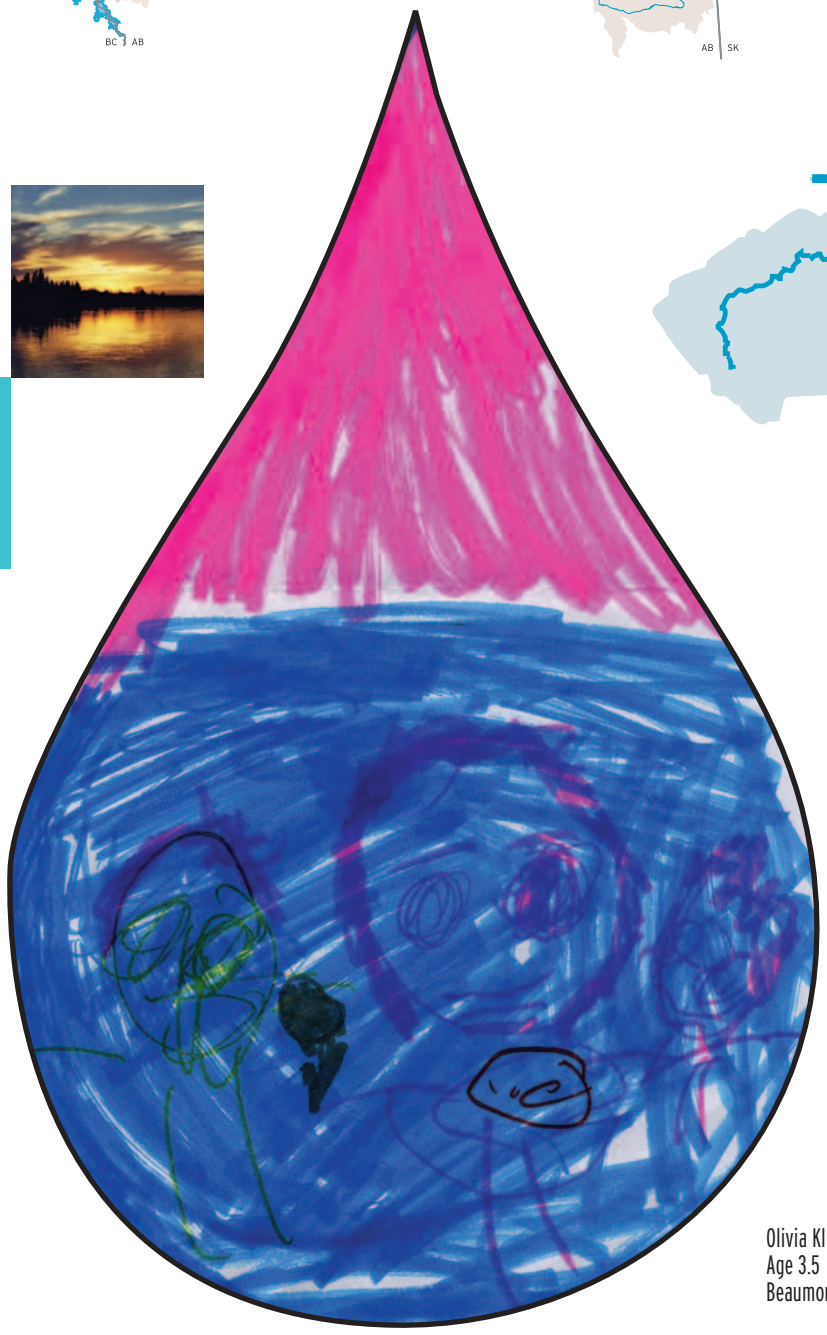
# Strawberry





Olivia Klimosko
Age 3.5
Beaumont






## 5.6 STRAWBERRY SUBWATERSHED

The Strawberry Subwatershed lies in both the Boreal Forest and Parkland Natural Regions and encompasses 299,662 hectares including 5,240 hectares of natural and artificial water bodies. The Strawberry Subwatershed includes the municipal boundaries of Leduc, Parkland, Strathcona and Wetaskiwin Counties and the settlements of Beaumont, Buford, Calmar, Devon, Edmonton, Kavanagh, Leduc, Looma, New Sarepta, Nisku, Rolly View, St. Albert, Sunnybrook, Telfordville, Thorsby, Warburg and the Stony Plain First Nations Reserve 135.

Most of the regional landmass is covered by forests or has been developed for agriculture, but there are also large oil and gas reserves in the area. As a result, the main economic base is oil and gas extraction and agriculture, including both beef and dairy cattle.

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

### 5.6.1 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.

#### 5.6.1.1 Riparian Health

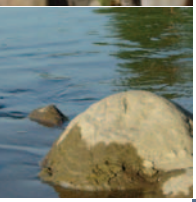
The health of the riparian area around water bodies and along rivers and streams is an indicator of the overall health of a watershed and the impact of changes in land use and management practices. Several creeks have been assessed in the Strawberry Subwatershed by Leduc County and Cows and Fish.

Riparian assessment data were collected for Conjuring Creek in 2003 (ARHMP Cows and Fish, unpublished data). Of the 14 quadrats sampled, 72% were considered healthy, 7% were healthy with problems, and 21% scored in the unhealthy range. The only major problem noted was the presence of the noxious weeds Canada Thistle and Common Tansy. Other problems that were identified included narrow buffer strips, the over-utilization of trees and shrubs, poisonous plants, and the presence of old feeding sites with bare ground and introduced species.

Riparian assessment data were collected for Weed Creek in 2003 (ARHMP Cows and Fish, unpublished data). Of the 16 quadrats sampled, 63% were considered healthy, 31% were healthy with problems, and 6% scored in the unhealthy range. The only major problem noted was the presence of the noxious weeds Canada Thistle, Scentless Chamomile and Common Tansy. Bare ground at crossings and heavily grazed areas, and introduced species with insufficient root mass to protect banks were major concerns. Heavy utilization of poplar and willow, and grasshopper pressure on open areas were also problems.

Riparian assessment data were collected for Cache Creek in 2003 (ARHMP Cows and Fish, unpublished data). Of the 2 quadrats sampled, 50% were considered healthy, 50% were healthy with problems. The major problem noted was the presence of the noxious weeds Canada Thistle and Scentless Chamomile.



Riparian assessment data were collected for Willow Creek in 2003 (ARHMP Cows and Fish, unpublished data). Of the 3 quadrats sampled, 100% were considered healthy. The only major problem noted was the presence of the noxious weeds Canada Thistle, Scentless Chamomile and Common Tansy. ATV use had left trails with bare ground that was susceptible to erosion, and some litter was also present.

Riparian assessment data were collected for Strawberry Creek in 2002 (ARHMP Cows and Fish, unpublished data). Of the 19 quadrats sampled, 62% were considered healthy, 24% were healthy with problems, and 14% scored in the unhealthy range. The only major problem noted was the presence of the noxious weeds Canada Thistle and Scentless Chamomile.

Riparian assessment data were collected for Sunnybrook Creek in 2002 (ARHMP Cows and Fish, unpublished data). Of the 7 quadrats sampled, 86% were considered healthy, 14% were healthy with problems. The only major problem noted was the presence of the noxious weeds Canada Thistle and Perennial Sow Thistle.

#### 5.6.1.2 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.

Almost 4% (11,395 ha) of land in the Strawberry Subwatershed is taken up by linear developments. The majority of this (55%) is in roads of one form or another, including gravel and unimproved roads (52%) and paved roads (48%). Other linear developments include pipeline rights of way, (25% of the area of linear developments), cutlines (6%), transmission line rights of way (11%), and active or abandoned rail lines (3%).

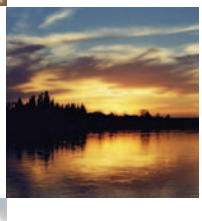
#### 5.6.1.3 Land Use Inventory

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.

About 19% of the land area in the Subwatershed has been disturbed by various forms of development; most of this disturbance (11% of the Subwatershed) is due to municipalities of various sizes; including Beaumont, Devon, Leduc, and Nisku. The remainder of the land disturbance is related to linear developments (4%), wellsites (2%), and industrial sites. The First Nation Reserve 135 covers an area of about 5,200 ha (less than 2% of the Subwatershed area).

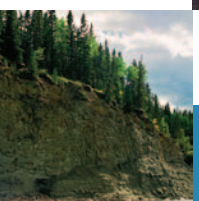
Water bodies, both natural and constructed, including lakes, rivers, streams, wetlands, dugouts and reservoirs cover less than 2% of the Subwatershed. The vast majority of the Subwatershed is classified into various land uses related to agricultural production: forage, 54%; cropland, 23%; and grassland, 10%. The treed area of the Subwatershed is about 3.5% (10,399 ha), while 69% of the Subwatershed lies in a Provincial FMU.

#### 5.6.1.4 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 Strawberry Subwatershed are moderate. Manure production in the soil polygons that cover the Strawberry Subwatershed was estimated at between 1,194,000 and 3,246,000 tonnes.

#### 5.6.1.5 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. In the Strawberry Subwatershed, wetlands were not identified from either the PFRA Land Classification data or the Alberta Sustainable Resources Development base features hydrology data. However, an inventory completed by Ducks Unlimited Canada for the Subwatershed found a total of 70,454 hectares of wetlands (23.5% of the Subwatershed area). The inventory included both permanent and temporary wetlands.

As part of their policy, the City of Edmonton is working hard to conserve remaining natural wetlands and upland areas that exist within its boundaries. Where possible, natural wetlands are incorporated into drainage infrastructure for natural stormwater management benefits and water quality benefits that wetlands provide. Whether or not they are drawn into the City's drainage infrastructure, conservation of wetlands is a high priority. Constructed stormwater management facilities comprise an important part of modern drainage infrastructure for all new urban developments. It is also City policy that new stormwater management facilities are planned and implemented as constructed wetlands for their water quality benefits. Dry and wet ponds are no longer encouraged as part of new development.

### 5.6.2 Water Quality and Quantity

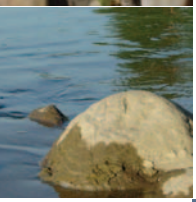
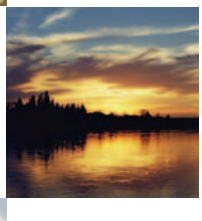
Water bodies in the Strawberry Subwatershed include the North Saskatchewan River, and the Whitemud, Blackmud, Conjuring, and Strawberry Creeks. Larger lakes in the Subwatershed include Wizard, Looking Back, Saunders, Telford, Ord, Cawes, Frog, Kinokamau and Levering Lakes. ALMS Lakewatch data for Wizard Lake exists for 1996. Water quality for Wizard Lake can also be found in the Atlas of Alberta Lakes (Mitchell and Prepas 1990). The Devon Watershed Alliance is an active watershed stewardship group in this Subwatershed.

Water quality is monitored regularly on the main stem of the NSR by Alberta Environment at Devon under the long-term river network (LTRN) program. In 2001, the SWQI for metals, nutrients, bacteria and pesticides all rated good (Alberta Environment, 2004). In the prior five-year period, all parameters were excellent or good, except for nutrients in 1998-99 and 1999-2000, which had a fair rating (Table 3). Fair nutrient ratings resulted from instances of high nutrient concentrations during the spring runoff period. Concentrations of total phosphorus (TP) ranged from 0.64 to 0.0015 mg/L, total nitrogen (TN) ranged from 2.422 to 0.01 mg/L. The decreasing trend through time may suggest that water quality is deteriorating due to increased development and land practices upstream of this sampling location. However, this decrease may be within the natural variation seen in water quality as it related to lower flow events, as has been experienced with recent drought conditions.








Numerous samples for TP and fecal coliforms have been taken from the upstream portion of the North Saskatchewan River during the years 1997-2002 (upstream samples include those coming into the city from the west and up to the intake of the Rossdale water treatment plant). The 324 fecal coliform samples taken upstream from the water treatment plant ranged from 0 to 250 counts/100mL, and averaged 13 counts/100mL. Some of these samples are above the CCME Guidelines for Contact Recreation. The 120 samples taken for TP ranged from 0 to 0.64 mg/L, and averaged 0.028 mg/L. Pesticide detections in this Subwatershed included 2,4-D, Dicamba, MCPA, MCPP and Picloram, all of which were below the Guidelines for the Protection of Aquatic Life. Other compounds detected include monochloroacetic acid, as well as Triclopyr. Currently, there are no existing water quality guidelines for either of these chemicals.

Seven sites along Strawberry Creek were sampled for fecal coliforms and TP during the years 1994-2002. The 18 fecal coliform samples ranged from 0 to 44,000 counts/100 mL, and averaged 1109 counts/100 mL. Most of these results exceed the CCME Surface Water Quality Guidelines for Contact Recreation. The 18 TP samples ranged from 0.011 to 3.15 mg/L, and averaged 0.311 mg/L. Pesticide detections in this Subwatershed included 2,4-D, Bromoxynil, MCPA, MCPP, Dicamba and Picloram, all of which were below the CCME Surface Water Quality Guidelines for the Protection of Aquatic Life. Also detected were the pesticides Alpha-BHC, Imazamethabenz-methyl, Clopyralid, and Triclopyr, but there are currently no water quality guidelines for these compounds.

**Table 3:** ASWQI Devon, Alberta in the Strawberry Subwatershed

| Index Period | Metals | Nutrients | Bacteria | Pesticides |
|---|---|---|---|---|
| 1996 - 1997 | E | G | E | G |
| 1997 - 1998 | E | G | E | E |
| 1998 - 1999 | E | F | E | E |
| 1999 - 2000 | G | F | G | G |
| 2000 - 2001 | G | G | G | G |

[1]Alberta Surface Water Quality Index (ASWQI) ratings: E = Excellent, G = Good, F = Fair, P = Poor

Water quality data is collected by EPCOR Water Services at both E.L. Smith and Rossdale water treatment plant intakes. E.L. Smith data shows pesticide concentrations below detection for all compounds analyzed (e.g. carbamates and glyphosate; Table 4), and low mean fecal coliform counts with episodic high counts (Table 5).

**Table 4:** Pesticide data collected by EPCOR Water Services 1999-2003 in the Strawberry Subwatershed[2]

| Year | Number of Samples Taken | Number of Compounds Analyzed | Number of Compounds Below MDL |
|---|---|---|---|
| 1999 | 2 | 1 | 1 |
| 2000 | 2 | 14 | 14 |
| 2001 | 3 | 30 | 30 |
| 2002 | 2 | 28 | 28 |
| 2003 | 4 | 51 | 51 |

[2] Data provided by EPCOR Water Services, August 2004. MDL=Minimum detection limit.

**Table 5:** Fecal coliform counts in raw water at EL Smith intake, 1998-2003[3]

| | 1999 | 2000 | 2001 | 2002 | 2003 | All years |
|---|---|---|---|---|---|---|
| Mean | 5 | 9 | 8 | 6 | 9 | 7 |
| Maximum | 160 | 2200 | 900 | 260 | 350 | 2200 |
| Minimum | 1 | 1 | 1 | 1 | 1 | 1 |

[3] Data provided by EPCOR Water Services, August 2004.

The City of Edmonton (population 850,000) and surrounding areas serviced by EPCOR Water Services has the largest attributable impact on the North Saskatchewan River's water quality due to return water flows of treated wastewater and urban stormwater runoff. Treated wastewater from the Gold Bar and Capital Region wastewater treatment plants are major sources of BOD (biological oxygen demand), fecal coliform bacteria and nutrients (nitrogen and phosphorus), while 238 stormwater outfalls from all areas of the City add suspended solids to the river (Figure 13) (See Map Pocket, or CD-ROM for Figure 13). Combined sewer overflows are a major source of fecal coliforms (River Water Quality Taskforce 1996). There are currently 19 combined sewer overflows that discharge to the North Saskatchewan River, and the City of Edmonton is working towards completing an impact reduction strategy by 2016.

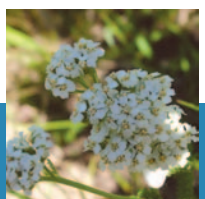
Municipalities in the Subwatershed have wastewater treatment plants and detention lagoons from which treated effluents release into the North Saskatchewan River or its tributaries. The Devon wastewater treatment plant chlorinates its treated effluents before discharging to the North Saskatchewan River. Thorsby and Warburg have detention lagoons; Thorsby discharges into Weed Creek and Warburg into Strawberry Creek. The Genesee Power Plant, near Warburg, has a reservoir for cooling water, which is filled from the North Saskatchewan River.

Riverwatch (www.riverwatch.ab.ca) occasionally monitors water quality at four sites along the river within the town of Drayton Valley, at seven sites within the City of Edmonton on the "Aqualta run", and at nine sites on the "Gold Bar run". Riverwatch can be contacted directly for their data.

Strawberry Creek was part of the CAESA stream network as a site in an area of high agricultural activity. Water quality data (nutrients, organic and inorganic chemistry, suspended solids, color, pH, and bacteria) is available for this creek from 1995-1996 (CAESA 1998).








The channel of the North Saskatchewan River in this Subwatershed has a mean width of approximately 135 metres and a mean depth of 1.4 metres. The channel is irregularly meandering with point and side bars and is entrenched in a stream cut valley. Upstream regulation from the Bighorn and Brazeau dams has modified flows.

Water quantity is measured at six HYDEX stations (05DF001-05DF004, 05DF006-05DF007), two of which have real-time online data (05DF001 and 05DF004). Station 05DF001 is located on the Low Level Bridge in Edmonton (Table 6). Figure 14 shows the Blackmud Creek hydrograph, which is typical of a non-glacial fed stream. Flow contributions are from spring runoff and summer storms only.

**Table 6:** Daily mean flow ($m^3/s$) for the North Saskatchewan River at Edmonton, Station 05DF001[4]

[4] Data provided by EPCOR Water Services, August 2004.

| | 1999 | 2000 | 2001 | 2002 | 2003 | All years |
|---|---|---|---|---|---|---|
| Mean | 237 | 165 | 145 | 147 | 201 | 178 |
| Maximum | 1500 | 778 | 846 | 360 | 774 | 1500 |
| Minimum | 65 | 64 | 43 | 71 | 81 | 43 |



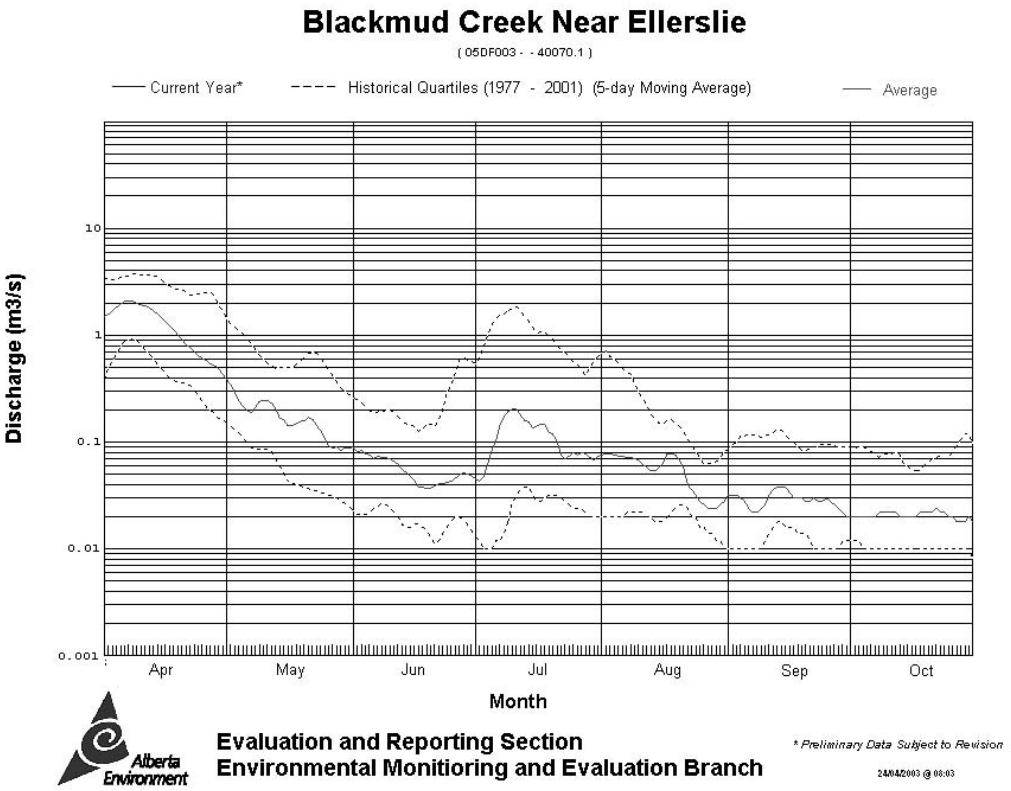



**Figure 14:** Blackmud Creek near Ellerslie mean monthly discharge for the open water season (Station 05DF003).






### 5.6.3 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.

#### 5.6.3.1 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 Strawberry 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 Strawberry Subwatershed.

#### 5.6.3.2 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. Cool water fish species such as pike, walleye and goldeye are common or seasonally abundant. Other cool water species including sauger, mooneye, yellow perch, lake sturgeon, and cold water species such as mountain whitefish and bull trout are occasionally found in this reach of the North Saskatchewan River.

#### 5.6.3.3 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 Strawberry Subwatershed is located in both the Boreal Forest Region and the Parkland Natural Region of Alberta. The Boreal Forest Region includes many areas of bogs, fens, swamps and marshes, as well as the Dry Mixedwood Subregion. The Dry Mixedwood Subregion includes species such as aspen, balsam poplar, white spruce, balsam fir and jack pine, and has many peatland areas. The Parkland Natural Region is the transition region between grasslands and coniferous forests. It includes one subregion, the Central Parkland, which is composed mainly of grassland with aspen, to aspen parkland to closed aspen forest. Species include trembling aspen and balsam poplar.

#### 5.6.3.4 Benthic Invertebrates

Inventories of benthic invertebrate populations may show changes in the presence and abundance of species that may be related to changes in water quality.

Alberta Environment surveyed benthic invertebrates in the North Saskatchewan River between 1973 and 1977. Data were summarized in a report published in 1978 (Reynoldson and Exner 1978). One sampling site was located at Devon, Alberta. The authors concluded that upstream of the City of Edmonton there was little change in the species diversity or total numbers of macrobenthic fauna from year to year or season to season. The upstream site also showed less variability in both diversity and standing crop compared to sites downstream of Edmonton. The main invertebrate groups in five years of sampling at Devon were Chironomidae (38.4%),


Ephemeroptera (Mayflies - 31.7%) and Plecoptera (Stoneflies - 20.0%). The remainder of the sample was Trichoptera (Caddisflies - 4.9%) and Oligochaeta (Earthworms - 0.5%).

### 5.6.4 Strawberry Summary

The Strawberry Subwatershed includes several towns and municipalities, parts of the City of Edmonton, and a First Nations Reserve. The vast majority of the Subwatershed is under heavy agricultural production, and only 3.5% of the Subwatershed is treed. Based on the available information, livestock densities in the Strawberry Subwatershed are moderate to high in the southern portion of the Subwatershed. There are also large oil and gas reserves. As a result, the main economic base is oil and gas exploration and processing, and agriculture.

Almost 4% of land area is taken up by linear developments including roads, pipeline rights of way, cutlines, transmission line rights of way, and rail lines. An additional 19% of the Subwatershed has been disturbed by municipalities of various sizes, wellsites, and industrial sites. Water bodies cover less than 2% of the Subwatershed.

Data from both the Alberta Sustainable Resources Development base features hydrology and PFRA Land Classification showed no wetlands in the Subwatershed; however, a Ducks Unlimited Canada inventory found that wetlands covered 23.5% of the land area. These important discrepancies must be resolved during the development of a management plan.

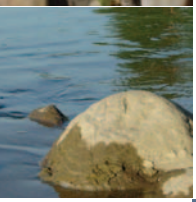


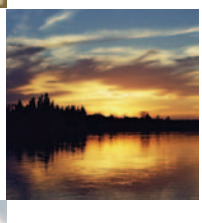
Water quality is monitored regularly by Alberta Environment at Devon. In 2001, the Alberta Surface Water Quality Index for metals, nutrients, bacteria and pesticides all rated good. This was an improvement in nutrient levels over the rating for the two previous years, but generally a decrease in rating for metals, bacteria and pesticides. Further examination of the data is needed to determine if the changes in ratings are significant.

Treated wastewater from the Gold Bar and Capital Region wastewater treatment plants and stormwater runoff from the City of Edmonton are major sources of contaminants in the Subwatershed; although, the quality of these effluents has improved in recent years.

Water quantity is measured at six stations, two have real-time online data.

No detailed population assessments were found for fish species in the Subwatershed, nor was a systematic examination of riparian health, aquatic plants or benthic invertebrates found for the lakes, creeks, rivers and streams of the Strawberry Subwatershed. Surveys of benthic invertebrates in the North Saskatchewan River at Devon concluded that upstream of Edmonton there was little change in the species diversity or total numbers of macrobenthic fauna from year to year or season to season. However, of the eleven indicators assessed, three were good, three were fair, and five were poor, yielding an overall subjective rating of poor. Given that the above are recognized as important indicators of ecological health, these data gaps should be addressed in future research in the Strawberry Subwatershed.





Given the high degree of linear development in the Subwatershed and the intensity of agriculture, there is a significant potential for additional development to have an impact on this Subwatershed. The available data indicate a possible decline in water quality upstream of Edmonton. The significance of potential changes in water quality should be assessed. The conflicting information on the area of wetlands in the Subwatershed must also be resolved.