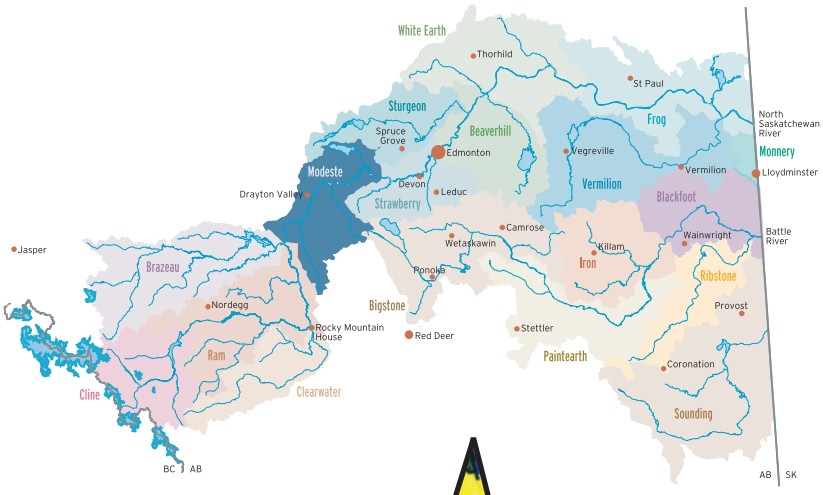
Modeste



Elizabeth Orr
Age 7
Elk Point




5.5 MODESTE SUBWATERSHED

The Modeste Subwatershed lies in the Foothills and Boreal Forest natural regions of Alberta, and encompasses 482,746 hectares including 21,461 hectares of natural and artificial water bodies which include lakes, quarries, reservoirs, rivers, wetlands and canals. The Modeste Subwatershed includes the municipal boundaries of Brazeau, Clearwater, Leduc, Parkland and Wetaskiwin Counties, the settlements of Alder Flats, Betula Beach, Breton, Buck Creek, Carvel, Drayton Valley, Duffield, Fallis, Kapasiwin, Keephills, Lakeview, Lodgepole, Point Alison, Rocky Rapids, Seba Beach, Tomahawk, Wabamun, Winfield and the First Nation's Reserves Wabamun Lake 133A, O'Chiese 203 and Buck Lake 133C. The Jack Pine Provincial Grazing Reserve and the Buck Mountain Provincial Grazing Reserve are within the Subwatershed. The geology consists of fluvial and glaciofluvial deposits along major stream valleys.

The economic base of the region is primarily oil and gas, with agricultural and forestry activity. The Highvale Coal Mine near Wabamun Lake is the largest surface strip mine in Canada and supplies coal to the nearby TransAlta Utilities Corporation Wabamun, Keephills and Sundance power plants.

The larger lakes in the Subwatershed, Wabamun, Buck, Jackfish, Johnnys, Mayatan, Mink and Hasse, are popular for swimming, camping, boating, and fishing.

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

5.5.1 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.

5.5.1.1 Riparian Health

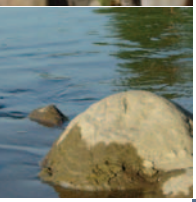
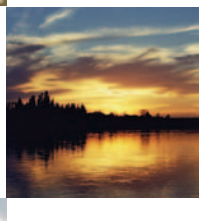
The health of the riparian area around water bodies and along rivers and streams is an indicator of the overall health of a watershed and the impact of changes in land use and management practices. No published assessment of riparian health was found for the lakes, wetlands, rivers or creeks in the Modeste Subwatershed, so we cannot make any conclusions about riparian health for this Subwatershed using this indicator. This data gap could be addressed in future research in this area.

5.5.1.2 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. More than 3.5% (17,255 ha) of the land in the Modeste Subwatershed is taken up by linear developments. The area of linear development includes roads of one form or another (31%; unimproved and gravel roads), pipeline rights of way, (33% of the area of linear development) and cutlines and trails (25%). There also is a small amount of transmission line rights of way (10.3%) and rail lines (0.7%).






5.5.1.3 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 just over 4% of the Subwatershed. The majority of the Subwatershed is in various land uses related to agricultural production: forage, 43%; grassland, 23%; and cropland, 1%. About 19% of the Subwatershed is treed; however, 100% of the Modeste Subwatershed lies in a provincial FMU.

In addition to the area of linear disturbance, about 3% of the land area (14,486 ha) has been disturbed by various forms of development including oil and gas wells, sand and gravel pits, open pit mines, and power stations. Several small towns and villages in the Subwatershed cover 917 hectares and First Nations lands encompass 7642 hectares.

5.5.1.4 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 Modeste Subwatershed are generally moderate. Manure production in the soil polygons that cover the Modeste Subwatershed was estimated at between 0 in the west to 3,246,000 tonnes in some of the soil polygons in the eastern part of the Subwatershed.

5.5.1.5 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 PFRA Land Classification failed to identify wetlands in the Modeste Subwatershed, however, Alberta Sustainable Resource Development has collected hydrology data and identified wetlands over 4.7 ha of the land area in the Modeste Subwatershed (1% of land area). However, an inventory completed by Ducks Unlimited Canada for part of the Modeste Subwatershed found a total of 20,565 hectares of wetlands (4.3% of the Subwatershed area). The DUC inventory included both permanent and temporary wetlands.

5.5.2 Water Quality and Quantity

Water bodies in the Subwatershed include the North Saskatchewan River, and Modeste, Bucklake, Tomahawk, Mishow, Washout, and Rose Creeks. Larger lakes in this Subwatershed include Wabamun, Buck, Jackfish, Johnnys, Mayatan, Mink and Hasse. Lakewatch water quality data for Buck and Jackfish Lakes are available for 2001 from ALMS. Water quality for Buck, Jackfish, Hasse and Wabamun Lakes can be found in the Atlas of Alberta Lakes (Mitchell and Prepas 1990).

The Town of Drayton Valley has a primary wastewater treatment plant, which uses chlorination disinfection prior to discharge into North Creek. The towns of Alder Flats, Breton, Tomahawk, and Buck Creek all have wastewater treatment lagoons. Alder Flats discharges into Rose Creek, Breton into Modeste Creek, Tomahawk into Tomahawk Creek, and Buck Creek into an unnamed creek.




No LTRN water quality stations exist in this Subwatershed, therefore no long term water quality data has been summarized. However, Rose Creek was part of the CAESA stream network as a site in an area of low agricultural activity. Water quality data (nutrients, organic and inorganic chemistry, suspended solids, color, pH, and bacteria) is available for this creek from 1995-1996 (Anderson *et al.* 1998).

AESA stream monitoring took place yearly on Tomahawk Creek from 1996-2001 (CAESA 1998, Anderson 1998, Anderson 2000, Carle 2001, Donahue 2001). This creek is in an area of "moderate" agricultural intensity (CAESA 1998), and has shown very high fecal coliform counts (1999), low flows (2000) and high particulate phosphorus concentrations (2001) resulting in marginal to fair Alberta Agriculture, Food and Rural Development Water Quality Index Scores (1999-2001) (Carle 2001, Donahue 2001).

Wabamun Lake is one of the most intensively studied lakes in Alberta. Recent water quality, fisheries, and sediment data were reported by Alberta Environment (2003). Results of a comprehensive study in 2002 and a 20-year history of water quality have shown that ion concentrations have increased due to inputs from the Wabamun Lake Wastewater Treatment Plant. A variety of disinfection by-products discharged by the wastewater treatment plant are found throughout the lake. When compared to other Alberta lakes, Wabamun sediments had higher metal and polycyclic aromatic hydrocarbon levels, due in part to the TransAlta Utilities Corporation power plants on the lake. An environmental risk assessment of the power plant on the lake is currently being undertaken by Alberta Environment.

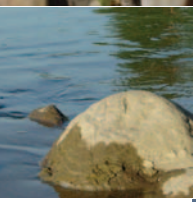
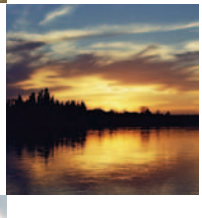
Modeste Creek was sampled at one station for fecal coliforms and TP during the years 1985-86, 1988, and 1998-2000. The eight fecal coliform samples ranged from <10 to 4300 counts/100 mL, and averaged 1068 counts/100 mL. Most of these samples are above the CCME Surface Water Quality Guidelines for Contact Recreation. The 18 TP samples ranged from 0.006 to 1.58 mg/L, and averaged 0.192 mg/L. Pesticide detections in this Subwatershed included 2,4-D, Bromoxynil, MCPA, MCPP, Dicamba and Picloram, all of which were below the CCME Guidelines for the Protection of Aquatic Life.

The North Saskatchewan River channel in this Subwatershed averages about 120 metres wide and 1.2 metres deep. The channel is sinuous with islands and bars and a pool and riffle sequence. It is partly entrenched and frequently confined in a stream-cut valley. Peak summer flows have been reduced and minimum winter flows increased by water releases from the Brazeau and Bighorn dams (Allan 1984).

Water quantity is measured at seven HYDEX stations (05DE001; Figure 12, 05DE003, 05DE006-05DE009, 05DE911): two have real-time online data (05DE006 and 05DE007). Water is removed from the North Saskatchewan River for use in TransAlta's cooling towers. Figure 12 shows the North Saskatchewan River hydrograph, which is typical of a glacial meltwater dominated stream, with peak flows during the warm summer months and some impact on flows from spring runoff and summer storms.





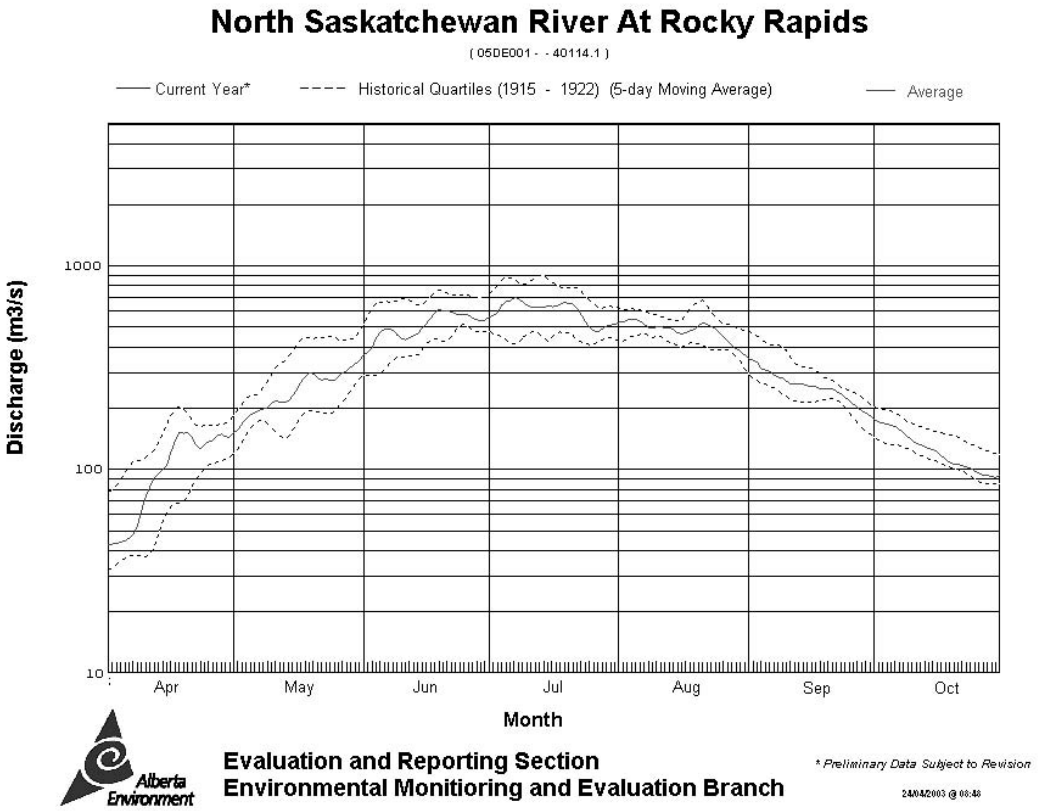



Figure 12: North Saskatchewan River near Rocky Rapids mean monthly discharge for the open water season (Station 05DE001).

5.5.3 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.

5.5.3.1 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.

A systematic examination has not been conducted of macrophytes in the Modeste Subwatershed; however, inventories were completed in several lakes as part of fisheries inventories completed by R.L. & L. in 1986. The inventory of Wabamun Lake (R.L. & L. 1987a) found aquatic macrophytes throughout the photic (shallow) zone of the lake. The main species of emergent vegetation were greater bulrush, common cattail, reed grass and sedge. The most abundant submerged macrophytes were northern watermilfoil, Richardson pondweed, stonewort, and large-sheath pondweed.




Similar emergent macrophytes were found in Mayatan Lake. In addition, arrowhead was reported. Among the submergent vegetation species in Mayatan Lake, the most abundant were stonewort, northern watermilfoil and large-sheath pondweed. In addition, sago pondweed was abundant (R.L. & L. 1987b).

Aquatic vegetation also was found throughout the photic (shallow) zone of Jackfish Lake. The most abundant emergent vegetation species were sedge, common cattail, greater bulrush, arrowhead and reed grass. The most common species of submergent macrophytes were stonewort, northern watermilfoil, sago pondweed and large-sheath pondweed (R.L. & L. 1987c).

5.5.3.2 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.

The North Saskatchewan River in this Subwatershed is transitional from cold water to cool water fish habitat and contains a wide variety of fish species. Some streams in the Subwatershed also provide cool water fish habitat. Fish species in the North Saskatchewan River include pike, walleye, sauger, goldeye, mountain whitefish and bull trout as well as longnose, white, mountain and northern redhorse suckers and burbot. In lakes in the Subwatershed, walleye, pike, yellow perch, lake whitefish, longnose and white suckers and burbot are generally the most abundant species (Allan 1984, R.L. & L. 1987 a, 1987b, 1987c).

Buck Lake contains walleye, pike, yellow perch, lake whitefish, longnose and white suckers and burbot. Wabamun Lake supports a mix of cool water species with lake whitefish, pike, yellow perch, and white suckers being the most abundant (Allan 1984). R.L & L. (1987a) caught white sucker, burbot, yellow perch and northern pike and minnow species in beach seines. Brook stickleback were collected in seine hauls in Mayatan Lake. Yellow perch and northern pike have been reported from the lake but severe winter kills since may have eliminated these populations (R.L. & L. 1987b). Northern pike and yellow perch were caught in gill nets or seines and walleye have been reported from Jackfish Lake (R.L. & L. 1987c).

5.5.3.3 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 Modeste Subwatershed lies in the Foothills Region and Boreal Forest Region of Alberta. The Foothills Region is split into the upper foothills and the lower foothills. The upper foothills region includes species such as white spruce, black spruce, lodgepole pine and subalpine fir. The lower foothills are composed mainly of mixed forests, featuring white spruce, black spruce, lodgepole pine, balsam fir, aspen, balsam poplar and paper birch. Fens are very common in the lower foothills as well. The Boreal Forest Region includes many areas of bogs, fens, swamps and marshes. The Dry Mixedwood Subregion, within the Boreal Forest Region, includes species such as aspen, balsam poplar, white spruce, balsam fir and jack pine, along with many peatland areas.

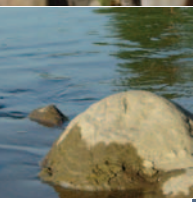
5.5.3.4 Benthic Invertebrates

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


Alberta Environment conducted surveys of benthic invertebrates in the North Saskatchewan River between 1973 and 1977. Data were summarized in a report by Reynoldson and Exner (1978). One sampling site was at Drayton Valley. 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 site at Drayton Valley also showed less variability in both diversity and standing crop compared to sites downstream of Edmonton. The main invertebrate groups at river stations upstream of Edmonton, over a five year sampling time frame, were Chironomidae (Midges), 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%.

A benthic invertebrate survey was conducted in Wabamun Lake in November 2002 to determine if discharges from the ash lagoon for the Wabamun Power Plant and the Wabamun Lake Water Treatment Plant had an impact on the distribution of benthic invertebrates in the lake. A total of 128 taxa of benthic invertebrates were identified. The benthic invertebrate population was typical of fauna generally found in shallow, fairly productive lakes in Alberta (Stantec 2003). The survey indicated some effects in the areas of the discharges when compared to background areas in the lake. Overall, the differences in the area of the lake influenced by the ash lagoon discharge were slight and not indicative of a toxic effect; however, signs of mild enrichment were apparent. In the area of the water treatment plant discharge, there were significant differences, which may have been related to the different water quality of the discharge but also to differences in substrate and the presence of macrophytes.

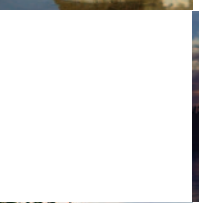
5.5.4 Modeste Summary



The majority of the lands in the Modeste Subwatershed are used for agricultural production and only about 19% of the area is treed. The Subwatershed includes several towns and First Nation's Reserves, which cover about 2% of the land area, and discharge treated wastewater to local creeks. The economic base is primarily oil and gas, with agriculture, forestry activity, and strip mines to supply coal to local power plants. Water bodies cover about 4% of the Subwatershed and lakes are popular for recreational uses. Data from different sources show wetlands accounting for less than 1% to 4.3% of the Subwatershed area. These data do not include peatlands, which are abundant in some parts of the Subwatershed.

More than 3.5% of the land area has been affected by linear developments including roads, pipeline rights of way, cutlines trails, transmission line rights of way and rail lines. In addition, oil and gas wellsites, sand and gravel pits, open pit mines, and power stations have disturbed about 3% of the land area.

Livestock densities generally are moderate and no long-term river water quality information exists for the Subwatershed. However, water quality monitoring on Tomahawk Creek in an area of "moderate" agricultural intensity showed very high fecal coliform counts, low flows, and high particulate phosphorus concentrations. These conditions resulted in marginal to fair Water Quality Index Score as determined by Alberta Agriculture, Food and Rural Development. In addition, studies on Lake Wabamun have shown changes in water and sediment quality due to industrial impacts when compared to other Alberta lakes.



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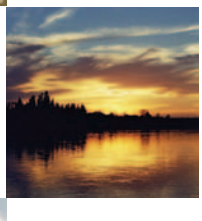
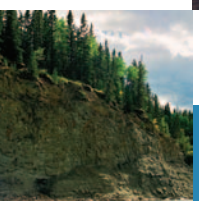


No published assessment of riparian health was found for the Subwatershed and a systematic examination of aquatic plants in the Subwatershed has not been done; although, inventories have been completed in several lakes. Inventories of fish species have been conducted on several lakes in the Subwatershed but no published summary of fish populations was found.






Surveys of benthic invertebrates in the North Saskatchewan River at Drayton Valley concluded that upstream of the City of Edmonton there was little change in the species diversity or total numbers from year to year or season to season. A benthic invertebrate survey in Wabamun Lake indicated some effects due to the Wabamun Power Plant and the Wabamun Lake Water Treatment Plant. The differences were slight and not indicative of a toxic effect; however, signs of mild nutrient enrichment were apparent.

There has been little systematic assessment of the Subwatershed. However, of the 10 indicators assessed, none were good, six were fair, and four were poor, yielding an overall subjective rating of fair. The available information suggests that various human activities such as agriculture in the Subwatershed may be having an impact on water quality in local waterbodies. The Modeste Subwatershed has a moderate level of development of agricultural and industrial activities and a relatively high amount of disturbance. The data gaps should be addressed given the potential for impacts to the Subwatershed.