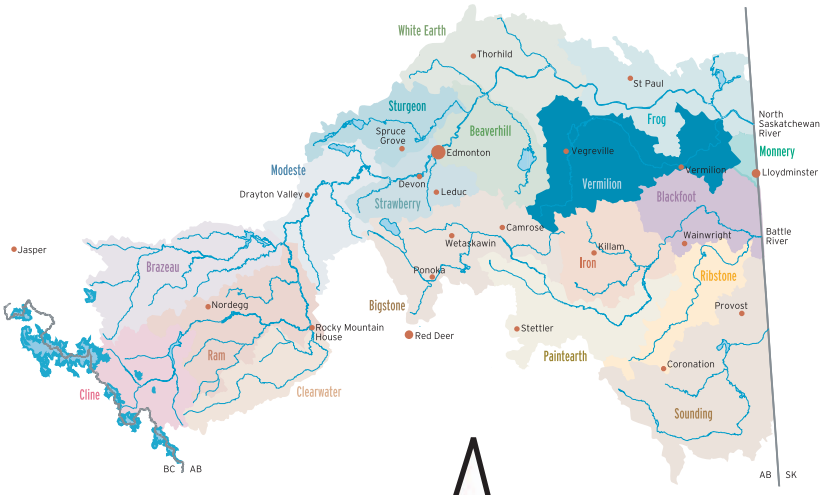
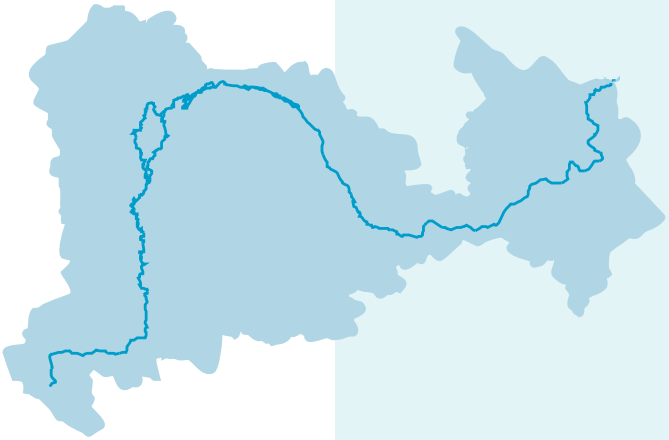
Vermilion





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5.10 VERMILION SUBWATERSHED

The Vermilion Subwatershed comprises about 11% of the entire North Saskatchewan Watershed in Alberta and drains 5,700 km^2 of land in the Parkland Natural Region. The Vermilion Subwatershed encompasses 782,642 hectares including 35,995 hectares of natural and artificial water bodies and includes the Minburn Provincial Grazing Reserve. The Vermilion Subwatershed includes the municipal boundaries of Beaver, Lamont, Minburn, Two Hills, St. Paul and Vermilion River Counties and the towns of Beauvallon, Clandonald, Dewberry, Hairy Hill, Holden, Innisfree, Islay, Kitscoty, Mannville, Marwayne, Minburn, Mundare, Musidora, Ranfurly, Two Hills, Vermilion, Vegreville and Willingdon. Vermilion Provincial Park occupies 728 hectares in the Subwatershed. Vermilion Provincial Park provides recreational opportunities including hiking, camping, canoeing, cross-country skiing, bird watching and fishing in an artificial lake in the park. Major structures are located at Watts/Bens Lakes, Morcambe and Vermilion.

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

5.10.1 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.

5.10.1.1 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 health along the Vermilion River was assessed in the summer of 1999 by Westworth Associates Environmental Ltd. and the Land Stewardship Centre of Canada using Cows and Fish methodology (1999). Fifty-four percent of the sites were assessed as 'unhealthy', 30% as 'healthy, but with problems' and 16% as 'healthy'. Livestock grazing and cultivation were mostly associated with unhealthy sites. A riparian bird biodiversity inventory was also conducted in 2003 by Cows and Fish, and a report should be published sometime in 2004.

5.10.1.2 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 3% (20,984 ha) of land in the Vermilion Subwatershed is affected by linear developments. The majority of this (62%) is in roads of one form or another, including gravel and unimproved roads (48% of the linear development) and paved roads (12% of linear developments). Other linear developments include pipeline rights of way (18% of the area of linear development), cutlines (9%), transmission line rights of way (8%), and active or abandoned rail lines (4%).


5.10.1.3 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, including lakes, rivers, streams, wetlands, dugouts and reservoirs cover 5% of the Subwatershed. The vast majority of the Subwatershed is classified in various land uses related to agricultural production: cropland, 51%; grassland, 46%; and forage, 1%. About 0.2% (1,227 ha) of the Subwatershed is covered with trees.

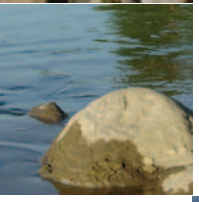
About 4% of the land area in the Subwatershed has been affected by various forms of disturbance including the linear development described above. The greatest area of disturbance following linear development is due to well sites, which affect about 1% of the Subwatershed (7,065 ha). Disturbance due to municipalities of various sizes including Vermilion, Two Hills, Vegreville and Minburn affects about 0.5% of the Subwatershed (4,157 ha). The remainder of the land disturbance is related to linear developments (2.7%), and industrial facilities including oil and gas plants, runways, sand and gravel pits, and other industrial sites (311 ha).

Water bodies including rivers, lakes and dugouts cover about 35,995 hectares; about 5% of the Subwatershed.

5.10.1.4 Livestock Density

Areas of higher livestock density may be expected to have greater impacts on downstream aquatic systems.

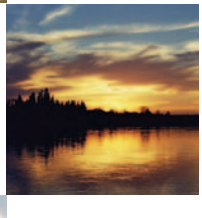
Manure production was used as a surrogate for livestock density. Manure production information was available only on the basis of soil polygons. These polygons do not correspond to the Subwatershed boundaries and provide only a rough estimate of manure production within the actual Subwatershed. Based on the available information, livestock densities in the Vermilion Subwatershed are moderate with higher densities indicated in the north-central portion of the Subwatershed in a soil polygon that also extends into the Frog and White Earth Subwatersheds. Manure production in the soil polygons that cover the Vermilion Subwatershed was estimated at between 726,400 and 5,422,000 tonnes. Surface water bodies within the regions of high agricultural intensity may be adversely affected by elevated total phosphorus concentrations, fecal coliform counts and elevated pesticide concentrations.

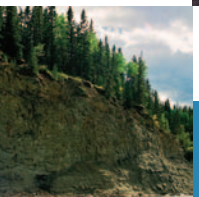


5.10.1.5 Wetland Inventory

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 PFRA Land Classification shows 1,770 hectares of wetlands occurring in the Vermilion Subwatershed (0.2% of the land area). However, an inventory completed by Ducks Unlimited Canada for the Subwatershed found a total of 43,783 hectares of wetlands (5.6% of the Subwatershed area). The inventory included both permanent and temporary wetlands. The Holden Drainage District, the oldest in Alberta, drains approximately 12,000 acres in the southwest portion of this and the southeast part of the Beaverhill Subwatershed into the Vermilion River.








5.10.2 Water Quality and Quantity

Water bodies in the Subwatershed include the Vermilion River, and Waskwei, Deer, Irish, and Birch Creeks. Larger Lakes include Birch, Kenilworth, Akasu, Plain, Watt, Bens, Campbell, Dusty, Vermilion Lakes and Raft.

Towns in the Subwatershed have various types of wastewater treatment facilities. Vermilion's wastewater is pumped into an extended aeration plant and then into a lagoon system from which it is discharged into the Vermilion River.

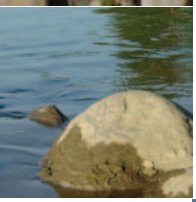
Water quality in the main stem of the North Saskatchewan River is monitored regularly by Environment Canada at Lea (Jubilee) Park and the river crossing at Highway 17. Monthly physical, nutrients, metals and flow data are available from 1970 to the present. CCME Water Quality Index (WQI) data are available for both sites from Environment Canada for 1983-2002 (*Glozier et al.* 2004). For the 1983-2002 period, river water quality at both sites was found to be marginal (calculated WQI = 53). A marginal value (calculated WQI 45 to 59) means that water quality is frequently threatened or impaired, and that conditions often depart from natural or desirable levels. The variables of non-compliance were not stated in the report (*Glozier et al.* 2004). As expected, the CCME WQIs decreased markedly from the other Environment Canada headwater site WQI at Whirlpool Point. Water quality typically decreases as one travels downstream due to inputs from both natural, anthropogenic, point and non-point sources.

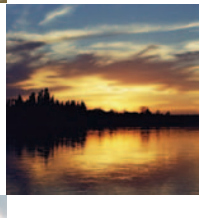
Thirteen samples were taken for pesticides between 1997-2001. Pesticides detected in this Subwatershed included 2,4-D, Bromoxynil, MCPA, MCPP, and Picloram, all of which were below the CCME Surface Water Quality Guidelines for the Protection of Aquatic Life. 2,4-DP and Clopyralid were also detected, but there are currently no water quality guidelines for these compounds.

Water quantity is measured at eleven HYDEX stations (05EE001-05EE007, 05EE009, 05EE913, 05EE915 and 05EE930): three have real-time online data (05EE005, 05EE006, and 05EE009). The main stem of the Vermilion River is 380 kilometres long and has no major permanent tributaries. The flow regime is characterized by lengthy periods of low flow. The system depends on groundwater sources for base flows and zero discharge has been recorded on several occasions. Figure 19 shows the Vermilion River hydrograph, which is typical of a non-glacial fed stream. Flow contributions are largely from spring runoff and smaller contributions from summer storms.







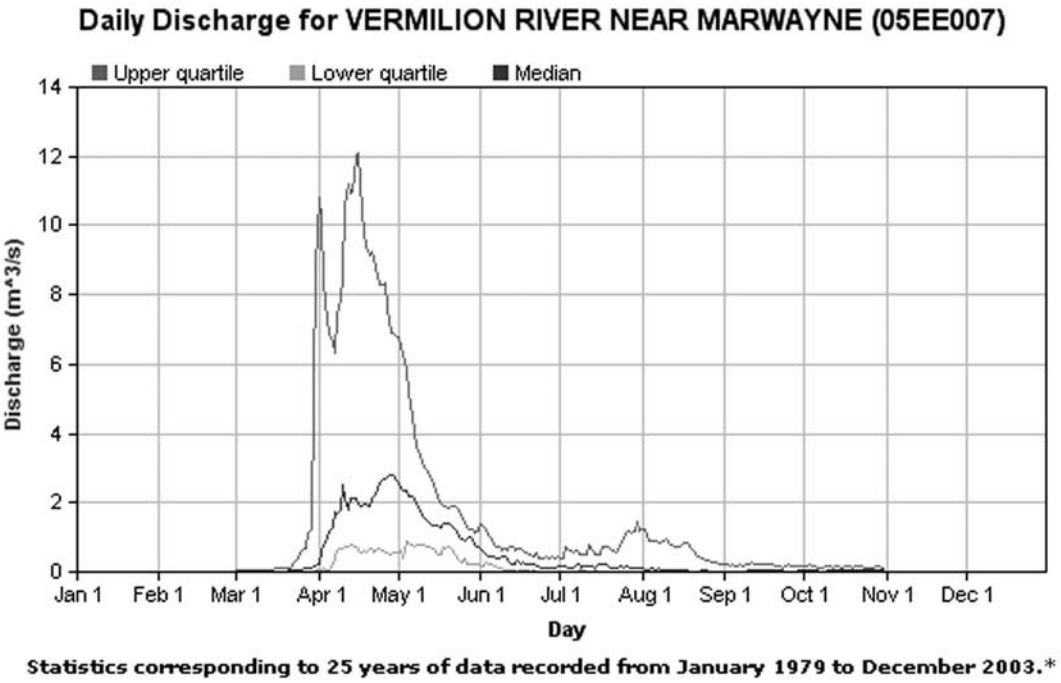


Figure 19: Vermilion River near Marwayne mean monthly discharge (Station 05EE007).

5.10.3 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.

5.10.3.1 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 Vermilion 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 Vermilion Subwatershed.

5.10.3.2 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. A systematic estimate of fish populations in the Vermilion Subwatershed has not been done. Northern pike is the only game fish occurring in the main stem of the North Saskatchewan River in this Subwatershed. It is sparsely and irregularly distributed and restricted to a few sites (Allan 1984). Future research on the Vermilion Subwatershed should address this gap.




5.10.3.3 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 Vermilion Subwatershed is located in the Parkland Natural Region of Alberta. 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.

5.10.3.4 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 Vermilion Subwatershed, so we cannot make any conclusions about ecosystem health using this indicator. This data gap could be addressed in future research within the Vermilion Subwatershed.

5.10.4 Vermilion Summary

The majority of the Vermilion Subwatershed land uses are related to agriculture. Only 0.2% is covered with trees. Livestock densities are moderate with higher densities indicated in the north-central portion of the Subwatershed. Almost 3% of the land is affected by linear developments including roads, pipeline rights of way, cutlines, transmission line rights of way, and rail lines. Another 4% is affected by well sites, disturbance due to municipalities, and industrial facilities. The available PFRA Land Classification shows wetlands on 0.2% on the land area; however, Ducks Unlimited Canada information indicates that wetlands cover 5.6% of the Subwatershed area. This variance should be resolved.

No published assessment of water plants, benthic invertebrates, or long-term river water quality information was found for the Subwatershed. The Vermilion River depends on groundwater sources for base flows and zero discharge has been recorded on several occasions. Water quantity is measured at eleven stations in the Subwatershed: three have real-time online data.

Riparian health along the Vermilion River was assessed in 1999. Fifty-four percent of sites were assessed as ‘unhealthy’, 30% as ‘healthy, but with problems’ and 16% as ‘healthy’. Livestock grazing and cultivation were mostly associated with unhealthy sites. A systematic estimate of fish populations in the Vermilion Subwatershed has not been done. No information was found on water plants or benthic invertebrates.

In summary, there has been little systematic assessment of this Subwatershed and there are significant gaps in the available information. However, of the seven indicators assessed, none were good, two were fair, and five were poor, yielding an overall subjective rating of poor. The overall size of this Subwatershed, the high level of agricultural land use and relatively high livestock densities, the results of riparian health assessments and the available water quality data would all suggest that it is important to address the data gaps and to further assess the impacts of various land uses on the Vermilion Subwatershed.