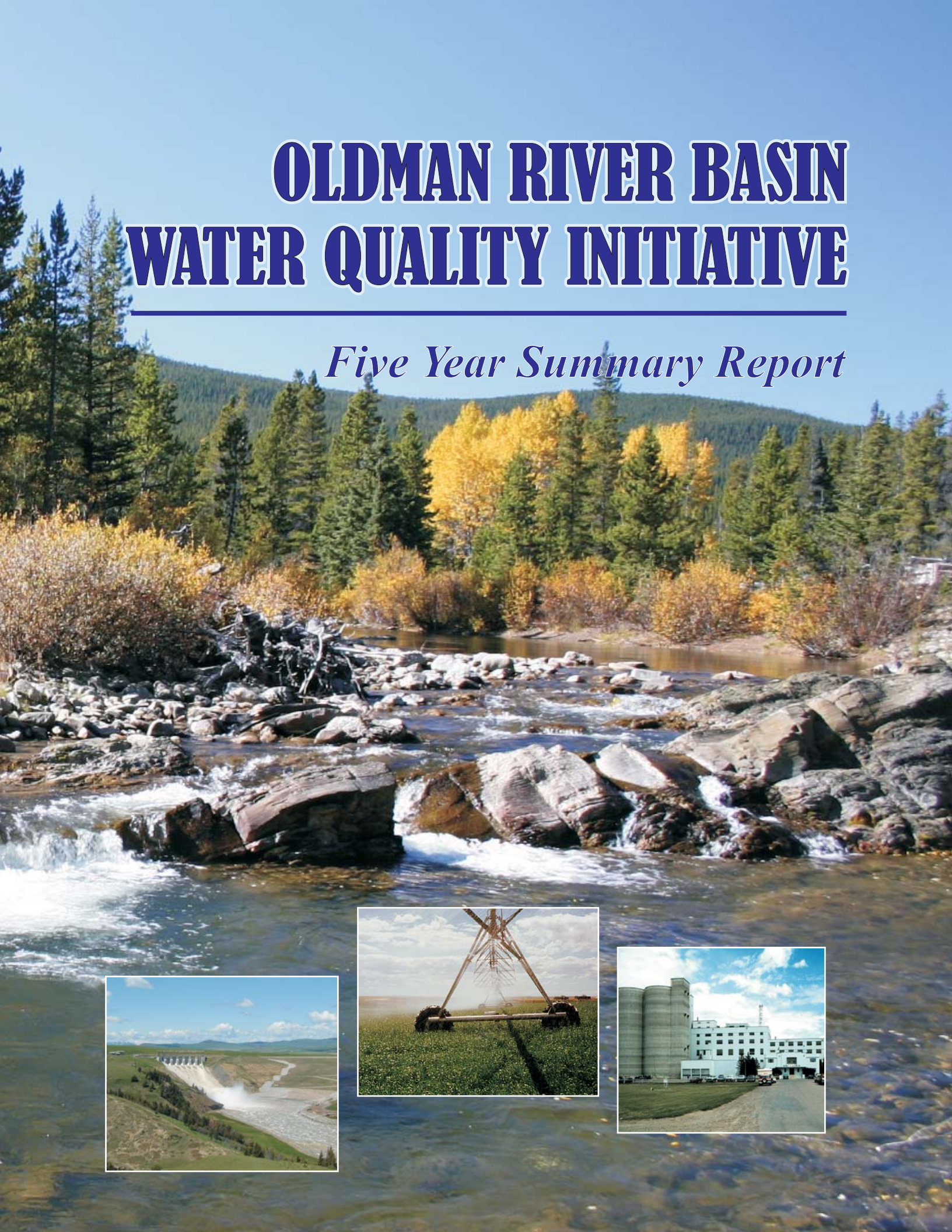


OLDMAN RIVER BASIN WATER QUALITY INITIATIVE

Five Year Summary Report



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OLDMAN RIVER BASIN WATER QUALITY INITIATIVE

Five Year Summary Report

Acknowledgments

This summary report was compiled from a series of technical reports prepared by many staff from a number government and private sector agencies that worked with the Oldman River Basin Water Quality Initiative. Many of these individuals continue to provide valuable input to the Oldman Watershed Council.

Special thanks to Bonnie Hofer, with the Irrigation Branch of Alberta Agriculture, Food and Rural Development, who was responsible for the layout and formatting of this report.



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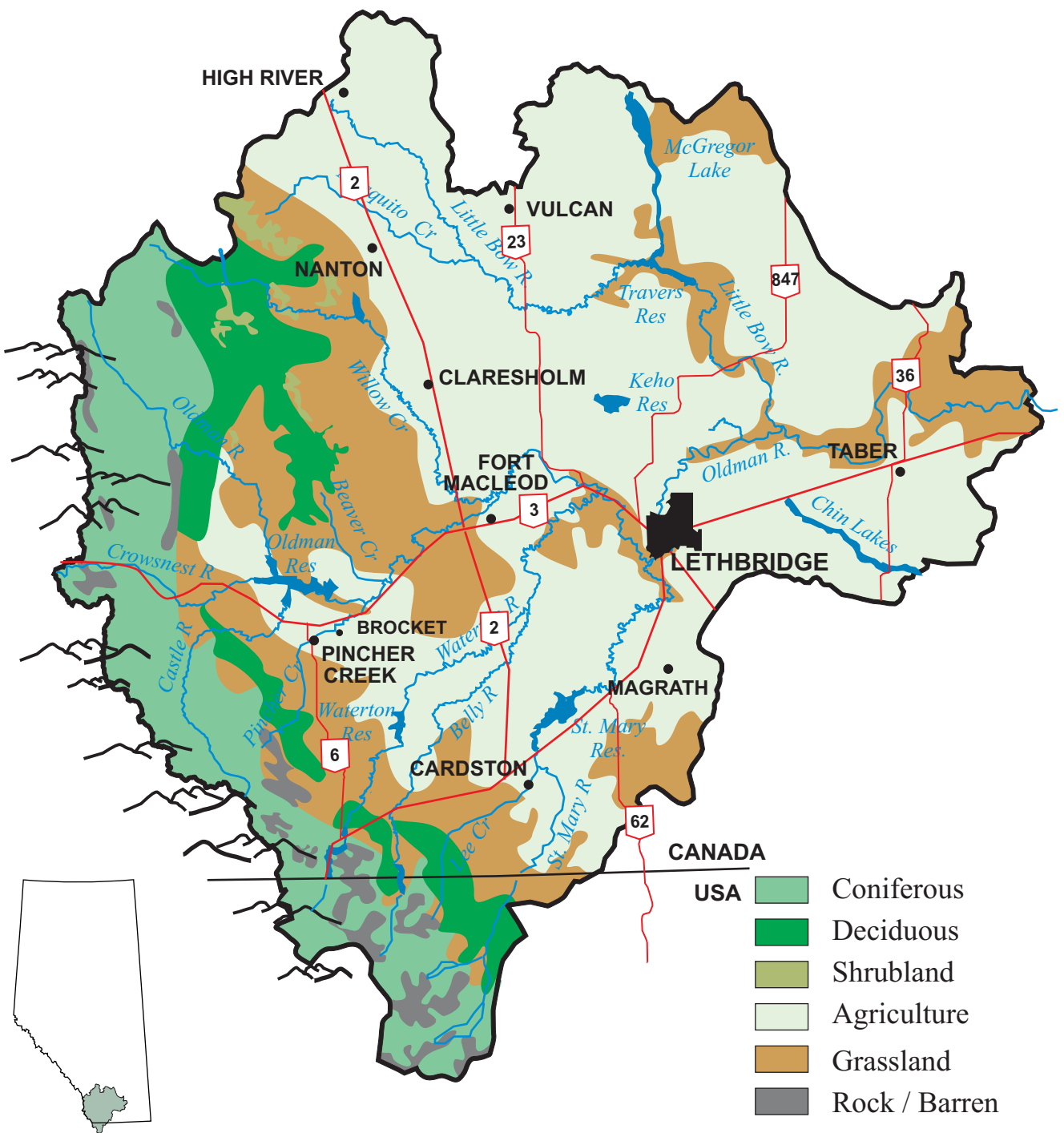


Figure 1. Vegetation in the Oldman River Basin.

OLDMAN RIVER BASIN WATER QUALITY INITIATIVE

FIVE YEAR SUMMARY REPORT

1.0 INTRODUCTION

In 1997, a diverse group of stakeholders came together to address mounting concerns about water quality in the Oldman River Basin. They were driven by a common goal to ensure the supply of good quality water to the citizens living in the Oldman River Basin.

This group formed the **Oldman River Basin Water Quality Initiative**, and in March 1998 developed a comprehensive five-year Action Plan to:

- Compile a land-use inventory and explore relationships between land-based activities and water quality;
- Assess the state of surface water quality throughout the basin;
- Develop and evaluate management practices that will benefit water quality; and
- Promote the implementation of water quality protection measures through education and awareness.

2.0 BASIN OVERVIEW

One of the first actions the Initiative undertook was to identify the vegetation and carry out a land use inventory for the Basin. The Data Collection and Integration Working Group used

methodologies to complete an inventory that included: satellite imagery, Statistics Canada population data, aerial photography, and ground truthing by Federal and Provincial government agencies. The data from this assessment form the basis for the following information.

The Oldman River Basin covers approximately 3 million hectares in southern Alberta, extending eastward from the forested slopes of the Rocky Mountains, through the rangelands of the foothills and the dryland and irrigated plains, to the prairie grasslands (Figure 1). Figure 2 shows the relative breakdown of vegetation classes within the Oldman River Basin. This region of the province is

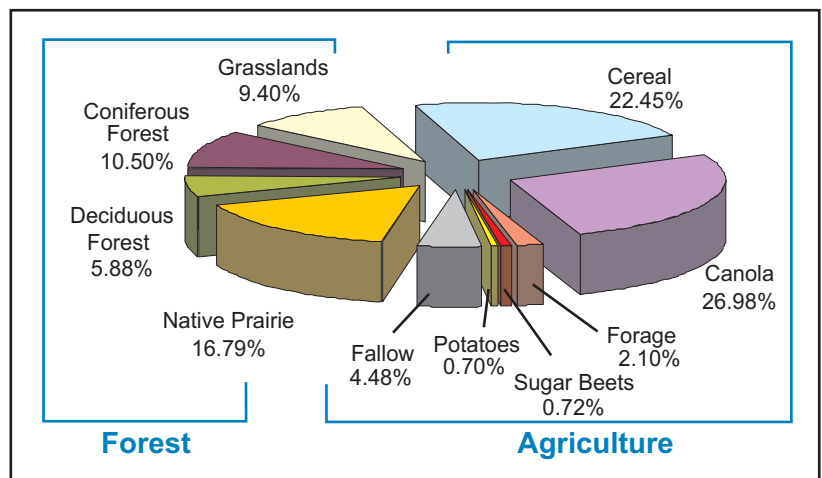
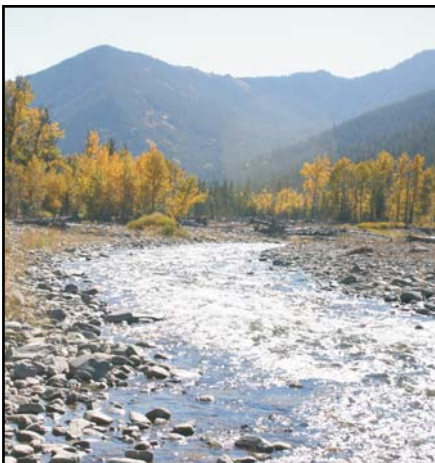
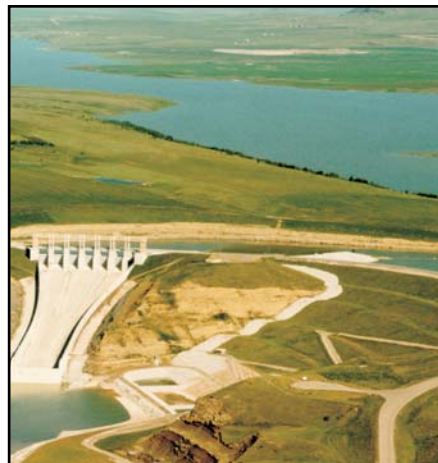


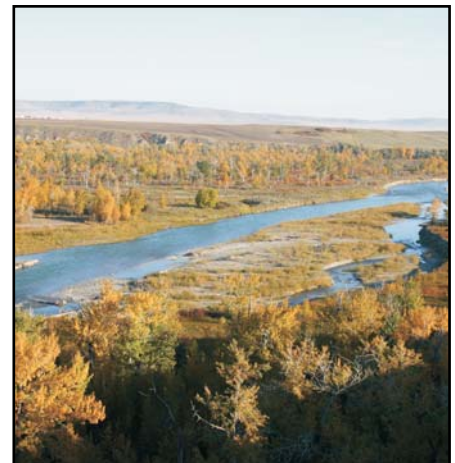
Figure 2. Vegetation classes within the Oldman River Basin.



Foothills stream



Oldman Reservoir



Oldman River valley

classified as semi-arid, with total precipitation ranging from 300 to 450 mm per year. Less than half of this falls during the agricultural growing season from May through August.

Water supply and water use has always been an important concern to the residents of the Oldman River Basin because of the potential for drought conditions and resultant water shortages. Figure 3 shows the sub-basin watersheds that contribute flow to the Oldman River. Surface water from the rivers and streams located throughout the basin are important for municipal, agriculture, business, and recreation needs.

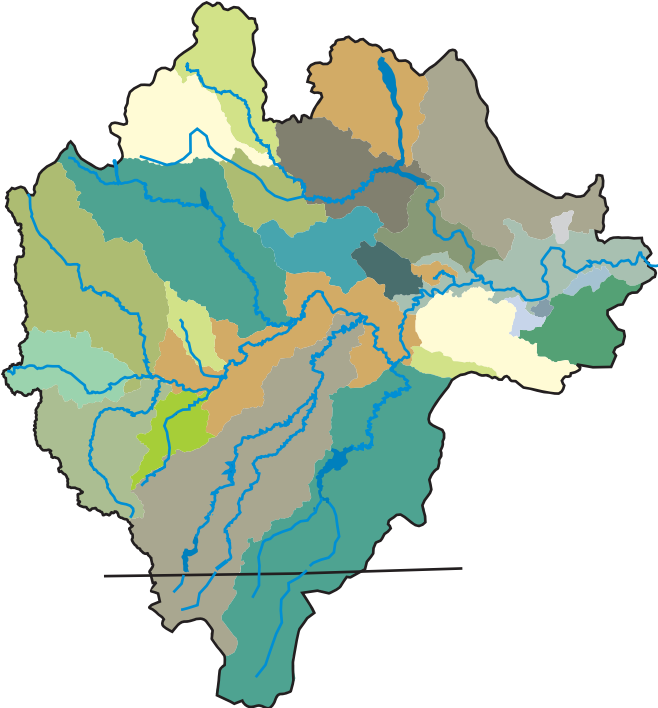


Figure 3. Sub-basin watersheds in the Oldman River Basin.

The Oldman mainstem river is fed by a number of rivers and streams throughout its journey from the eastern slopes of the Rocky Mountains to its confluence with the Bow River, where the South Saskatchewan River begins.



City of Lethbridge

Three rivers - the Oldman, the Castle, and the Crowsnest form the western headwaters for the Oldman River. These three rivers merge at the Oldman Reservoir near the town of Brocket, on the Piikani Reserve. The Oldman Reservoir was commissioned in 1991.

Near the City of Lethbridge, three additional rivers; the St. Mary, Waterton, and Belly, flow into the Oldman River. Two of these rivers (Waterton and Belly) originate in the southwest corner of the basin, while the St. Mary River begins its journey in the mountains of Montana, USA. Several other streams flow into the Oldman River as it continues to flow to the eastern edge of the Oldman River Basin.

Besides the natural watercourses found in this basin, an extensive network of storage reservoirs, canals and pipelines deliver water to irrigate a diverse range of crops and support communities, industry, recreation, and wildlife habitat throughout the basin.

The Oldman River Basin is home to more than 160,000 people, almost half of whom live in Lethbridge, the basin's largest municipality. Figure 4 shows the relative distribution of the basin's population throughout the basin. The majority of people live relatively close to the Oldman River or one of the numerous tributaries.

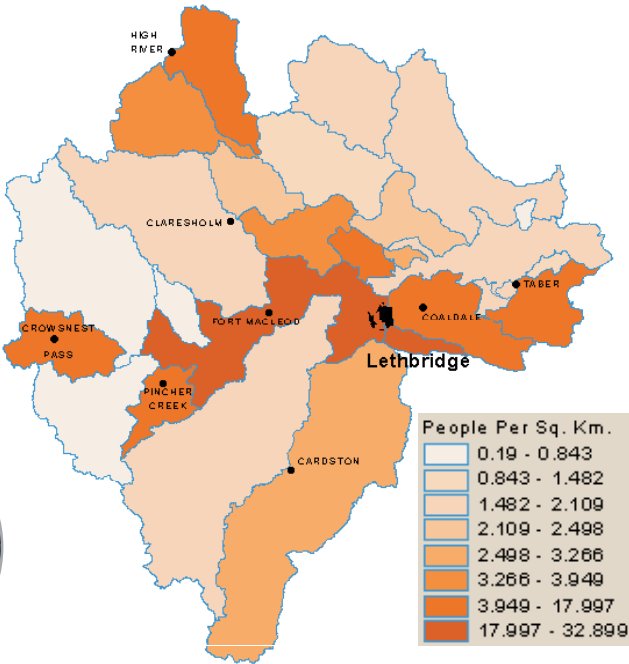


Figure 4. Distribution of population in the Oldman River Basin.

Activities within the basin include forestry, mining, recreation (Figure 5), oil and gas extraction (Figure 6), and agriculture. Figure 7 shows the location of all of these major activities being carried out in the basin, and shows that most of the pressures on the land and water are located towards the eastern section of the basin.



Figure 5. Location of recreation sites.

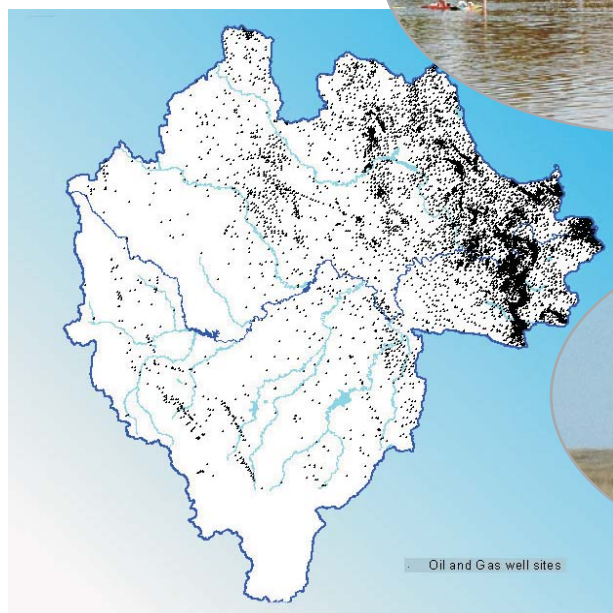


Figure 6. Location of oil and gas sites.

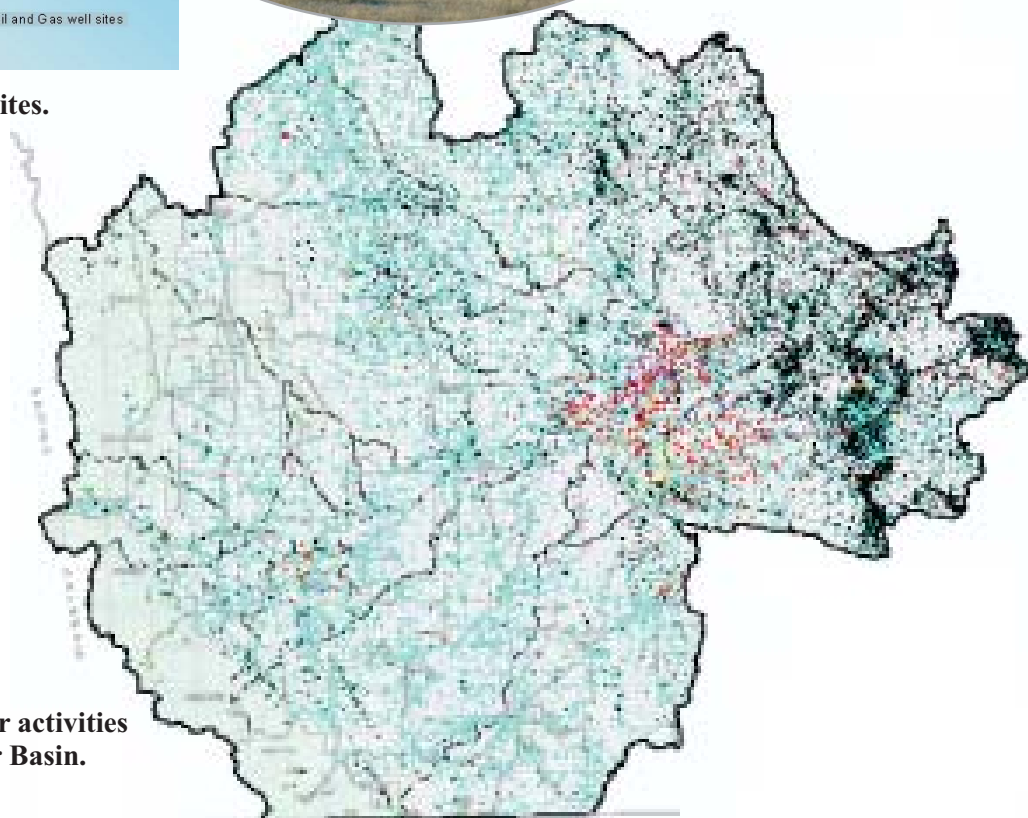


Figure 7. Location of all major activities in the Oldman River Basin.

Agriculture is the main land use within the Oldman River Basin, covering almost 60 percent of the total land base. Irrigation is the major consumer of water within the Oldman River Basin. At present, about 266,000 ha of land is irrigated within the basin, which represents more than 40 percent of the total irrigated land in Alberta. Figure 8 shows the distribution of the irrigated land throughout southern Alberta. The large area of irrigated cropland, combined with the high density of intensive livestock operations (Figure 9) and processing industries, make it one of the most intensively managed agricultural regions in western Canada.

The stress placed on water quality and quantity in this basin, as a consequence of the expanding activities of a growing population, is not unique. However, the intensity of the development, coupled with the semi-arid nature of this region, present a particular challenge to the protection of aquatic resources.

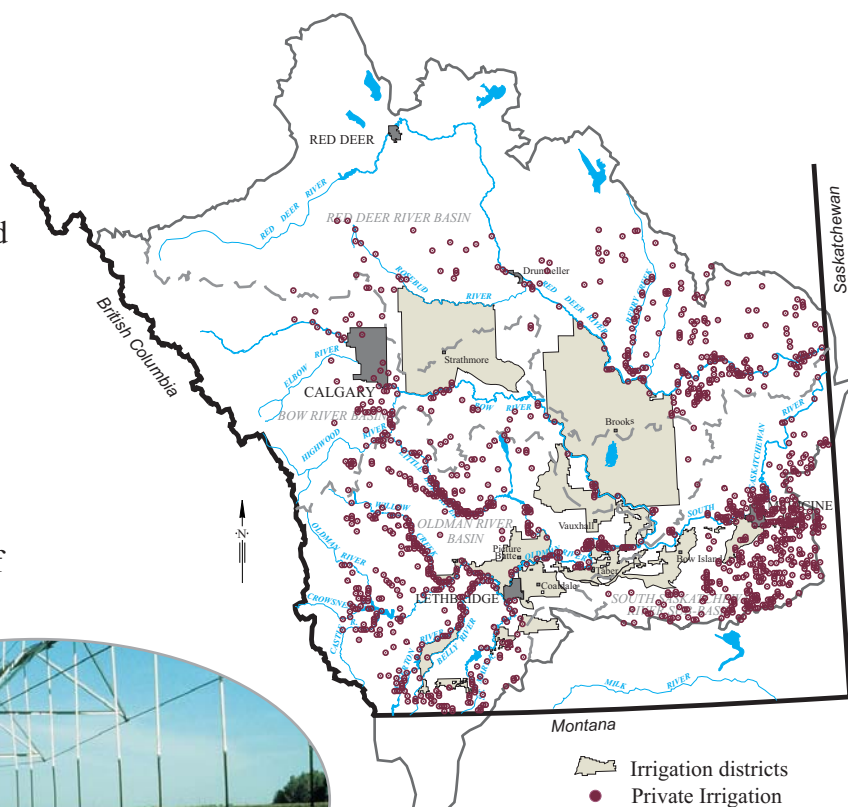


Figure 8. Location of irrigated areas.

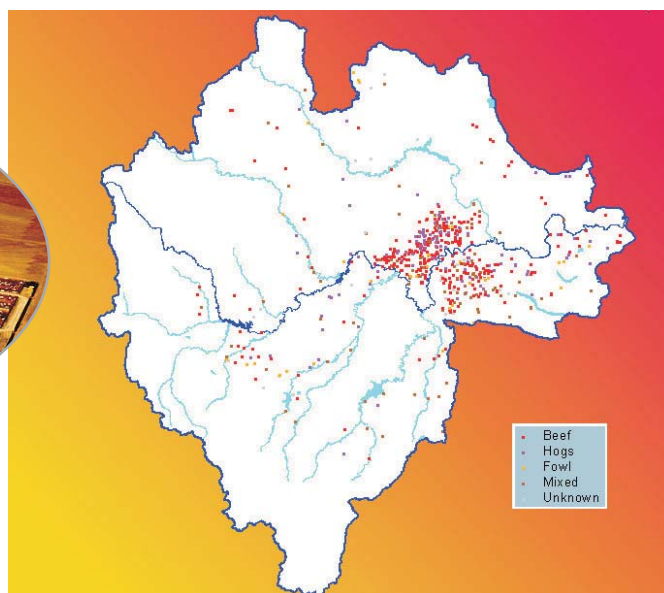


Figure 9. Location of intensive livestock operations.

3.0 STATE OF SURFACE WATER QUALITY IN THE BASIN

The surface water quality monitoring program was designed to fulfil a number of objectives. Firstly, the Initiative needed to expand on existing water quality information and provide a current assessment of the Oldman River and its tributaries. Secondly, there was some speculation about which areas of the basin and aspects of water quality were of concern. These areas needed to be confirmed, and others identified.

3.1 What Was Measured?

The many characteristics that define the quality of surface water are the result of complex interactions between climate, surficial geology, vegetation, and human influence in the basin. These characteristics can be divided into three general categories: biological variables (bacteria and protozoan parasites); physical variables (temperature and turbidity); and chemical variables (inorganic and organic compounds). This study measured selected variables to assess the overall water quality in the basin.

3.1.1 Biological Variables

Bacteria - The two bacterial variables investigated were **fecal coliform bacteria**, and a particular species of fecal coliform, *Escherichia coli* (*E.coli*). Fecal coliform bacteria originate in the intestines of warm-blooded animals, with the majority as *E. Coli*. Fecal coliform and *E. coli* bacteria do not in themselves represent a threat to the environment, but they do indicate that the

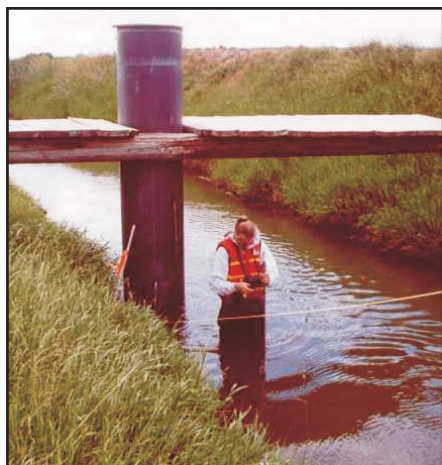
water may be contaminated by fecal matter (*i.e.* sewage or manure).

The Canadian Water Quality Guideline (CWQG) for water to be used for irrigation is 100 fecal coliform bacteria/dL (1 dL = 100 mL). The CWQG for recreation for either *E. coli* or fecal coliform bacteria is 200 colony forming units (cfu) /dL, which are generally compared to the geometric mean of at least 5 samples collected in a 30-day period.

Coliform bacteria should not be present in any drinking water. Both irrigation and recreation guidelines for coliform bacteria consider the risk of ingesting pathogens and becoming ill (e.g. eating unwashed produce or getting a mouthful of water while swimming). However, the fecal coliform bacteria themselves are not necessarily infective; they merely indicate that other harmful bacteria, viruses, or parasites may be present because of fecal contamination.

The general counts of *E. coli* reported in this study do not include the pathogenic O157:H7 strain. Specific testing for this microbe was beyond the scope of the study. However, water samples collected as part of the Oldman River Basin Water Quality Initiative were shared with researchers who performed more specialized microbial tests.

Protozoa - The protozoan parasites *Giardia* and *Cryptosporidium* were of particular concern at the time the Initiative was formed. Basin communities were occasionally asked to boil their drinking



water because of the presence of these single-celled organisms in the water supply. However, there was little information available about these organisms in the environment.

Both of these microscopic organisms live in the intestines of animals, including livestock, wildlife and people. Ingestion of food and water contaminated with infective *Giardia* and *Cryptosporidium* cysts, or contact with infected individuals or contaminated objects, can result in gastro-intestinal illness, which can be particularly severe for people with weakened immune systems. *Giardia* is the organism responsible for the disease known as “beaver fever” or giardiasis. Infection with the *Cryptosporidium* organism results in cryptosporidiosis.

While *Giardia* can be removed from drinking water by adding chlorine, *Cryptosporidium* cysts are much more resilient. For both organisms, filtration (through a 1 micron filter) or boiling is the best defense.

3.1.2 Physical Variables

Water Temperature has an important effect on the chemical and biological processes occurring in the aquatic environment, as it determines how much dissolved oxygen water can hold. Temperature is usually determined by ambient conditions but can be altered by effluent discharges. For this study, water temperature was used to determine acceptable levels for ammonia.

Turbidity is the scattering of light by suspended particles in the water. Disturbed sediments, organic debris, and plankton can all contribute to turbidity. Runoff is a major source of suspended particles.

3.1.3 Chemical Variables

Total dissolved solids (TDS) is a measure of the salts dissolved in water, which may come from both natural and man-made sources and are transported into surface water through runoff and wind. The irrigation CWQG for TDS is between 500 and 3500 mg/L, depending on the crop. The upper limit for TDS in water for livestock is 3000 mg/L (CCME 1999).

Electrical Conductivity (EC) is a measure of the total salt content in water. The higher the salt content of water, the more potential negative impact it can have on plant growth. Rather than examining sodium concentrations themselves as an indication of potential harm to plants and to soil permeability, the **Sodium Adsorption Ratio (SAR)** is calculated. This ratio relates sodium concentration to calcium and magnesium levels, which help to counter the effects of sodium.

Total Organic Carbon (TOC) is a measure of the organic matter present in water, whether in dissolved or particulate form. All organic matter contains the element carbon.

Dissolved Organic Carbon (DOC) tends to make up the majority of TOC and is usually positively correlated with flow. There are no guidelines for TOC or DOC, but an examination of organic carbon can provide useful information about agricultural, municipal, and industrial inputs to a water body.

Dissolved Oxygen (DO) is a crucial component of water quality because fish and other aquatic organisms require it in order to breathe. Dissolved oxygen is also a useful variable to examine because it is influenced by a wide variety of natural and manmade factors. The Alberta Surface Water Quality Guideline (ASWQG) for DO is a one-day minimum of 5 mg/L or a seven-day average of 6.5 mg/L. The CWQG for DO ranges between 5.5 and 9.5 mg/L, depending on whether cold- or warm-water organisms are present and their stage of development.

Nitrogen is an essential nutrient which exists in a number of different organic and inorganic forms, and is necessary for the basic processes of life. However, excess nitrogen in surface water can lead to excessive growth of plants and algae, which can lead to oxygen depletion in water. Nitrogen can also have toxic effects. The AWQG for **total nitrogen** is 1.0 mg/L.

Nitrate (No₃⁻) is the most soluble and stable inorganic form of nitrogen in surface water and is the most readily available source of nitrogen to

algae and aquatic plants. **Nitrite** (NO_2^-) is found less commonly in surface water because it is quickly converted (oxidized) to nitrate by bacteria. The two ions are reported in mg/L as nitrogen and are sometimes reported together as $(\text{NO}_2^- + \text{NO}_3^-)\text{-N}$. At the start of the ORBWQI, the only guideline available for nitrate (as nitrogen) was the Canadian Drinking Water Guideline of 10 mg/L, but recently a value of 3.0 mg/L has been set by the CCME for the protection of aquatic life. The CWQG for nitrite (as nitrogen) for the protection of aquatic life is 0.06 mg/L.

Phosphorus, like nitrogen, is an essential nutrient required by all forms of life. Natural phosphorus concentrations may be quite variable, depending on the characteristics of the surrounding landscape features. Fertilizers, industrial effluents, disturbed soils, and human and animal wastes can all increase the phosphorus levels in surface waters, leading to increased growth and abundance of algae, plants and other organisms. Besides its unpleasant appearance, this overgrowth will eventually decay and consume oxygen.

Total Phosphorus (TP) can be divided into inorganic and organic fractions, or into dissolved and particulate fractions. The only available guideline for phosphorus is the AWQG for total phosphorus of 0.05 mg/L.



3.1.4 Metals and Trace Elements

Metals and other trace elements are commonly found in surface waters. While necessary in very small amounts, higher concentrations of many of these elements can be toxic to aquatic life, humans,

livestock, and crops. The only metals tested regularly as part of the ORBWQI were **iron** and **manganese**. These metals are part of the routine water testing package offered by many laboratories because they can have aesthetic implications for drinking water. Tests for **mercury**, **arsenic**, and **selenium**, all of which can be toxic in relatively low concentrations, were occasionally done at selected sites, during the ORBWQI.

A longer list of other trace elements and metals were tested during the 2000 synoptic survey and on three occasions during the City Storm Drain study. All metals and trace elements examined are listed along with their relevant guidelines in Appendix A. Note that the Canadian Water Quality Guidelines are meant to be applied to total metal concentrations. In this report, the guidelines are used as a reference point even if only the dissolved metal fraction was available.

3.1.5 Pesticides

Pesticides can make their way into surface waters directly through aquatic application, through spills, and by runoff from fields, gardens, and lawns. They can also be deposited into distant water bodies by wind or rain. “Pesticide” is a general term; the more specific categories examined in this study were herbicides (for controlling weeds), insecticides (for controlling insect pests), and fungicides (for deterring mould and other fungi). A list of the pesticides routinely analysed, their general use, and any available guidelines, is presented in Appendix B. Note that the compounds examined are active ingredients or degradation products, not commercial mixtures (*i.e.* a test is not done for Killex® [Scotts Canada Ltd.], but its components **2,4-D**, **dicamba**, and **mecoprop (MCP)** are analysed.)

The list of pesticides for which analytical tests are available is occasionally updated. Therefore, the number of compounds routinely examined increased during the life of the Initiative. Additionally, tests for a number of specialty pesticides became available in 2002. These were performed at selected locations in the Oldman River Basin in June 2002 and are listed separately in Appendix C.

3.2 What Was Found?

During the five-year ORBWQI, several water quality monitoring projects were undertaken throughout the Oldman River Basin to fully assess the state of the water quality, and to identify existing causes where problems were found.

During the five years, flows of the Oldman River and its tributaries were variable, depending on the amount of annual precipitation received. Flows in the Oldman River and its tributaries were much lower in 2000 and 2001 compared with 1998 and 2002.

While flows in the Oldman River and its main tributaries are dependent on natural precipitation, flows in irrigation return flow channels are not always related to the amount of precipitation. During the irrigation season, these channels (drains) receive runoff even when weather conditions are dry. The most stable water flows throughout the year are found in the wastewater effluent sites from the towns and the City of Lethbridge.

The flow in the Oldman River is influenced mainly by the combined flow of the eight tributary rivers and streams (Figure 10). The average median flow during the sampling period was about 30 m³/s. This is about 10 times greater than the average median flow for the tributary sites (3.0 m³/s), 60 times greater than the average median flow for the drains (0.5 m³/s), and 500 times greater than the average median flow for the urban wastewater effluent sites (0.06 m³/s). The river is regulated below the Oldman River Reservoir in order to meet minimum flow requirements for the protection of aquatic life and to meet apportionment flows to Saskatchewan.

While a large suite of biological, physical, chemical, and pesticide parameters were measured during this study, this report will focus on the main nutrients (nitrogen and phosphorus), fecal coliform bacteria, and pesticides. A more detailed analysis of all measured parameters is contained in the report “**Oldman River Basin Water Quality Initiative - Surface Water Quality Summary Report (April 1998 to March 2003)**”.

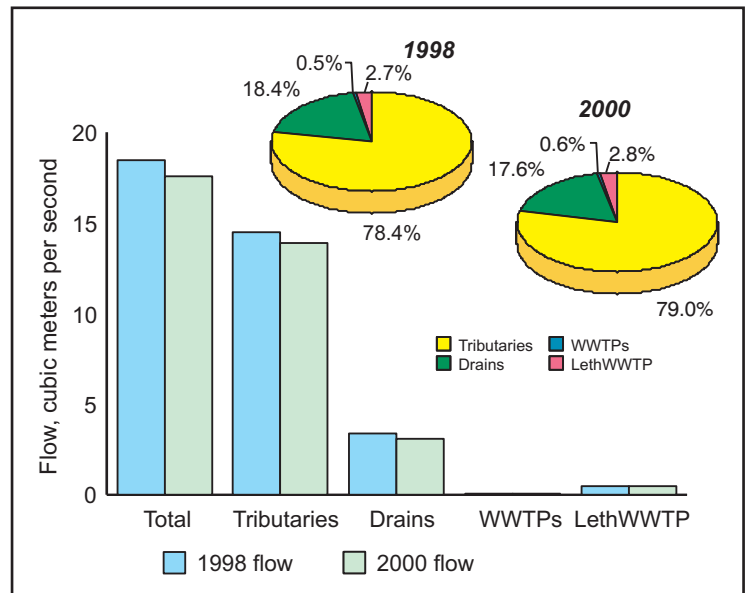


Figure 10. Relative flows in the Oldman River Basin – 1998 and 2000.

3.2.1 Oldman Basin Overview (April 1998 to March 2003)

This study provided a general indication of water quality conditions along the length of the Oldman River and in its tributaries. Figure 11 shows the sampling locations along the Oldman River. Monthly samples were collected at the numerous sites along the Oldman River from April 1998 through March 2003, and at all tributaries and major surface drains entering the river. More

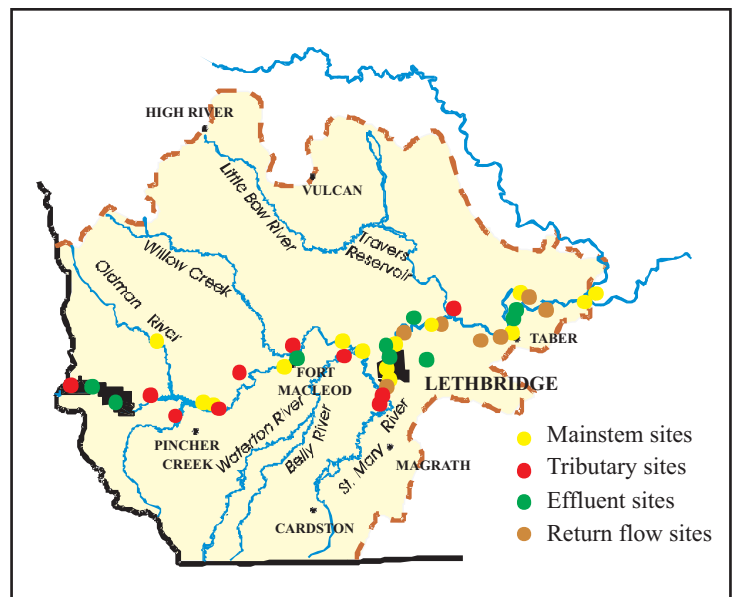


Figure 11. Water sampling sites along the Oldman River.

frequent samples were collected at some sites during the open-water season in 1998 and 1999 to provide better estimates of the annual load of nutrients and bacteria entering the river. During the first year, all wastewater effluent sites that discharged to the Oldman River were also sampled each month to define point-source impacts.

Overall, water quality in the Oldman River was good, meeting or exceeding water quality guidelines for the major nutrients such as nitrogen and phosphorus and bacterial levels related to recreational and irrigation activities.

Figures 12 and 13 provide a 10-colour index of water quality in the Oldman River for 1999, which was a relatively dry year, and 2002, which was a wet year. The colour index takes into account the concentrations of nutrients and bacteria in the water during the year. This index shows that water quality in the western portion of the Oldman River Basin was generally better than the water quality further downstream. Water quality above the Oldman River reservoir and immediately downstream of the reservoir was usually excellent. The quality of water in the Oldman River decreased downstream and was most degraded immediately below the City of Lethbridge. As the river flowed from Taber to the confluence

with the Bow River, water quality improved somewhat.

Tributaries upstream from Lethbridge were generally good quality. Beaver Creek is notable in that its water quality was somewhat poorer than most of the other streams in the foothills part of the basin. As a result of this information, the Beaver

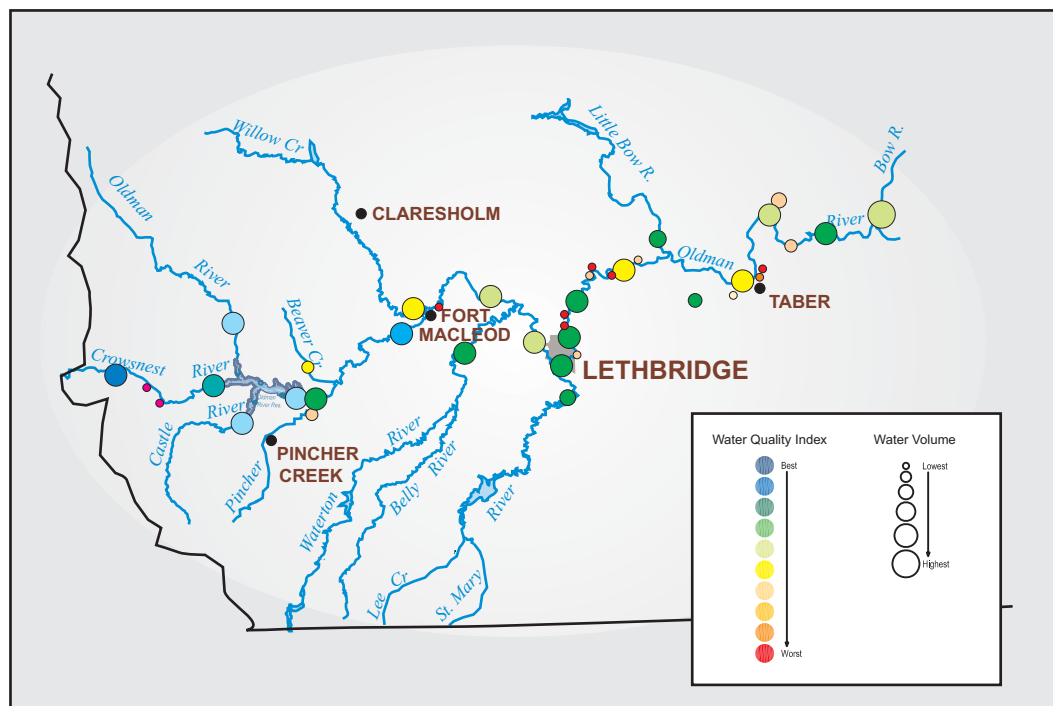


Figure 12. Oldman River Basin overview – 1998 water quality index.

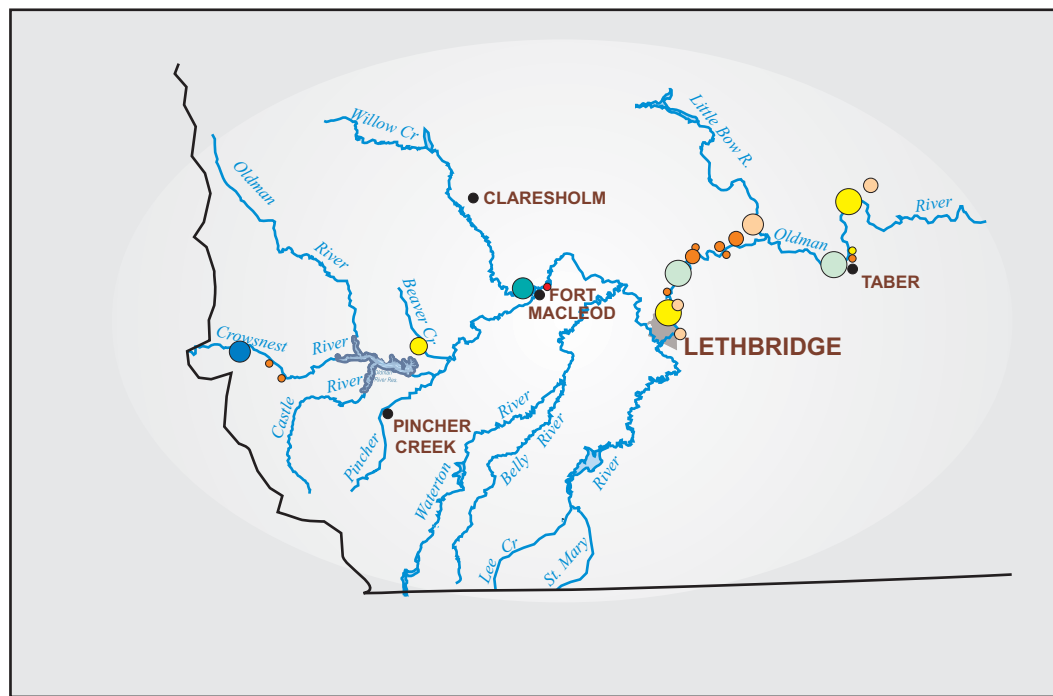


Figure 13. Oldman River Basin overview – 2002 water quality index.

Creek Watershed Group was formed in 2000 by concerned landowners to address water quality issues in this creek.

Downstream of Lethbridge, water quality in the tributaries flowing into the Oldman River was much poorer. Some of these tributaries are irrigation return flow drains and some are natural streams that receive irrigation return water. The Piyami, Haney, and Battersea drains, which drain the agricultural areas in the Picture Butte area, had higher nitrogen and phosphorus concentrations than elsewhere in the basin. Six Mile Coulee, which receives agricultural runoff from the area south and east of Lethbridge, plus urban runoff from Lethbridge, often had the highest pesticide concentrations and the most frequent pesticide detections of anywhere tested in the basin.

Figures 14, 15 and 16 show the average nitrogen, phosphorus and bacterial levels in the Oldman River, plus the tributaries and surface drains that discharge into the river. These figures show the average nutrient and bacteria concentrations from 1998 - 2002, plus the average levels for 2002, a relatively wet year. The graphs show that even during 2002, when accelerated runoff from the surrounding landscape took place, nitrogen and phosphorus levels in the Oldman River remained at or below surface water quality guidelines. However, some of the tributaries showed increased concentrations during 2002.

Pesticides were measured at pre-determined dates during the growing season in the Oldman River, its tributaries and in the Lethbridge storm drains to determine their presence in the surface water. Figures 17, 18 and 19 show the number of pesticide detections and the maximum concentrations found at the measured locations in 2001, a relatively wet year.

The data clearly show that the number of pesticide detections and the maximum concentration of 2,4-D in the tributaries is significantly higher than for the Oldman River. Even further increases in detections and the highest concentration of 2,4-D are found in the Lethbridge storm drains.

Figures 20 and 21 allow a comparison of the pesticide detections and concentrations between

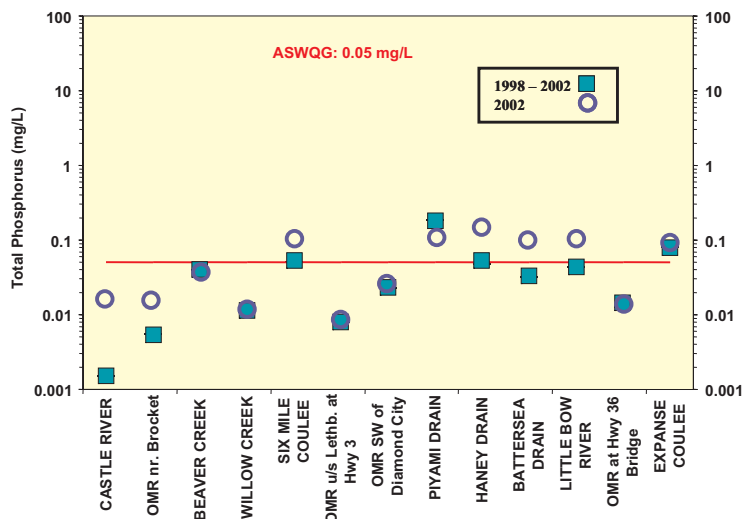


Figure 14. Total phosphorus concentrations.

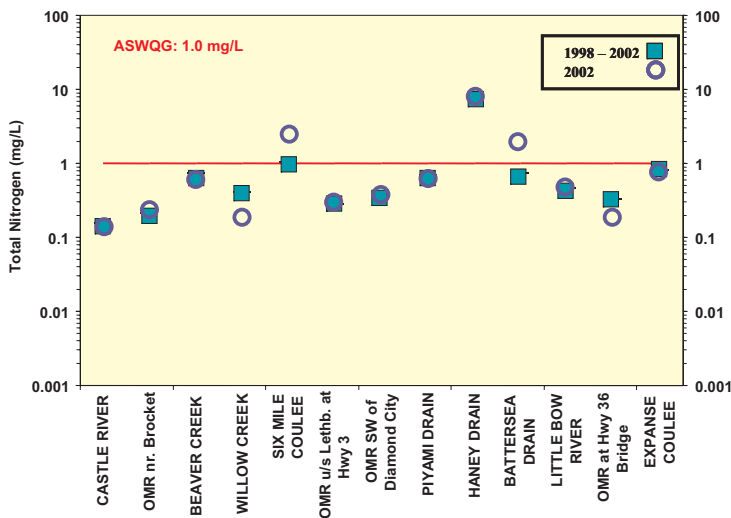


Figure 15. Total nitrogen concentrations.

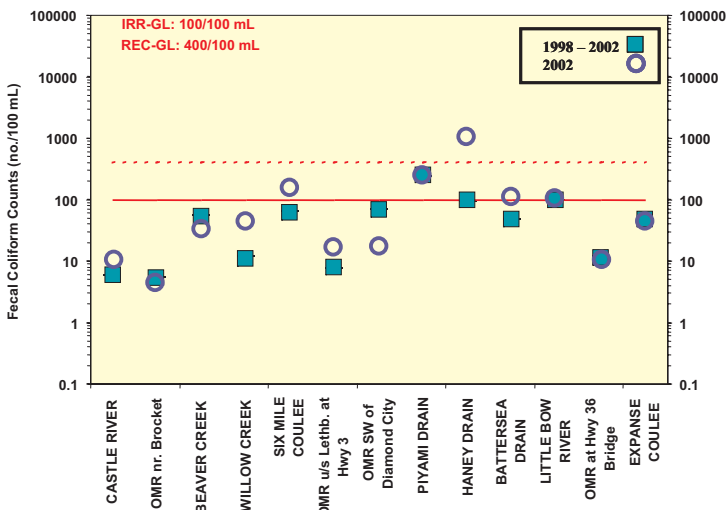


Figure 16. Fecal coliform bacteria counts.

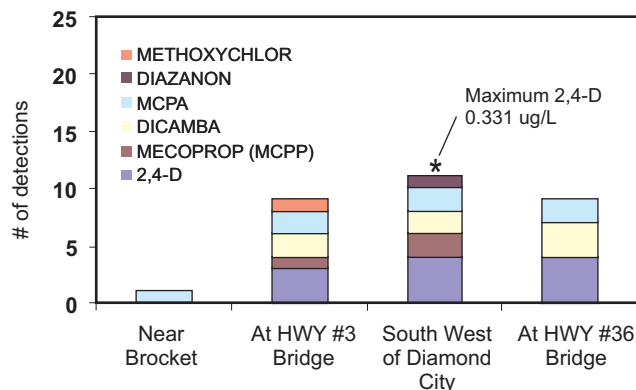


Figure 17. Pesticides – Oldman River (2001).

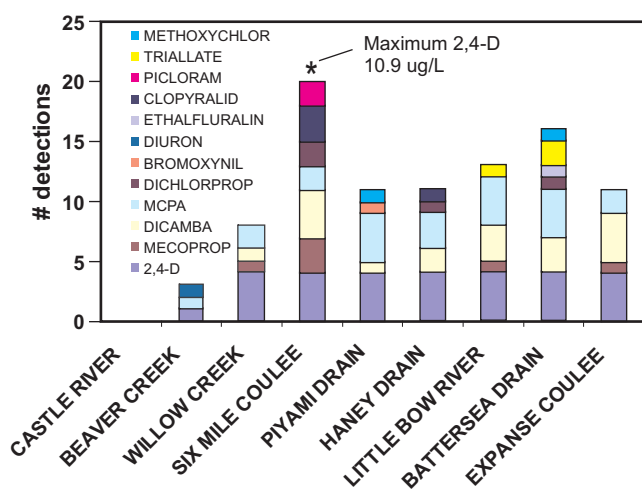


Figure 18. Pesticides – Tributaries and return flow drains (2001).

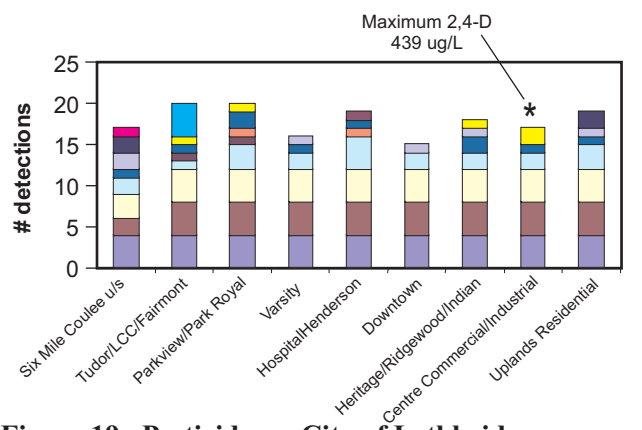


Figure 19. Pesticides – City of Lethbridge Storm Drains (2001).

Aquatic – 4 ug/L
Drinking – 100 ug/L
Irrigation – 100 ug/L

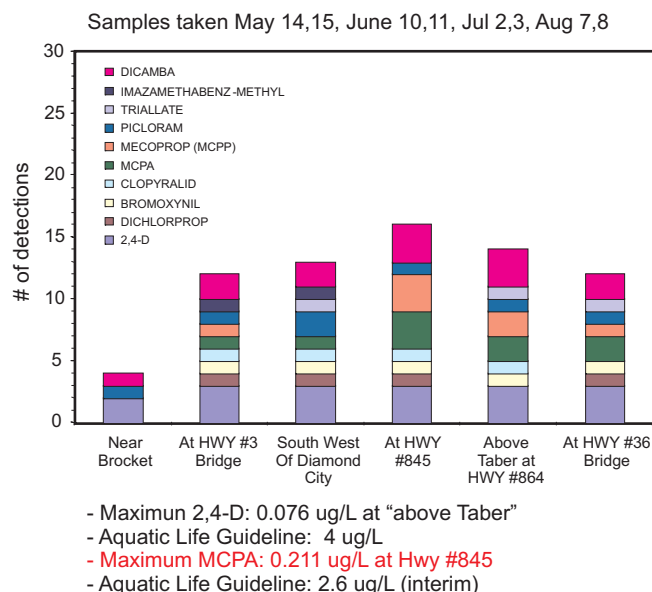


Figure 20. Pesticides – Oldman River mainstem sites (2002).

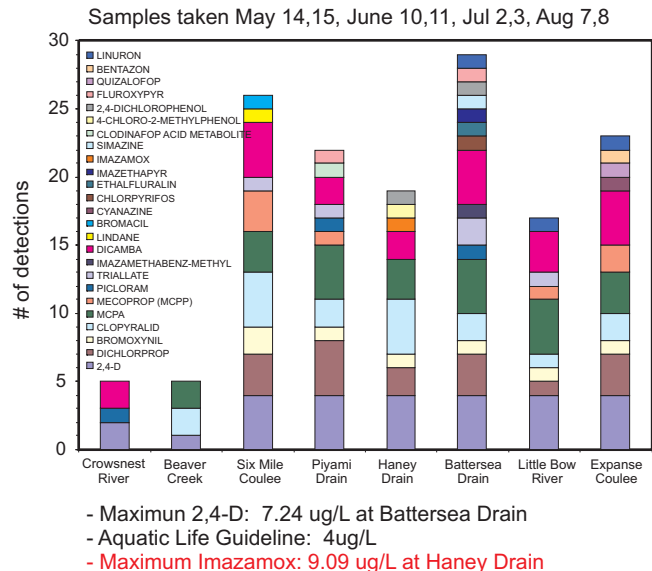


Figure 21. Pesticides – Oldman River tributary sites (2002).

2001 (Figures 17-19) and 2002, for the Oldman River and the tributaries. As expected, the number of detections increased during the wet year (2002) for both the Oldman River and the tributaries. However, the maximum concentration of 2,4-D was less in 2002 than in 2001 (dry year), likely because the increased volume of water in the river and tributaries diluted the pesticide concentrations.

3.2.2 Synoptic Surveys (September 1998, September 2000)

In September of 1998 and 2000, intensive synoptic surveys of the Oldman River were carried out to measure the relative impacts of various contaminant sources along the length of the river. A synoptic survey is one in which water samples are collected according to river travel time, so that the same “drop” of water is sampled as it flows down the river. This allows researchers to assess the source and relative load of contaminants entering the river.

Figures 22, 23 and 24 show the results of these synoptic surveys. The survey carried out in 1998 showed that the urban waste water treatment facilities on the Oldman River contributed nearly all of the phosphorus and bacterial loading to the river, and about 65 percent of the nitrogen loading. The City of Lethbridge's wastewater treatment plant was by far the largest point-source contributor of nutrients and bacteria to the Oldman River, responsible for 59 percent of the total nitrogen, 87 percent of the total phosphorus and 82 percent of the bacterial loading.

However, a major upgrade to the Lethbridge wastewater treatment facility was carried out in 1999. The introduction of ultra-violet disinfection and nutrient removal equipment to the wastewater treatment plant as part of the upgrade significantly reduced the total nutrient and bacteria loading to the river.

The upgrade of the Lethbridge wastewater treatment plant not only reduced the nutrient and bacteria loading to the Oldman River, but it also changed the relative contribution levels of the urban and rural sources. The tributaries and surface drains predominantly drain the rural parts of the basin, and wastewater treatment

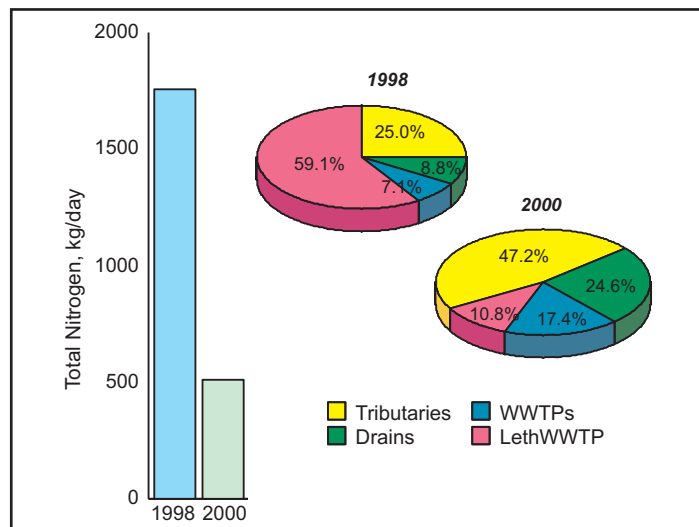


Figure 22. Sources of total nitrogen in the Oldman River.

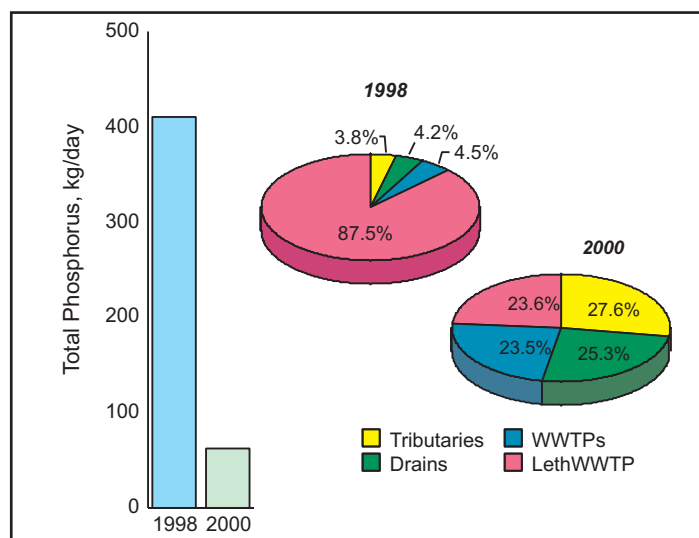


Figure 23. Sources of total phosphorus in the Oldman River.

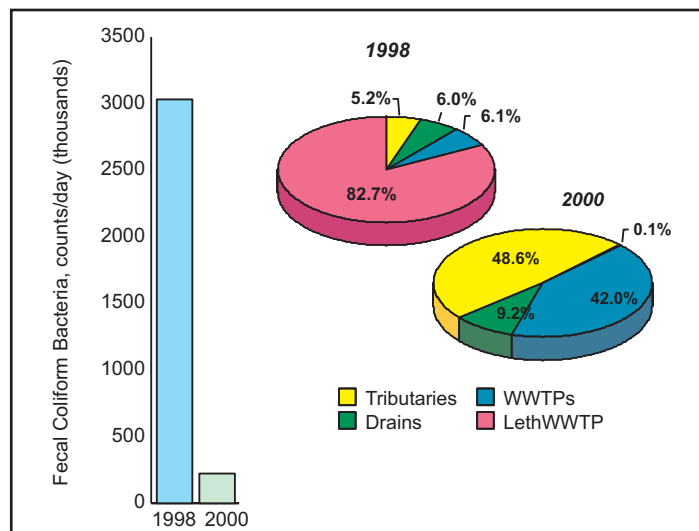
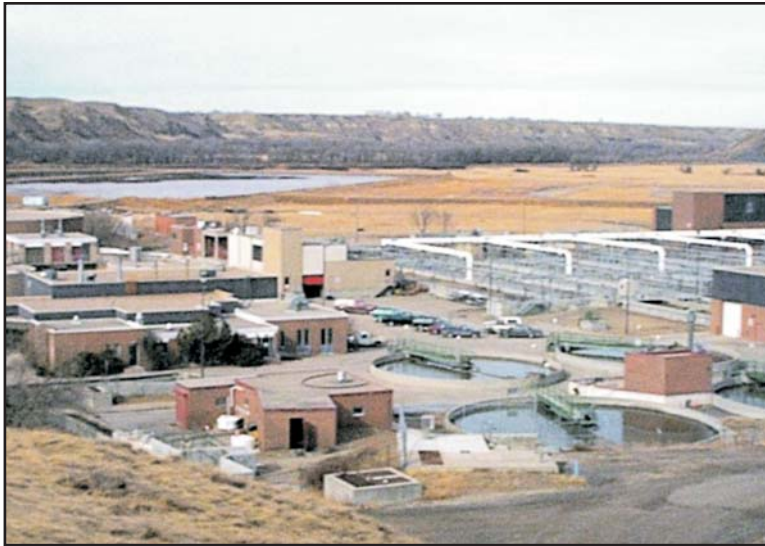


Figure 24. Sources of bacteria in the Oldman River.



Lethbridge wastewater treatment plant

facilities account for the main drainage from the urban centres. Based on the synoptic survey information (Figures 22, 23 and 24), about 70 percent of total nitrogen loading is caused by rural land use activities, and only 30 percent from urban centres. Phosphorus and bacteria loading is almost equally split between urban and rural sources.

3.2.3 Lethbridge Northern Irrigation District (LNID)

Irrigation canals carry a significant share of the surface water that flows through the Oldman River Basin. From May through September of 1998 and 1999, samples were collected at 10 sites throughout this irrigation district to provide information about the quality of water as it travels through the distribution system.

Apart from some localized events, water quality in the LNID distribution system was excellent. Concentrations of protozoan parasites were particularly low. Any water quality concerns arising in the canals should be relatively easy to identify and address through ongoing monitoring carried out by the District.

3.2.4 Lower Little Bow River and Battersea Basins (1998-2002)

These two agricultural watersheds located northeast of Lethbridge (Figure 25), are home to the most intense agricultural activities within the Oldman River Basin, and were

therefore identified for more detailed monitoring and assessment. Eight mainstem and five return-flow sites were monitored in the Lower Little Bow Basin, and three water delivery canals and six surface drain sites were monitored in the Battersea Basin.

Sites in both watersheds were sampled intensively during the irrigation season, particularly during precipitation events. Less frequent sampling was carried out in the winter if water was flowing. Data from these two studies were used to: examine the impacts of irrigation return flows on water quality of the Oldman River; assess the potential relationships between land use and land type with water quality; and evaluate the effect of implementing beneficial management practices on water quality.

While the Oldman River headwaters were generally of excellent quality, conditions deteriorated as the water moved downstream. The highest counts of fecal coliform bacteria measured during the first five years of the ORBWQI were found in the Lower Little Bow River Basin. Because this stream receives return flow water from irrigated fields during the summer growing season, contaminants are carried to the Oldman River even under dry weather conditions.

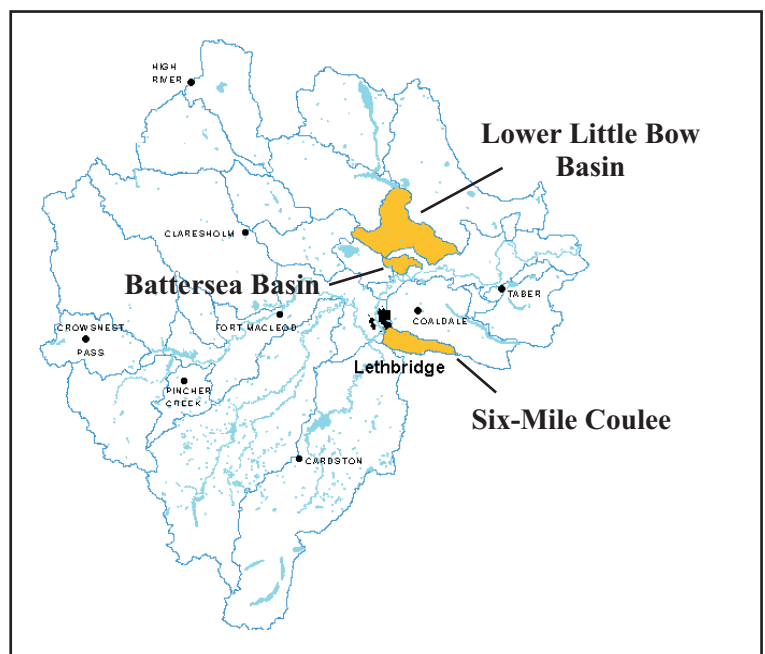


Figure 25. Location of selected sub-basins.

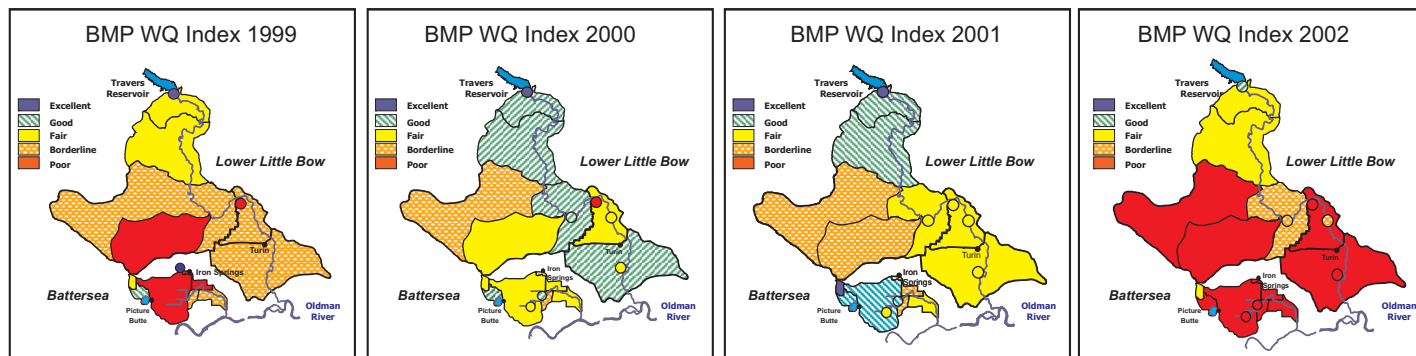


Figure 26. Water quality in the Battersea and Lower Little Bow basins from 1999 to 2002.

Figure 26 shows the relative difference in the water quality in these two basins from 1999 to 2002. The first three years (1999-2001) were relatively dry, while 2002 was much wetter. The data clearly show that water quality in these small basins is affected very much by the amount of precipitation received and the resulting runoff from the surrounding landscape.

Since the flow volumes from these drains are relatively low in comparison to the flow of the Oldman River, the impact of an individual stream is likely to be small. However, the combined effect of these streams and other irrigation return flows could play a significant role if river volume was low. This is unlikely, however, because the river's flow is regulated at about 30 m³/second. In addition, beneficial management projects within the Lower Little Bow and Battersea watersheds will help address land issues that may result in excess loss of nutrients and bacteria to the rivers and drains.

3.2.5 Six Mile Coulee (1999)

Data collected near the start of the water quality monitoring program revealed that concentrations of nutrients, bacteria, and pesticides were relatively high in Six Mile Coulee (Figure 25) compared to other areas of the basin. More detailed sampling was undertaken in 1999 at eight locations along the length of the surface drain in this coulee and at four inflow sites to the coulee to examine the possible causes of this poor water quality.

Ongoing monitoring showed concentrations of bacteria and nutrients were relatively high at various locations along Six Mile Coulee and pesticide occurrences were frequent. The herbicide

2,4-D, which has broad municipal, domestic, and agricultural uses, was found in 98 percent of the samples collected during this survey. This was the highest occurrence of 2,4-D for any of the ORBWQI projects. Another herbicide, MCPA, was found in 73 percent of the samples, which was also the most frequent occurrence for this compound. Water quality in Six Mile Coulee is affected by both rural and urban sources of runoff, both of which need to be more thoroughly addressed.

3.2.6 Lethbridge Storm Drains (2000, 2001, 2002)

Data collected in 1999 from Six Mile Coulee suggested that its water quality was affected by both urban and rural influences. In subsequent years, resources were shifted so that the impact of urban runoff from the City of Lethbridge could be examined more closely. Nine storm drains were sampled during the project. Most of these empty directly into the Oldman River, but two drain to constructed storm ponds and one drains to Six Mile Coulee. Sampling was continued in Six Mile



Lethbridge storm drain

Coulee upstream of the storm drain to assess the relative impacts of urban and rural development on the surface water quality.

The initial intent of the study was to sample water in city storm sewers during rainstorm events, but because of dry conditions, few such events occurred. Even in the absence of rain or snowmelt, sufficient water from a variety of urban sources flowed through these drains, which meant that samples could be collected from April through September.

Concentrations of nutrients, bacteria, and pesticides were higher in many of the storm drains than in Six Mile Coulee. The highest count of *E. coli* measured from any of the ORBWQI studies occurred in the storm drain that drains the Lethbridge Regional Hospital and Henderson Lake areas.

Pesticide concentrations were also higher in the Lethbridge storm drains than anywhere else in the Oldman Basin (Figure 19). In particular, the herbicides 2,4-D, mecoprop, and dicamba were found together in high amounts. These three compounds are ingredients of common domestic lawn and garden products and serve as an urban pesticide “signature”.

The storm drains tend to flow throughout the summer as a result of domestic lawn watering, municipal irrigation and other urban water practices. This constant flow results in the constant transfer of nutrients, bacteria and pesticides from the land to the water. The total load of contaminants flowing to the river through the storm drains during a year is potentially significant.

4.0 LAND USE ASSESSMENT

It was recognized that to better understand water quality impacts in the basin, a detailed land use assessment of the basin was needed. The assessment objectives were to identify and map the location and intensity of municipal, industrial, agricultural, and recreation activities throughout the basin, and to relate these activities to the results of the water quality monitoring program.

The Oldman River Basin was divided into National Topographic System (NTS) blocks

(Figure 27) and an inventory was completed to identify vegetation and population densities, plus the location of major land use activities including: oil and gas sites; intensive livestock operations; recreation areas; sewage lagoons; waste facilities; and landfills. A digital elevation model (DEM) of the Basin was also developed to assess the general topographic features of the basin. The figures shown in the earlier part of this report are the result of these land use assessments.

Satellite images from an Indian Remote Sensing (IRS) satellite were used as a backdrop for the land use inventory. These images provided the mapping context and framework for the information that was being collected, and accurate ground detail for the land use activities.

This led to a second land use activity phase which was to evaluate the relationship between land use and water quality. The land use program also included the acquisition of more information such as a crop inventory data from satellite imagery and population data from Statistics Canada. These data were used to develop groundwater and surface water vulnerability maps.

In year 3 of the Initiative, more emphasis was placed on the urban effect on water quality. In addition to the enhanced city water monitoring

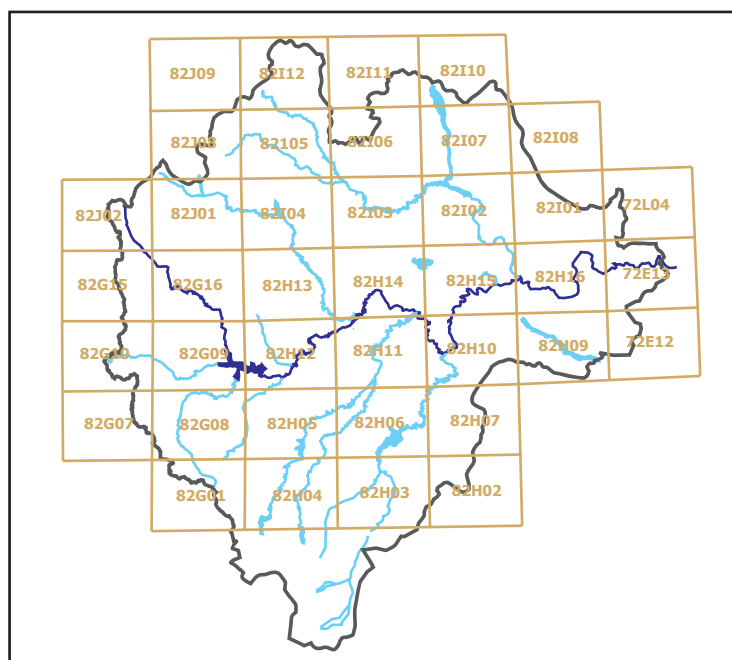


Figure 27. National Topographic System of the Oldman River Basin.

program, more focus was placed in assessing urban land use for the City of Lethbridge. An inventory of urban land use practices was completed along with inclusion of the storm sewage drainage system and the storm sewer catchment areas. The result of the land use assessment provided much useful information to help planners develop sustainable land use plans in the basin.

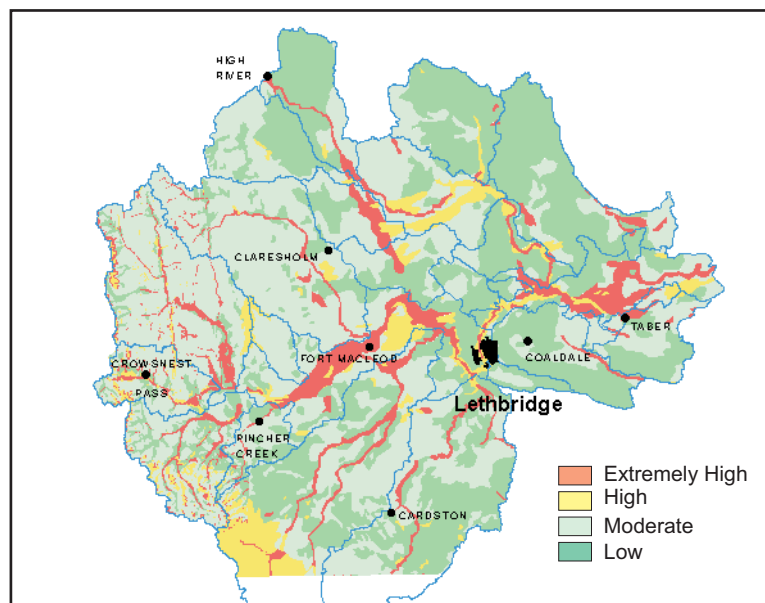


Figure 28. Groundwater vulnerability map of the Oldman Basin.

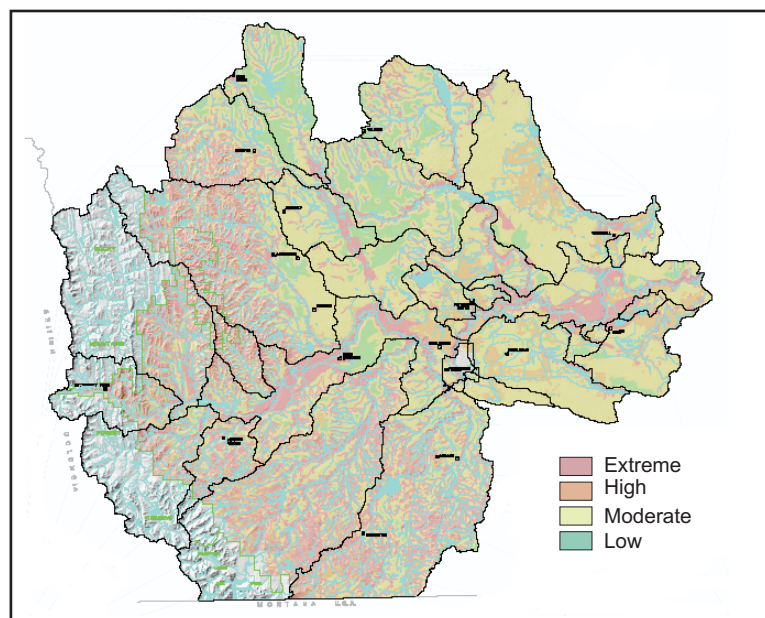


Figure 29. Surface water vulnerability map of the Oldman Basin.

4.1 Groundwater Vulnerability

To determine the groundwater vulnerability, surficial geology information was evaluated, as well as water well data from Alberta Environment.

The water well data indicated the depth of the water table and the thickness of the different sub-surface layers. From these data, a groundwater assessment was completed to determine the groundwater areas that were most vulnerable to contamination from land use activities (Figure 28). The groundwater with the highest vulnerability was found in the areas with shallow, unconfined aquifers.

It was recognized that this information is regional in scale and is not suitable for specific site planning. However, the information generated was useful to site planners because it provided a context for further study, and has been used to assist planners, developers, and municipalities identify the most suitable locations for various land use management practices.

4.2 Surface Water Vulnerability

The surface vulnerability map (Figure 29) provides a good indication of the relative potential for surface runoff to enter the Oldman River, its tributaries and surface drains. The map integrates the Agricultural Regions of Alberta Soil Inventory (AGRASID) with elements of the Hog Environmental Management Strategy (HEMS), including factors such as soil erodability, potential transport of materials over the surface, and leaching. This information is linked with the physical characteristics of the Oldman River Basin, such as slope and distance to water, as well as groundwater vulnerability data. This information will be very useful in assessing the potential for specific land use activities to impact the water quality at various locations throughout the Oldman Basin. Understanding the link between land use and water quality will allow researchers and planners the ability to develop better mitigation practices in the future.

5.0 BENEFICIAL MANAGEMENT PRACTICES

A unique program of the Oldman River Basin Water Quality Initiative was the implementation and demonstration of management practices that will mitigate the cause of water quality problems and prevent future water quality problems from occurring. Efforts were made to implement and test these Beneficial Management Practices (BMPs) in both the rural and urban areas of the basin.

5.1 Rural Beneficial Management Practices

The Rural Beneficial Management Practices (BMP) Team was formed to:

- Identify agricultural causes of water quality problems;
- Implement and demonstrate BMPs that were considered effective in mitigating agriculture's impact on water quality;
- Assess the cost and practicality of the BMPs;
- Evaluate the effectiveness of the BMPs; and
- Promote the use of successful BMPs throughout the Oldman River Basin.

Two priority watersheds, the Lower Little Bow River and Battersea Basins (Figure 25) were selected based on water quality monitoring data collected by the Initiative to implement and demonstrate BMPs. To create awareness of the Initiative's proposed work in these watersheds, staff worked with local agricultural producers along the Lower Little Bow River to identify community water quality issues and to determine potential interest in implementation of BMPs.

The BMP Team also completed a manure management survey of intensive livestock operations in the Battersea Drain. Survey results from responding producers indicated that 95% of producers incorporated manure within 48 hours of its application on cropland, and nutrient management practices (balancing

nutrient input with crop needs) were being used by about half the producers.

5.1.1 Off-Stream Watering Systems

The Rural BMP Team, in partnership with agricultural producers who established the Lower Little Bow River Watershed Group, initiated several BMP demonstration projects. Five types of off-stream watering techniques were demonstrated in the Lower Little Bow River sub-basin. Off-stream watering significantly reduces the impact of cattle on the riparian zone, which is the most sensitive landscape area adjacent to a water body. Research has also shown that cattle weight gains improve when they drink from cleaner, off-stream sources.

Off-stream demonstrations included a paddle-wheel pump (Figure 30), that uses the flow of the river to push water to an off-stream watering trough, and solar watering systems (Figure 31) that



Figure 30. Paddle wheel pump.



Figure 31. Solar pump.

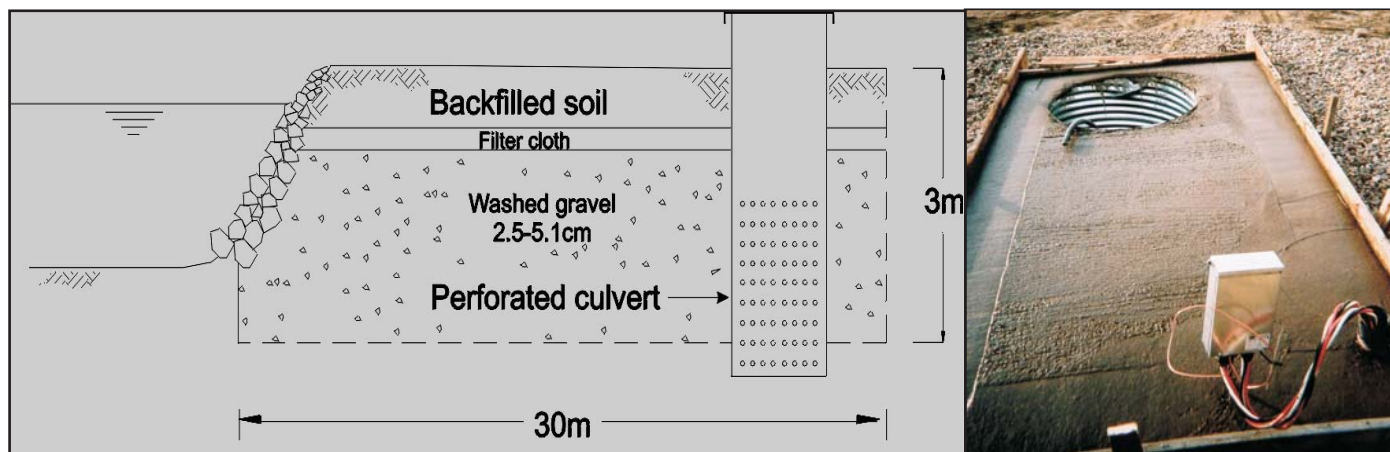


Figure 32. Off site infiltration well.

pump water from the river to off-stream water troughs.

One cattle producer installed a permanent infiltration well (Figure 32) to allow watering of their livestock away from the river in winter. The system draws water from the river through a gravel seam into an inverted culvert. Since the water line is below the frost line, it will not freeze. A pressure system is used to pump water from the culvert to water troughs.

Nose-pumps were installed on a pasture to provide off-stream water for cattle. These unique devices get their name because the cattle operate them by pushing a valve with their noses to pump water (Figure 33). The pump provides a low cost (about \$10/cow-calf pair) pumping system. A single pump can effectively water 30-40 cow-calf pairs, and can be designed to operate in winter and summer seasons.

A Koender windmill (Figure 34) was set up in a pasture to provide off-stream water to cattle. In conjunction with the windmill, the adjacent reach of the Little Bow River was fenced to prevent cattle from having direct access to the water. The windmill has been effective in pumping sufficient water to supply about 70 head of cattle. Pheasants Forever will be setting up a wildlife habitat project in conjunction with this site.

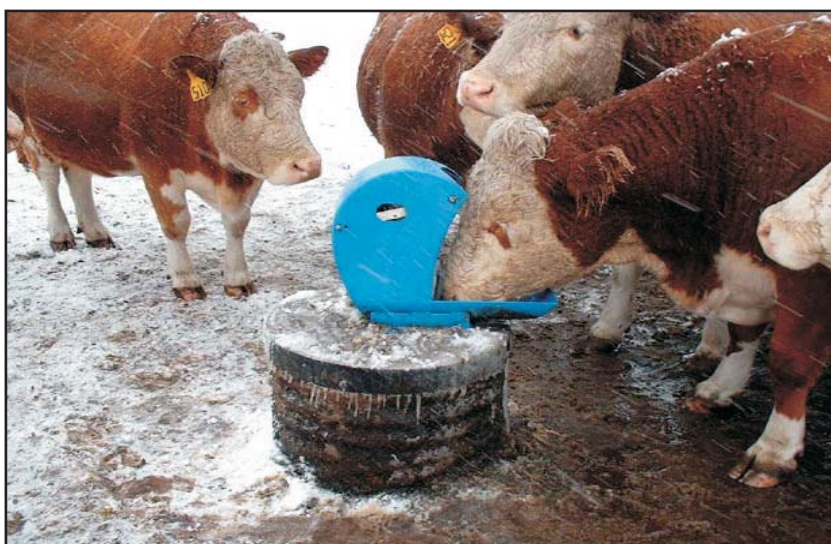


Figure 33. Nose pump watering system.

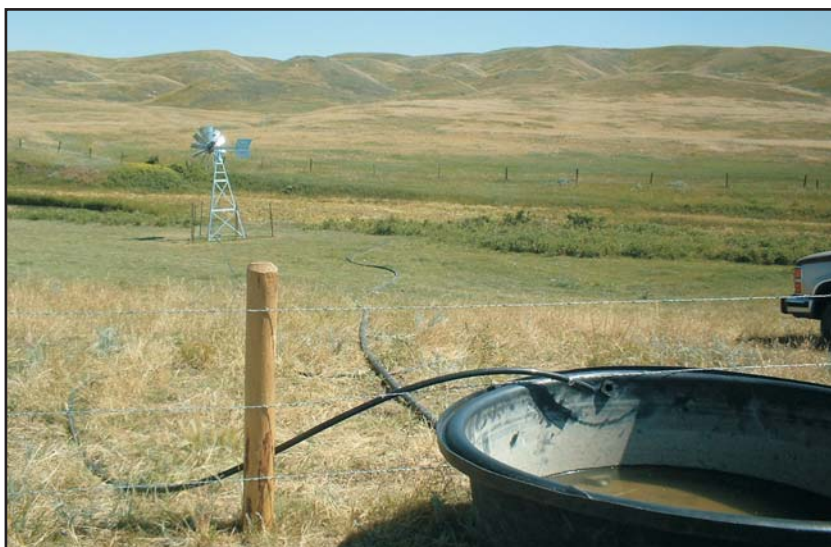


Figure 34. Windmill water pumping system.

5.1.2 Riparian Zone Protection

A riparian pasture was created at another demonstration site by fencing approximately 30-50 m on both sides of the river to protect the riparian zone by restricting grazing activity during the period of active vegetative growth (Figure 35). A low-impact livestock crossing (Figure 36) was also constructed at that site to minimize erosion disturbance of the river bed, while still allowing cattle to access pasture on both sides of the river.

5.1.3 Buffer Strips

Buffer strips, areas adjacent to waterways that have permanent vegetation, can protect water quality by trapping sediment, organic matter, nutrients, pesticides, and other contaminants found in surface runoff in the vegetation before they reach surface waters. In partnership with agricultural producers, buffer strips (Figure 37) have been installed adjacent to the Battersea Drain and Lower Little Bow River to assess cost and effectiveness in reducing contaminant movement to the surface water. Preliminary results show that nutrients such as nitrogen and phosphorus accumulate in the buffer strips during relatively dry seasons. However, it is still unknown whether retention of nutrients will also take place during wet years.

5.1.4 Manure Incorporation

In 2000, research plots were established at the Lethbridge Research Station to assess nitrogen and phosphorus losses from manure application to farmland, and evaluate the relative effectiveness of different methods



Figure 35. Fencing to protect the river's riparian zone.



Figure 36. Low impact cattle crossing on the Lower Little Bow River.



Figure 37. Example of a buffer strip.



Figure 38. Rainfall simulation research plots.

of manure incorporation to reduce runoff losses (Figure 38).

The results from this study underline the importance of incorporating surface applied manure to reduce the exposure of manure to surface runoff. Surface applied manure that was not incorporated resulted in the highest losses of both nitrogen and phosphorus from the fields. The

challenge for researchers and livestock owners will be to find a better way of incorporating the nutrients found in manure into the soil profile, without excessive disturbance of the soil.

5.1.5 Future Activities

Continued work will take place with agricultural producers, industry and local municipalities to develop BMPs and encourage the establishment of BMP demonstration projects throughout the Oldman River Basin. To date, cooperation and financial support from agricultural producers in the selected watersheds has been excellent.

The Rural BMP Team is also partnering with Agriculture and Agri-Food Canada on a major research project in the Lower Little Bow River sub-basin to further assess the impacts of BMPs on surface quality protection. This major study is part of a Canada-wide study to assess BMP effectiveness (Figure 39).



Figure 39. Watershed evaluation of BMPs (WEBs) sites across Canada.

5.2 Urban Beneficial Management Practices

The Urban Beneficial Management Practices Team's goal was to make a concentrated effort to establish effective BMPs that mitigate water quality problems related to the urban areas of the basin. Strong support for this team was provided by the City of Lethbridge.

5.2.1 Storm Water Management

The primary focus of the team for the first three years was to monitor the City of Lethbridge storm water outfalls. Seven storm drain outfalls were selected to be part of this study (Figure 40).

Section 3.3.6 describes the findings of the storm water quality monitoring program. The monitoring during the first three years showed 13 pesticides were detected in city storm water as well as fecal coliforms, phosphorus, and nitrogen. Most of the water entering the storm drains during the monitoring was attributed mainly to human activities such as lawn and garden watering and other activities.

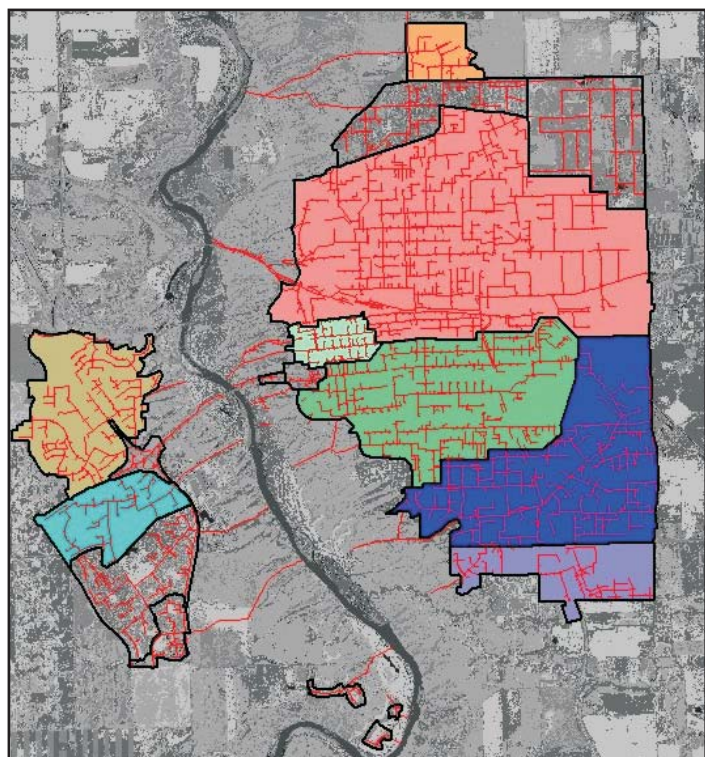


Figure 40. Location of storm drainage basins in the City of Lethbridge.

Near the end of the Initiative, work was initiated to promote practices that urban residents could implement that would reduce contaminant losses to the storm drains. These included recommendations regarding: effective lawn watering practices; reducing the pesticide use on lawns and ornamentals; and practicing “poop and scoop” management with pets.

5.2.2 Water Conservation

In 2003, the Oldman Initiative partnered with the students and staff of Wilson Middle School in Lethbridge to develop a Water-Wise garden (Figure 41). The students were involved in the design and development of the garden, including the planting of native flowers, shrubs, and grasses that do not require irrigation to survive. As part of this Initiative, the students learned about water conservation and the importance of protecting our water resources.

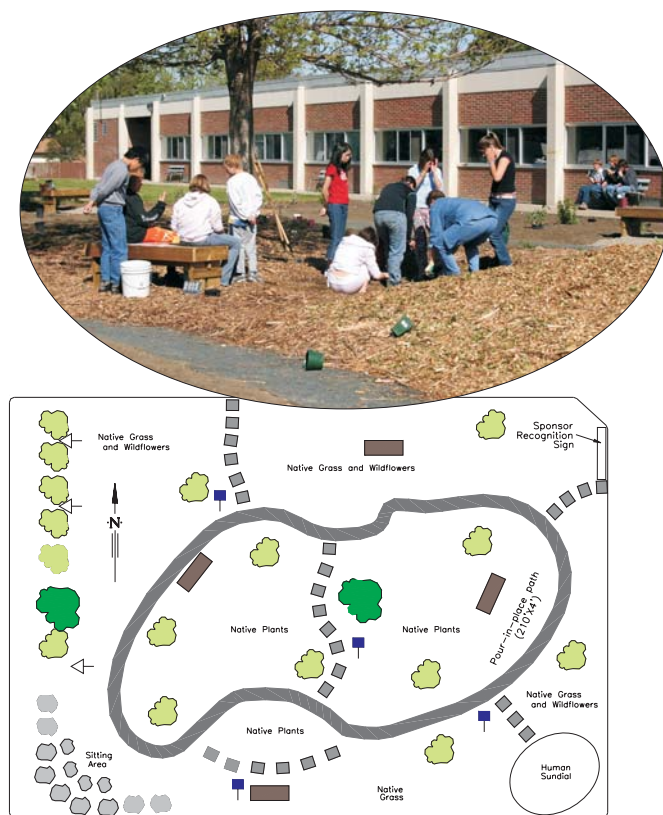


Figure 41. Xeriscape plan for Wilson Middle School xeriscape project.

5.2.3 Public Awareness

In 2002, the Urban BMP team began developing a public awareness campaign that primarily addressed water conservation activities. A storm water education model was purchased and demonstrated at the Lethbridge Home and Garden Show and the Lethbridge Environment Week Festival to increase public awareness of water quality issues. The City of Lethbridge and the Town of Coaldale teamed up to produce a brochure to promote summer water conservation, healthy lawns, and actions that residents can take to improve storm water quality. The brochure was delivered to every home in Lethbridge and Coaldale.

In 2003, the Urban BMP team refocused its efforts in the creation of a residential BMP pilot project within the City of Lethbridge. Two groups, a Technical Subgroup and a Public Education and Communications Subgroup, were formed to investigate practical, economic, and effective ways of improving water quality in the urban environment. The education subgroup identified a set of desired outcomes for the implementation of the Education Program:

- Heighten residents' awareness about the urban storm water system and its links to the Oldman River;
- Promote the use of environmentally beneficial practices and behaviours by household residents to reduce storm water pollution; and
- Foster positive attitudes towards environmentally beneficial household practices relative to storm water.

Urban land development.



Gravity drainage pond.

The goal of this program was for urban residents of the watershed to be able to apply the BMPs to their daily lives in their own households.

In the future, the Urban Beneficial Management Practices Team will continue to focus on development of BMPs that will mitigate urban impacts on water quality. In addition to homeowners, the team will develop BMPs that urban industries can apply to protect surface water quality.

6.0 EDUCATION AND AWARENESS

A key goal of the Oldman River Basin Water Quality Initiative was effectively communicating the activities of the Initiative to stakeholders within the Basin. It was recognized that accurate, scientifically sound information related to water quality problems and solutions should be made available to all stakeholders on a regular basis.

This communication program began with the organization of a workshop in December 1997 to: help people better understand the issues related to water quality in the Oldman River Basin; and to solicit support and resources in developing an action plan to deal with water quality.

The Initiative was recognized in 2001 with a Special Emerald Award, presented by the Alberta Emerald Foundation for Environmental Excellence. The Award recognized the Initiative's progress in engaging a wide range of stakeholders, working together to address water quality concerns throughout the Oldman River Basin.

Each year the Initiative recognized, through its annual award program, the outstanding efforts of Oldman River Basin individuals and organizations that helped preserve or improve the quality of our water resources. These awards were presented on the basis of nominations received from the public. Appendix C provides an overview of a number of award winners.

Throughout the five-year life of the Initiative, many activities and projects were undertaken to increase awareness about water quality throughout the basin.

6.1 Workshops

Each year two workshops were held to provide the public with updates on the Initiative's progress and to receive feedback and direction. One workshop was held in the fall of the year and was targeted towards the partner agencies that provided support to the Initiative. A second workshop was held in the spring that was designed to provide all stakeholders with information about the Initiative's actions. The spring workshops proved to be very popular, regularly attracting in excess of 175 participants.

Additional workshops were held in surrounding towns and villages to provide residents with up-to-date information regarding water quality issues in their communities. Topics covered included surface and ground water quality in southwestern Alberta, water and health, water treatment options, and BMPs to protect water quality.

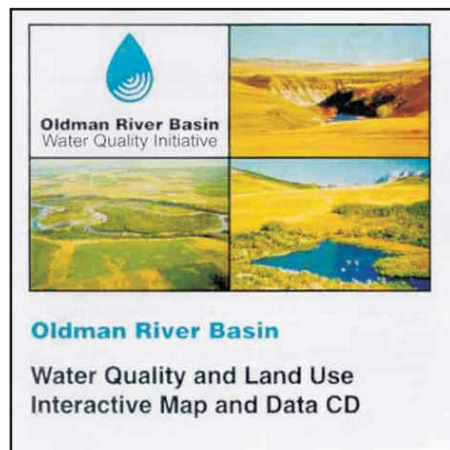
6.2 Website

An internet website, <http://www.oldmanbasin.org>, was developed to allow stakeholders and the public easy access to information related to the Initiative's programs. Reports, newsletters, and information related to water quality were regularly posted on the website.

6.3 Information CD

In 2002, the "Water Quality and Land Use Interactive Map and Data CD" was produced. This CD provided a comprehensive overview of the water quality monitoring work completed to date, plus all of the land use maps that had been generated. The CD was interactive to allow users

to click on specific river reaches and immediately see the summarized water quality results.



6.4 Newsletters and Annual Reports

Since 1998, an Annual Report and two to four newsletters were published each year to inform stakeholders about the progress of the Initiative and upcoming meetings and actions. The Annual Report was included as an insert in the Lethbridge Herald and weekly newspapers throughout the Basin. Each report provided a full colour map that showed the water quality results for the Basin during the past year.

6.5 Brochures

Two brochures 'Urban Water Quality' and 'Rural Water Quality' were prepared to provide easy-to-understand information regarding water quality issues in the Basin. The brochures also provided practical recommendations that residents can follow to minimize their impacts on water quality.

A more comprehensive brochure, "Water Ways" was published to increase stakeholder awareness about the importance of clean water and a healthy ecosystem.

6.6 Tours and Field Days

A number of tours were arranged to showcase demonstration and research projects that can help protect and maintain water quality. Most of the tours were organized by the Rural Beneficial Management Practices Team to observe demonstration projects within the Lower Little Bow River and Battersea Drainage basins. The tours regularly attracted up to 100 participants, who found them valuable for connecting with neighbours and sharing information about their own project successes and challenges.



BMP tour in the Lower Little Bow drainage basin

7.0 CONCLUSIONS

The following conclusions are based on results from the five-year Initiative.

- In general, water quality in the Oldman River is quite good. Water quality is almost always better than established guidelines set by Canada and Alberta.
- The water quality in the upstream source rivers is always excellent. As the Oldman River flows east, water quality generally deteriorates in direct relationship with distance.
- The water quality in many of the tributaries and surface drains that flow into the Oldman River in the settled areas is often poor, and does not always meet established water quality guidelines. Wastewater effluent quality from urban communities is always poor.
- While water quality from each of these water sources by themselves does not have a significant impact on water quality of the Oldman River, their cumulative effects can be quite significant. This is supported by the general deterioration of water quality in the Oldman River as it flows from the headwaters to its confluence with the Bow River.
- Fecal Coliform bacteria are found in all reaches of the Oldman River, from the headwaters to its confluence with the Bow River east of Taber, at levels that always exceed Canadian Water Quality Guidelines for human consumption. All surface water, regardless of its source, needs to be treated before being consumed.
- Prior to 1999, the single largest source affecting water quality in the Oldman River was the Lethbridge Wastewater Treatment Plant. Since upgrading the plant, no single activity or source can be identified as having the main influence on water quality in the Oldman River Basin. Both agricultural and urban activities affect the water quality in the river.
- Both point and non-point sources impact the water quality of the Oldman River and its tributaries. Point source water quality impacts, such as wastewater treatment facilities and industrial complexes, are relatively easy to monitor and mitigate. Because of their diffuse nature, non-point sources of contaminants are harder to trace and therefore much more difficult to remedy than point sources.
- Underlying all water quality factors is climate. In rural areas, major storm events that produce surface runoff are the main cause of contaminant movement into tributaries and surface drains. In drier years, water quality in the agricultural areas appeared to improve, the result of less material being washed from the land into the river.



- In urban areas, increased precipitation also results in large amounts of materials being washed into the storm drains. However, even during dry years, human activities such as improper or excess watering of parks, lawns, and gardens also creates surface runoff that enters storm drains, and subsequently the Oldman River.
- The link between the quality of water and the land through which it flows is particularly critical in this semi-arid environment. Further work is required to more fully understand the relationship between land use activities and water quality in the basin.
- There are management practices that agricultural producers, urban residents, municipalities, and industry can implement to improve water quality in both surface water and ground water resources in the Oldman River Basin.

The Oldman River Basin Water Quality Initiative was designed to bring all stakeholders together to: assess the water quality problems in the Oldman Basin; develop an integrated plan to mitigate existing problems; and implement management practices that will protect our water resources in the future.

The Initiative was very successful in accomplishing its stated goals during its five-year mandate. Representatives from a diverse group of government and private organizations provided the needed resources for the Initiative to implement a comprehensive and integrated strategic plan. The Education and Awareness program ensured that residents were more aware of their impacts on water quality and management practices that will improve the quality of the limited water resource.

The teamwork and commitment by many stakeholder organizations and individuals made this Initiative a success, and will serve as a model for other basins in Alberta and North America.



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APPENDIX A

Metals and trace elements monitored during the Oldman River Basin Water Quality Initiative.

Values are in mg/L

Element		ASWQG (DRAFT)	CWQG	CWQG	CWQG
			Aquatic Life	Irrigation	Livestock
Aluminum	Al	-	0.1 (pH>6.5)	5	5
Antimony	Sb	no guidelines			
Arsenic	As	-	0.005	0.1	0.025
Barium	Ba		no guidelines (drinking water: 1)		
Beryllium	Be	-	-	0.1	0.1
Boron	B	-	-	0.5 - 6**	5
Cadmium	Cd	-	0.000017	0.0051	0.08
Chromium	Cr		guidelines are specific for trivalent or hexavalent forms		
Cobalt	Co	-	-	0.05	1
Copper	Cu	0.007 chronic	0.002-0.004*	-	-
Iron	Fe	-	0.3	5	-
Lead	Pb	-	0.001 - 0.007*	0.2	0.1
Lithium	Li	-	-	2.5	-
Manganese	Mn	-	-	0.2	-
Mercury	Hg	0.00013 acute 0.00005 chronic	0.0001	-	0.003
Molybdenum	Mo	-	0.073	0.01 - 0.05**	0.5
Nickel	Ni	-	0.025-0.15*	-	-
Selenium	Se	-	0.001	0.02-0.05**	0.05
Silicon	Si	no guidelines			
Silver	Ag	-	0.0001	-	-
Strontium	Sr	no guidelines			
Sulphur	S	no guidelines			
Thallium	Tl	-	0.0008	-	-
Thorium	Th	no guidelines			
Titanium	Ti	no guidelines			
Uranium	U	-	-	0.01	0.2
Vanadium	V	-	-	0.1	0.1
Zinc	Zn	-	0.03	1-5**	50
Zirconium	Zr	no guidelines			

NOTES:

* depends on hardness

** depends on crop

ASWQG = Alberta Surface Water Quality Guideline

CWQG = Canadian Water Quality Guideline

SOURCES:

Surface Water Quality Guidelines for Use in Alberta (Alberta Environmental Protection 1999)

Canadian Environmental Quality Guidelines (Canadian Council of Ministers of the Environment 1999 + updates)

APPENDIX B

Table B-1. Pesticides monitored during the Oldman River Basin Water Quality Initiative.

ACTIVE INGREDIENT	TRADE NAME	USES	WATER QUALITY GUIDELINES			
			Freshwater Life	Irrigation	Livestock	Drinking
HERBICIDES						
MCPB	Tropotox, Clovitox	A	29	0.5	190	190
MCPP (MECOPROP)	Compitox	A M D				
PICLORAM	Tordon, Grazon	A M I				
QUINCLORAC	Accord	A	10	10	10	
SIMAZINE	Princep Nine-T	A	0.24	230		
TRIALATE	Avadex BW, Fortress	A	0.2	45	45	
TRIFLURALIN	Advance, Bonanza, Fortress, Rival, Treflan	A D				
TRYCLOPYR	Garlon, Remedy	A				
INSECTICIDES						
ALPHA-BHC*	(isomer of lindane)	A	0.0035		24	20
ALPHA-ENDOSULFAN*	(Endosulfan, Thiodan)	A				
AZINPHOS-METHYL	Guthion, Sniper	A				
CHLORPYRIFOS-ETHYL	Lorsban, Pyrinex, Dursban, (domestic use discontinued)	A M I D	6.2	3	20	
DIAZINON	Diazinon, Diazol, Basudin (domestic use discontinued)	A D	0.01	4		
DIMETHOATE	Lagon, Cygon, Dimethoate (domestic use discontinued)	A D				
DISULFOTON	Di-Syston	A				
ETHION	Ethion	A D				
GAMMA-BHC (LINDANE)	Vitavax Dual, Vitavax RS (registration discontinued)	A				
MALATHION	Malathion, Cythion	A M I D				190
METHOXYCHLOR	Moxy, Methoxyl, Methoxychlor	A D				900
PHORATE	Thimet	A				2
PYRIDABEN	Sanmite, Pyramite, (greenhouse use)	A				
TERBUFOS	Counter	A				1
FUNGICIDES						
CARBATHIIN	Vitavax Single, Vitavax Dual	A				

NOTES:

A = Agricultural

M = Municipal

I = Industrial

D = Domestic

** = Degradation product or isomer*

*4-chloro-2-methylphenol, 2,4-dichlorophenol,
simazine & tryclopyr added in 2002*

imazamox added in 1999

SOURCES:

Alberta Environment (A.M. Anderson, G. Byrtus)

Surface Water Quality Guidelines for Use in Alberta (Alberta Environmental Protection 1999)

*Canadian Environmental Quality Guidelines (Canadian Council of Ministers of the
Environment 1999 + updates)*

Table B-2. Extra pesticides monitored during of the Oldman River Basin Water Quality Initiative, June 2002.

Values are
in mg/L

ACTIVE INGREDIENT	TRADE NAME	USES	WATER QUALITY GUIDELINES			
			Freshwater Life	Irrigation	Livestock	Drinking
HERBICIDES						
BENTAZON	Basagran, Laddok	A				
CLODINAFOF-PROPARGYL	Horizon	A				
CLODINAFOF ACID METABOLITE*						
ETHOFUMESATE	Nortron	A				
FLUAZIFOP-P-BUTYL	Fusion, Venture	A				
FLUROXYPYR	Attain, Prestige	A				
LINURON	Afolan, Lorox, Linuron 480	A				
METOLACHLOR	Dual II Magnum, Primextra	A	7.8	28	50	50
METRIBUZIN	Sencor, Pea Pack, Crossfire	A	1.0	0.5	80	80
QUIZALOFOP-ETHYL	Assure II, Freedom Gold	A				
INSECTICIDES						
ALDRIN	No longer registered				(+dieldrin)	0.7
DIELDRIN	No longer registered				(+aldrin)	0.7
PARATHION	Plant-Fume, Parathion	A				50
FUNGICIDES						
CHLOROTHALONIL	Bravo, Daconil	A M				
HEXACONAZOLE	Proseed	A				
IPRODIONE	Foundation, Rovral	A M				
METALAXYL-M	Ridomil	A				
PROPICONAZOLE	Tilt, Banner	A M				

NOTES:

A = Agricultural

M = Municipal

I = Industrial

D = Domestic

* = Degradation product or isomer

SOURCES:

Alberta Environment (A.M. Anderson, G. Byrtus)

Surface Water Quality Guidelines for Use in Alberta (Alberta Environmental Protection 1999)

Canadian Environmental Quality Guidelines (Canadian Council of Ministers of the Environment 1999 + updates)

(3.3.4)

APPENDIX C

Oldman Water Quality Initiative Annual Award Winners

The *Partnering for our Future* Award was presented annually to recognize a Basin resident or organization that made an outstanding effort to help preserve or improve water quality in the Oldman River Basin. A Nomination Committee made up of Initiative members selected award recipients from public nominations.

Award Categories

The award was presented in two categories. The Rural category recognized one rurally-based resident or organization that implemented beneficial management practices designed to minimize the impact of rural activities on water quality in the Basin. The Urban category recognized one resident or organization located in a hamlet, village, town, or city that implemented practices to reduce the impact of urban activities on water quality in the Basin. An award in one or both categories was made in 2000, 2001, 2002, and 2003.

Partnering for our Future! 2000 Award Winners



Honorable Clint Dunford, MLA (centre) presents John Vander Heyden (left) and Fred Gould (right) with their award.

The first ever “Partnering for Our future” award was presented by the Oldman River Basin Water Quality Initiative. A call for nominations sent out year yielded two strong winners in the rural category.

Fred Gould of Chinook Feeders of Nanton received the Award of Merit and John Vander Heyden of Picture Butte received an Honourable Mention.

Mr. Gould and Chinook Feeders Ltd., were nominated for work on controlling runoff from the feed lot operation. They constructed a two hectare wetland to remove nutrients and bacteria, and reduce solids from run-off. From the wetland the treated water flows through a grass filter strip and into a clean water holding pond before it is used for irrigation.

This is the first constructed wetland in Alberta to treat run-off from a large, custom feedlot operation.

In co-operation with PFRA, Chinook Feeders has hosted a number of tours of is project.

Winner of the Honourable Mention Award, John Vander Heyden was recognized for his contribution to riparian zone management. Mr. Vander Heyden, in co-operation with the County of Lethbridge, established a riparian zone management project on his pastureland adjacent to the Oldman River.

Approximately one hundred by three hundred feet was fenced off and a solar pump is now being used to provide water to the cattle.

Mr Vander Heyden’s site has also been used for demonstration to show how riparian management can help to improve water quality and improve the overall health of the environment.

Both winners were recognized at the Oldman River Basin Water Quality Initiative’s Annual workshop. Each winner received a framed certificate of recognition and a print by a local artist.

The Oldman River Basin Water Quality Initiative would like to thank Sandi Riemersma for nominating Fred Gould of Chinook Feeders, Ltd, and the County of Lethbridge for nominating John Vander Heyden.

Partnering for our Future! 2001 Award Winners

The second annual *Partnering for our Future* Awards were presented at the Annual Water Quality Workshop held in Lethbridge on February 12, 2002. Several strong nominations from the public made the selection of the 2001 award winners a challenging task for the Initiative's Award Nomination Committee.

The Hutterian Brethren of Turin were presented with the award in the rural category for their efforts to preserve water quality in the Lower Little Bow River subbasin. The City of Lethbridge was presented with the award in the urban category for the upgrade to its wastewater treatment plant. These two outstanding winners exemplify the mission and goals of the Initiative.

Mr. Chris Waldner accepted the rural award on behalf of the Hutterian Brethren of Turin. The Colony made an exceptional effort to promote, improve and preserve water quality in the Lower Little Bow River subbasin.

The Colony has a large, integrated feeding operation located near Turin. An irrigation return-flow drain flows adjacent to their operation and ultimately discharges into the Lower Little Bow River. The Brethren recognized the risks that their livestock feeding operation posed for water quality. In 2001, they constructed a new feedlot and a lined catch basin away from the drain in order to meet Alberta Agriculture, Food and Rural Development 2000 Code of Practice Guidelines. The old feedlot was decommissioned.

The Colony also constructed a lined pond and a geese-raising area away from the surface drain. In addition, they abandoned a lagoon used for storing hog slurry and constructed a steel storage facility to prevent the movement of contaminants into the groundwater.

The Brethren have actively promoted their environmental stewardship by sharing their experiences and practical solutions with others. In the summer of 2001, the Colony worked closely with the Initiative to welcome tours of their operation so that others could see their management improvements. The actions of the Brethren, who have dedicated a lot of their time and money to making environmental improvements to the Colony's operation, will ultimately improve water quality in the watershed and protect the water resource for the future.

Mr. Robert Butler and Mr. Dalton Stafford accepted the urban award on behalf of the City of Lethbridge wastewater treatment plant. In 1992, the City embarked on an innovative project to enhance the performance of its wastewater treatment plant for nutrient removal and effluent disinfection.

The primary goal of the City's project was to reduce

phosphorus and ammonia loading in the Oldman River and to disinfect the effluent with minimal use of chemicals. The project was completed successfully through extensive partnering and innovation. The partnered team consisted of the owner (the City of Lethbridge), the designer (CH2M Hill), the contractor (North American Contractors), operations assistance (OMI), and many subconsultants and subcontractors.

The final results of the project included an innovative biological nutrient removal (BNR) process to treat Lethbridge's wastewater to a standard that exceeds regulatory requirements for nutrient removal. The new BNR system did not require plant expansion that would have cost the City approximately \$10,000,000. The project included the piloting and installation of an ultraviolet light to disinfect the effluent without the use of chlorine. The Initiative has rated the general water quality index downstream of the plant has dramatically improved, as a direct result of the wastewater treatment plant upgrade.



City of Lethbridge Mayor Bob Tarleck (R) and The Hon. Clint Dunford, presenting the Initiative's 2001 Partnering for our Future! Awards at the Water Quality Workshop, February 2002. Mr. Chris Waldner (L) accepted on behalf of the Hutterian Brethren of Turin. Mr. Robert Butler and Mr. Dalton Stafford accepted on behalf of the City of Lethbridge. They are joined (L-to-R) by Kellsie McLaren (Spark), Alyssa McLaren (Pathfinder) and Jenelle Hawkins (Guide), who made a presentation on the participation of the Girl Guides of Lethbridge in the Yellow Fish Road project. Yellow Fish Road is an important community initiative designed to educate the public about protecting against water contamination caused by dumping of household chemicals into roadside storm sewers that drain directly into the Oldman River and its tributaries.

Partnering for our Future! 2002 Award Winners

The third annual *Partnering For Our Future* Awards were presented to two very deserving candidates. The urban award was presented to the Helen Schuler Coulee Centre to recognize their dedication to the river valley through their educational programs. Sorgaard Ranches was presented with the rural award to honour their work and commitment to ensure their livestock have a minimal impact on the Lower Little Bow River.



*Robyn Harrington and Shawna Cook
accepted the award on behalf of the
Helen Schuler Coulee Centre*

The Helen Schuler Coulee Centre has been educating the community about the river valley environment for more than 21 years. In 2002, an exhibit was created to focus solely on the Oldman River. Visitors learned about floods, river species, watersheds, historic uses, and water quality concerns. To enhance the Nature Centre display, a special interpretive show called “The Oldman River” was also created. This western style play was performed in the summer in Galt Gardens and explored the complicated interconnectedness of the Oldman River. The Nature Centre staff and volunteers are committed to sharing their passion for nature and the belief that:

*Appreciation leads to Understanding which leads
to Protection.*

In 2001, Sorgaard Ranches contacted the County of Lethbridge to discuss concerns regarding the impact their buffalo and cattle had on the riparian zone of the Lower Little Bow River. Even before the Sorgaard Ranches sought outside help, they were developing ideas to lessen their livestock's impact on the riparian area.

With assistance from the County of Lethbridge (AESR Program) and Alberta Agriculture, Food and Rural Development, Sorgaard Ranches started to make their ideas work. Efforts led to the use of a solar pump and an infiltration well for off-stream watering. They also fenced the banks of the Little Bow River to protect the riparian zone, which created a more elaborate pasture rotation for their livestock. In 2002, they constructed a facility to winter the cattle away from the banks of the Little Bow River. Observations have shown that since Sorgaard Ranches implemented their modifications, positive changes have occurred in the riparian zone.



*Stephan Sorgaard accepting the award on behalf
of Sorgaard Ranches.*

Partnering for our Future! 2003 Award Winners

The fourth annual *Partnering for Our Future* Awards were presented at the Annual Water Quality Workshop held in Lethbridge on March 2, 2004. Several strong nominations from the public made the selection of the 2003 award winners a challenging task for the Initiative's Business Team.

The Beaver Creek Watershed Group was presented with the award in the rural category for their efforts to preserve water quality and quantity in Beaver Creek. Pratt and Whitney Canada, Lethbridge, was presented with the award in the urban category for their work to ensure environmental awareness and protection in their operations. These two outstanding winners exemplify the mission and goals of the Initiative.



*Rural Award Winner –
Beaver Creek Watershed Group*

Rural Award Winner – Beaver Creek Watershed Group

Dixon Hammond, the project coordinator, accepted the award on behalf of the Beaver Creek Watershed Group. The Beaver Creek Watershed Group has been working since 2000 to improve water quality in their area and is an inspiring example of cooperation between landowners, municipalities, private industry, provincial and federal government, and non-government groups. With the help of a riparian health inventory completed by Cows and Fish, the group developed a plan to improve riparian management, water quality, and wildlife habitat in the Beaver Creek watershed.

As part of this plan, seven off-stream developments have been completed and more than 600 head of cattle have been relocated to alternative wintering sites that do not impact Beaver Creek. As well, ranch plans have been developed to improve riparian areas and upland rangeland pastures.

In 2003, a water quality monitoring program was developed for the Beaver Creek watershed. Watershed group members collected water samples during the summer, transported the samples to the appropriate laboratories, and assisted Alberta Agriculture, Food and Rural Development in collecting flow data. The watershed group members initiated this monitoring program to determine the current condition of the watershed in terms of water quality and to assist them in evaluating their Beneficial Management Practice projects.



*Urban Award Winner –
Pratt and Whitney Canada*

Urban Award Winner – Pratt and Whitney

Steve Gruca, Gaetan Laplante, Sean Lee and Bill Haley were all on hand to accept their award on behalf of Pratt and Whitney Canada. Since 1993 when Pratt and Whitney opened its doors in Lethbridge, environmental awareness and protection has been a priority. To help protect the environment, Pratt and Whitney built their own wastewater treatment facility. They now treat and test all their wastewater before it is sent back to the Oldman River.

All water generated from production, cleaning, testing, and building is directed to an underground holding tank. All the drains within the facility are also directed to the same underground holding tank to prevent any accidental dumping of liquid hazardous waste into the sanitary sewer. Once the tank has reached a certain level, the water is directed to an Ultra-filtration unit where the water is treated, processed, and tested. The water is tested following both the Lethbridge Sewer By-Law 3250 limits and their own corporate requirements. If there are no exceedances, the water is discharged into the sanitary sewer. If exceedances are found, the water is again treated and tested.

List of Abbreviations

AGRASID	Agricultural Regions of Alberta Soil Inventory
ASWQG	Alberta Surface Water Quality Guidelines
BMP	Beneficial Management Practice
CCME	Canadian Council of Environment Ministers
CWQG	Canadian Water Quality Guidelines
Cfu	colony forming units
dl	deciliter (1 dl = 100 milliliters)
EC	Electrical Conductivity
E.coli	Escherichia coli
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
HEMS	Hog Environmental Management Strategy
LNID	Lethbridge Northern Irrigation District
M³/s	cubic metres per second
mg/l	milligrams per litre
NO₃	Nitrate-Nitrogen
NO₂	Nitrite
ORBWQI	Oldman River Basin Water Quality Initiative
SAR	Sodium Adsorption Ratio
TOC	Total Organic Carbon
TDS	Total Dissolved Solids
TP	Total Phosphorus

Unit Conversion Factors

SI Units Imperial Units

Area:	1.0 hectare (ha) = 2.471 acres
Length:	1.0 millimetre (mm) = 0.0394 inches
	1.0 metre (m) = 3.281 feet
	1.0 kilometre (km) = 0.621 miles
Volume:	1.0 cubic metre (m ³) = 35.315 cubic feet
	1.0 cubic decametre (dam ³) = 0.811 acre feet
Rate of Flow:	
	1.0 cubic metre per second (m ³ /s) = 35.315 cubic feet per second
Yield:	
	1.0 kilogram per hectare (kg/ha) = 0.893 pounds per acre
	1.0 tonne per hectare (t/ha) = 0.446 tons per acre