OLDMAN RIVER

State of the Watershed Report

SUMMARY

2010

MESSAGE FROM THE CO-CHAIRS

Stephanie Palechek and I would like to extend our sincere appreciation to the many individuals and organizations that supported the State of the Oldman River Watershed Project through countless hours of in-kind work and financial support. In particular, we would like to thank Alberta Environment providing funding for the project and for the many in-kind hours of staff during the development of this report.

It has been a long and enlightening process that could not have been completed without the contributions and hard work of the State of the Watershed Team members as well as the open and effective communication between the State of the Watershed Team and the AMEC Earth and Environmental team. The State of the Watershed Team consists of:

- Shane Petry (Co-chair)
- Stephanie Palechek (Co-chair)
- Jocelyne Leger
- Andy Hurly
- Brent Paterson
- Kent Bullock
- Brian Hills
- Farrah McFadden
- Doug Kaupp
- Wendell Koning

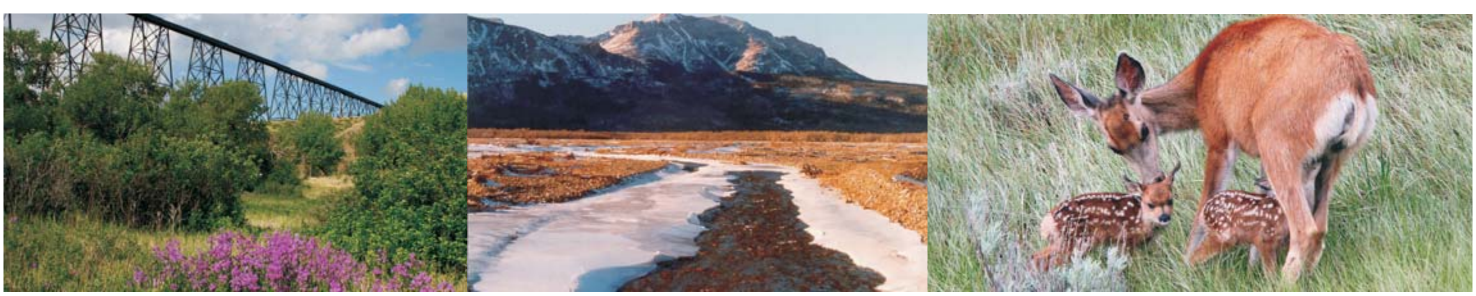
We also extend our appreciation to Mr. Lorne Fitch for writing an inspiring foreword that sets the basis from which we can begin to appreciate the beauty and complexity of our watershed – thank you Lorne.

Finally, to the many people who participated in our indicator workshops as well as to those who reviewed the draft report, thank you for providing your insight, expertise and experience to the State of the Oldman Watershed Project it could not have been a success without you.

Please enjoy.

Shane Petry

Stephanie Palechek



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OVERVIEW

The State of the Watershed report is a step towards understanding what we have, the challenges we face and how decisions we make today will affect future water users. This report provides a snapshot of the entire Oldman watershed: its current accounting and how well our watershed is working.

The Oldman watershed is a large diverse land and water system in southern Alberta covering 23 000 km^2 in southwestern Alberta and 2 100 km^2 in Montana. It extends eastward from the forested slopes of the Rocky Mountains, through rangelands in the foothills, dryland and irrigated agricultural plains, to the prairie grasslands. The Rocky Mountains feed the headwaters of the Oldman mainstem and its tributaries (Crowsnest and Castle rivers, Willow and Pincher creeks), while the headwaters of the Belly, Waterton and St. Mary rivers rise in Montana. The watershed varies greatly, both in terms of the status of the land and water resources and impacts from human activities. In headwater Sub-basins, water quantity is adequate, quality is fair to good, and riparian ecosystems are generally healthy. However, as the Oldman River flows east, water quality deteriorates, available water supplies diminish, and there are several issues of concern.

Moving from west to east, forests give way to grasslands and agricultural land uses. Cultivated agriculture is the main land use in 60% of the watershed and covers half or more of the Southern Tributaries and Prairie sub-basins. Approximately 20% of the cultivated land is irrigated. Approximately 30% of the watershed has a soil erosion risk of moderate or more, most of which occurs in the Prairie Sub-basins. The effect of long term climate change

Figure 1. Oldman Watershed and Sub-basins

may increase the magnitude and frequency of drought and the proportion of precipitation that falls in the form of rain. These changes will increase the likelihood of wind and water erosion. With increasing population, expanding land use activities and potential change to more arid climatic conditions, more attention to erosion control and conservation measures is necessary. The riparian areas of the watershed are less healthy than riparian areas in Alberta as a whole. The least healthy areas in the watershed are in the Prairie Sub-basins and the Oldman River mainstem. Land use activities in the watershed include agriculture, forestry, mining, recreation, and oil and gas extraction and affect 60% of the land base. The Prairie and Southern Tributaries sub-basins are the most disturbed. Integrating results from the terrestrial and riparian indicators for land cover, soil erosion, riparian health and land use provides an overall ranking of **"Fair"** for the Oldman watershed.

Natural flows in the Oldman watershed are highly variable both geographically and from year to year. Trend analyses of natural flows (recorded natural flows at some hydrometric stations and reconstructed at others) show signs of decreasing flows, but trends are not considered to be statistically significant at any stations except those on Beaver Creek in the Foothills Sub-basins and the Little Bow River in the Prairie Sub-basins.

The waters of the Oldman watershed are highly regulated and extensively used. Water demands are generally low in the upper reaches of streams in the watershed, but increase to high levels in lower reaches of most streams. Generally, the higher the actual use is, expressed as a percentage of natural flow, the greater the potential for water supply deficits. However, several other factors come into play in a complex water resource system. For instance, storage and flow regulation can help to reduce deficits. Within the watershed, there are three major onstream storage reservoirs, Oldman River, Waterton and St. Mary reservoirs, with a total storage capacity of about 970 000 dam^3. In addition, there are over 660 000 dam^3 of offstream storage, some of which is located outside of the Oldman watershed.

Actual water use is almost always less than total allocations. Water licence allocations and actual water use within the Oldman watershed are shown in Figure 2. The data for the Waterton, Belly and St. Mary rivers below the Belly-St. Mary Headworks and for the Oldman River at the Mouth indicate that there is potential for expansion in the Southern Tributaries Sub-basins and along the Oldman River mainstem without the requirement of additional allocations. However, the available water supply may not support additional expansion without increased deficits to instream needs and existing consumptive use projects with junior licence priorities. In contrast, the Little Bow River has high allocations, but the potential for expansion within existing allocations is low because there is little difference between the use and allocations.

Nine of Alberta's 13 irrigation districts are sourced from waters of the Oldman watershed. Some of the irrigated lands extend beyond the Oldman watershed. The irrigation districts in the Oldman watershed (as well as in the Bow River watershed) have made significant gains in water-use efficiency from the

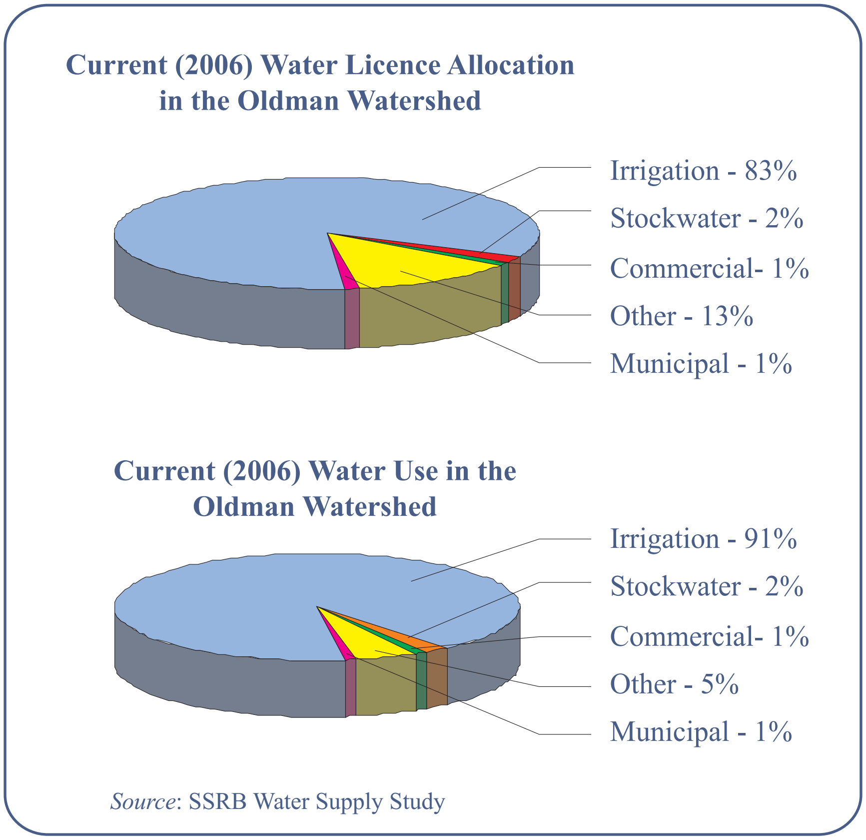


Figure 2: Water Licence Allocations and Actual Use in the Oldman Watershed

combined impacts of more effective on-farm application processes, district conveyance improvements, and reduced return flows.

Municipal use includes distributing water to homes, commercial and institutional establishments, and industrial users in cities, towns and villages. It does not include water use in hamlets, rural subdivisions or industrial complexes in rural areas. Water use records indicate that municipal use is usually highest in the summer months, primarily due to outside watering of lawns, gardens and parks. The total estimated surface and groundwater withdrawals for cities, towns and villages in the Oldman watershed was compared with Alberta and Canadian averages: in 2001 the average per capita withdrawal for the Oldman watershed was 742 litres per capita-day (L/c-d), which was considerably higher than the Alberta (519 L/c-d) and Canadian (622 L/c-d) averages.

Overall, the water quantity of the Oldman watershed is **"Fair"** based on the results of analysis of flow variability, licensed allocation and actual use, as well as water use efficiencies within irrigation districts and municipalities.

Water quality in the Oldman watershed is defined primarily by natural conditions in the headwaters and is modified by downstream drainage and associated land-use patterns. A combination of effects from non-point sources (e.g., runoff from agricultural lands, pastures, etc.) and point sources (mainly related to municipal, industry, and irrigation return flows) creates additional loadings to streams in the watershed. All of these factors affect changes in concentrations of indicators, their temporal trends and loadings in different streams and their reaches.

The overall temporal trend pattern for all water quality indicators in the Oldman watershed shows neutral and/or decreasing trends that result in better conditions within upstream reaches, except in the Foothills and Prairie sub-basins. These two Sub-basins show poorer water quality and increasing trends for almost all indicators. The upstream reach of the Oldman River shows no trend, with variable trends downstream. Increasing trends and accordingly poorer water quality in the Oldman River mainstem are caused by higher loading from tributaries and/or from urban centres. Improving (decreasing) trends in the Mainstem are maintained as a result of lower loadings from the tributaries.

Integrating the results of water quality analysis for nitrogen, phosphorus, total suspended solids (TSS) and fecal coliforms gives an overall rank of **"Good"** to **"Fair"** for the Oldman watershed.

Based on an evaluation of the combined ranking, the health of each of the Sub-basins is shown in Table 1.

Overall, the health of the Oldman watershed is rated as "fair". The Mountain Sub-basins are good, three Sub-basins are ranked fair, and the Prairie Sub-basins are ranked fair to poor. In the Foothills, Southern Tributaries, and Mainstem sub-basins, which are ranked fair, and the Prairie Sub-basins, land cover, riparian health, land use, water allocations, surface water nutrient levels are the indicators of most concern.

Storage, flow regulation, and water diversions are the keys to meeting current water use demands within the Oldman watershed. In one instance (Little Bow River sub-basin), diversions from outside the watershed are used to meet current demand. Overall, management actions in the watershed are required to maintain sustainability in light of potential expansion of demand (within current allocations) and potentially lower streamflow as a result of climate change.

Table 1: Overall State of the Watershed Ranking for all Indicators by Sub-basins

<table>
<tr><th rowspan="2">Indicator</th><th colspan="9">Sub-Basins</th></tr>
<tr><th>Mountain</th><th>Foothills</th><th>Southern Tributaries</th><th colspan="2">Prairie</th><th colspan="2">Mainstem</th><th colspan="2">Oldman Watershed</th></tr>
<tr><td>Terrestrial and Riparian</td><td>Good</td><td>Good</td><td>Fair</td><td colspan="2">Poor</td><td colspan="2">Good</td><td colspan="2">Fair</td></tr>
<tr><td>Water Quantity</td><td>Good</td><td>Fair</td><td>Poor</td><td>Fair</td><td>Poor</td><td colspan="2">Poor</td><td colspan="2">Fair</td></tr>
<tr><td>Water Quality</td><td>Good</td><td>Fair</td><td>Fair</td><td>Fair</td><td>Poor</td><td>Good</td><td>Fair</td><td>Good</td><td>Fair</td></tr>
<tr><td>Overall</td><td>Good</td><td>Fair</td><td>Fair</td><td>Fair</td><td>Poor</td><td colspan="2">Fair</td><td colspan="2">Fair</td></tr>
</table>

APPROACH

To assess the state of the Oldman watershed, it was divided using natural drainage patterns and water management history. Four Sub-basins – the Mountain, Foothills, Southern Tributaries, and Prairie – were defined. A fifth – the Oldman River Mainstem – was also identified because it receives and is influenced by water from the other Sub-basins (Figure 1).

Indicators and Thresholds

In the same way performance measures show how well systems function over time, environmental indicators are used to measure the state of the watershed. Indicators allow us to understand the cause and effect relationship between human activities on the landscape and the environmental response to those activities. Indicators have three roles: to show trends in environmental conditions over time, to inform managers and the public about the condition of a watershed compared to desired goals, and to help assess whether or not management actions are effective. As a result of the long history of monitoring water quantity and quality in the watershed, a large data set on indicators is available. These data provide the opportunity to conduct an analytical assessment of indicators.

For the Oldman watershed, three groups of indicators were chosen and assessed (Table 2).

Sub-basins and Watershed Ranking

The health of each of the Sub-basins was evaluated by integrating the rankings for terrestrial and riparian ecology, water quantity, and water quality indicators to determine an overall value. A comparative assessment of the rankings assigned to each of the Sub-basins was then used to assess the overall health of the Oldman watershed.

Instream Objectives (IOs) and Water Conservation Objectives (WCOs)

IOs - flows that should remain in the river to protect environmental values, human uses or parts thereof. IOs are maintained through dam operations or by restrictions on licences. IOs are in place throughout the South Saskatchewan River Basin (SSRB), although some offer only limited protection of the aquatic environment. IOs have usually been set in response to fish habitat instream needs and/or water quality.

WCOs are defined in Alberta's Water Act. A WCO is the amount and quantity of water necessary for the protection of a natural water body or its aquatic environment, or any part thereof. It may also include water necessary to maintain a rate of flow or water level requirements for human instream use. WCOs were established in the Oldman River Basin following completion and government approval of the SSRB plan.

Table 2: Indicators and Thresholds used for the Oldman River State of the Watershed Report

Indicator	Threshold
Terrestrial and Riparian Ecology	
Land Cover	• Good: >50% combined land cover of forest, grassland, shrubland and rock/barren land • Fair: 25 to 50% combined land cover of forest, grassland, shrubland and rock/barren land • Poor: <25% combined land cover of forest, grassland, shrubland and rock/barren land
Soil Erosion Rates	• Good: <25% of area at risk of erosion • Fair: 25 to 50% of area at risk of erosion • Poor: >50% of area at risk of erosion
Riparian Health	• Good: riparian class healthy • Fair: healthy but with problems • Poor: unhealthy
Land use Linear Developments	• Good: linear disturbance <2% • Fair: 2 to 3% linear disturbance • Poor: >3% linear disturbance
Total Land Use Disturbance	• Good: <50% total land use disturbance • Fair: 50 to 90% total land use disturbance • Poor: >90% total land use disturbance
Water Quantity	
Trends in Natural Flow	Thresholds for assessing water quantity within the Oldman watershed have not been established. Water quantity thresholds were assessed by a relative comparison among stations for each of the Sub-basins with assignment of rankings of good, fair or poor.
Licensed Allocation and Actual Use vs Natural Flow	See above
Performance in Meeting IO and WCO in Recent Years	See above
Irrigation and Municipal Water Use Efficiency	See above
Water Quality:	
Nutrients - nitrogen	• Good: no exceedances or less than 10% within the data set and neutral or decreasing trends in concentration particularly over the last decade • Fair: the number of exceedances not more than 50% of the analyzed data set with increasing trends in concentration for one or two indicators • Poor: exceedances occur in more than 50% cases and increasing trend in concentration pronounced in more than two indicators
Nutrients - phosphorus	See above
Total Suspended Solids (TSS)	See above
Fecal Coliforms	See above

MOUNTAIN SUB-BASINS

This is the westernmost portion of the Oldman watershed. The headwaters of the Crowsnest, Castle and Oldman rivers are deeply incised, narrow and swift flowing with boulders and cobbles forming the stream beds. These coldwater rivers are world-renowned among avid anglers for their native populations of mountain whitefish and trout.

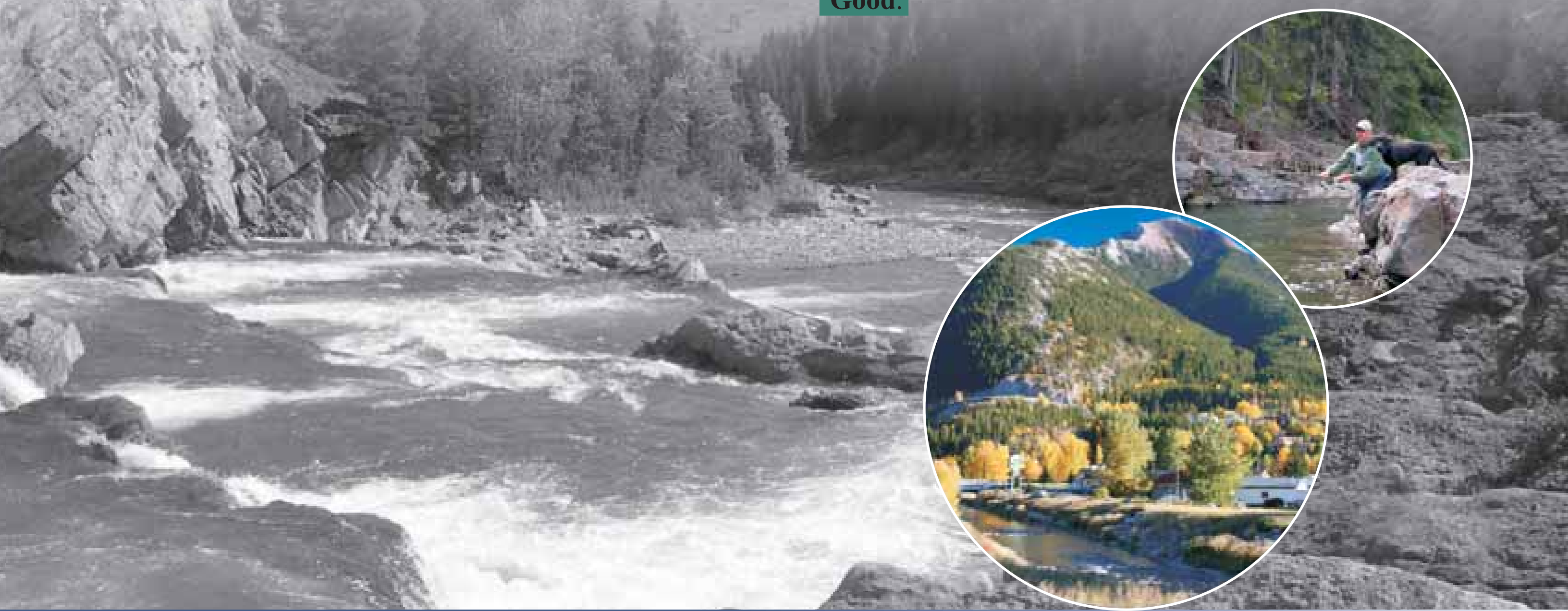
The dominant land cover is forest, and activities such as forest harvesting and reforestation, grazing, fire and mountain pine beetle can all affect the watershed. The growing season is short, the climate is harsh, and wind is a constant element. Soil erosion is generally not a concern, because 87% of the Mountain Sub-basins is covered by forest and grassland. The Mountain Sub-basins riparian areas are healthier than the average in the Oldman watershed. Approximately 25% of the Mountain Sub-basins is altered by human development, with the greatest disturbance by agriculture (22%), which is concentrated in the Crowsnest River valley bottom. Extensive random recreational use (hunting, fishing, camping and OHVs) occurs throughout the Sub-basins, but data are not available to quantify the area affected. Terrestrial and riparian indicators are rated as Good.

The Crowsnest and Castle river sub-basins have considerable snowpack and high amounts of precipitation contributing to flows typical of a mountain stream. In both rivers, recorded flows are equivalent to natural flows because the rivers are unregulated and have low water demands. Annual flows on the Crowsnest River are decreasing by an average 0.3% per year at Frank and by 0.5% per year near Lundbreck. However, these annual decreases do not represent statistically significant trends. On a monthly basis, a significant decrease in flows is observed in April on the Crowsnest River.

In the Mountain Sub-basins, water is used for agricultural, municipal, commercial, industrial, and other uses. The largest allocation and withdrawal is for the commercial sector, primarily the Allison Creek Fish Brood Station and Hatchery west of Coleman. The hatchery has high return flows. Actual use is much less than allocations within the Mountain Sub-basins. The rivers perform better at meeting water conservation and instream objectives at downstream sites than at upstream locations, however, deficits occurred at all monitored sites, primarily during the winter low flow period. Water quantity indicators are rated as Good.

Water quality within the Mountain Sub-basins is generally within guidelines. Exceedances observed in the past are related to an extreme rainfall event in June 2005 with subsequent flooding which is reflected in high loadings for phosphorus, nitrogen, TSS, and fecal coliforms. Loadings of total nitrogen, TSS and fecal coliforms were all typically higher in the Castle River sub-basin than the Crowsnest River sub-basin. Water quality tended to improve over time at the mouth of the Crowsnest River; improvements in water quality are apparent in the Castle River for nitrogen, phosphorus, and fecal coliforms. Water quality indicators are rated as Good.

Overall, the Mountain Sub-basins are rated as **Good**.



FOOTHILLS SUB-BASINS

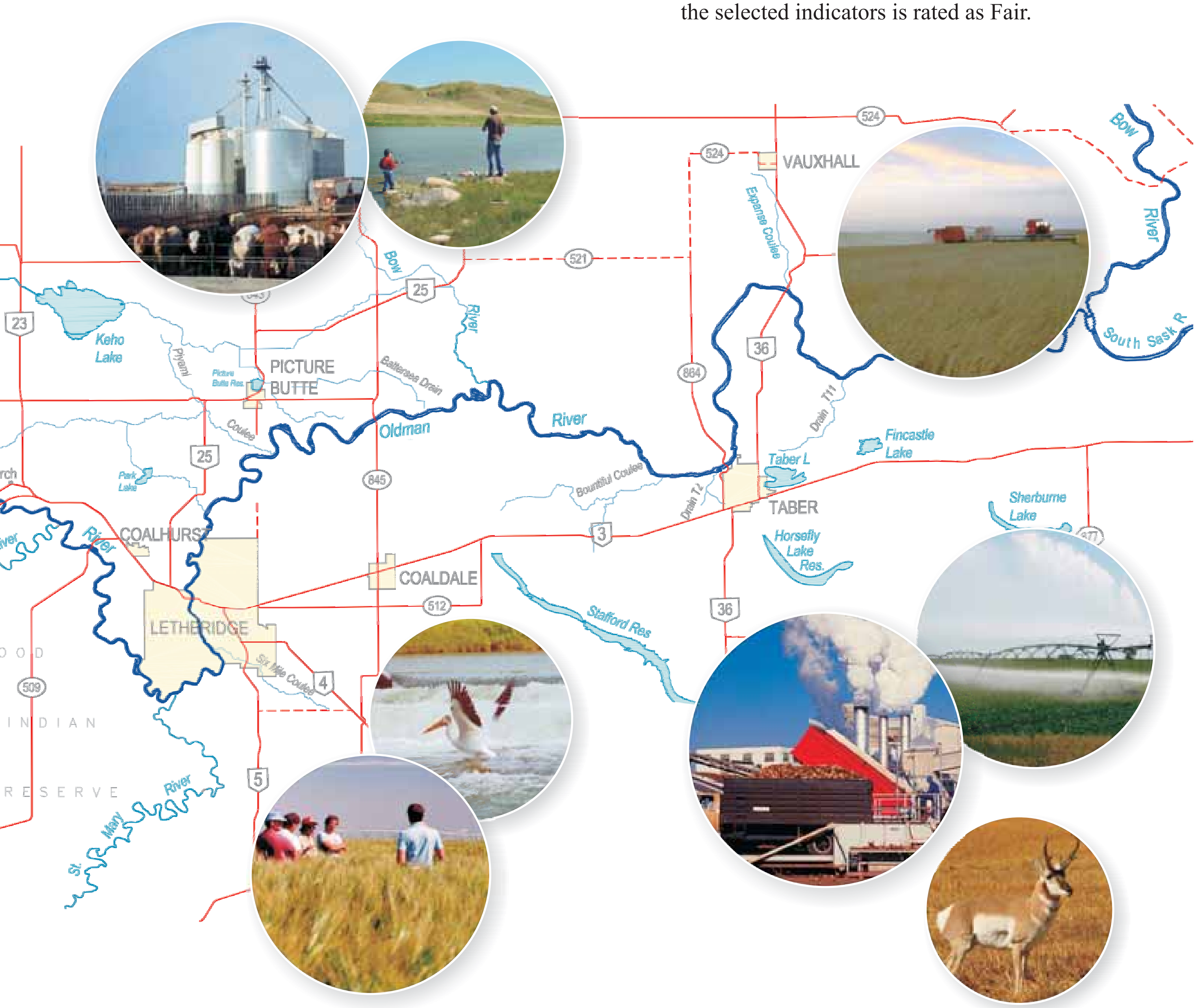
The Foothills Sub-basins lie in the transition zone between the mountains and forests to the west and the Prairie grasslands and agricultural land to the east. Three primary tributaries -Willow, Beaver and Pincher creeks – flow into the Oldman River. Although the headwaters of these tributaries are in the mountains, all three are shallow and warm up quickly in the summer.

Land cover is a mix of cultivated land and forest and native grassland. Grassland and forest covers approximately 60%. Soil erosion is rated as negligible over most (60%) of the area with small areas of moderate risk near Claresholm and south of Fort Macleod. Riparian health is slightly better than the average for the Oldman watershed and is comparable to that found throughout Alberta. Land use (agriculture, infrastructure, urban, recreation) affects 40% of the total area. This includes 1% of the land that is occupied by the Oldman, Chain Lakes and Pine Coulee reservoirs. Terrestrial and riparian indicators are rated as Good.

Flows on Beaver and Pincher creeks are closer to those seen on mountain steams, while flows on Willow Creek are typical of foothills region streams. The Chain Lakes Reservoir, build in 1966, regulates flows on Willow Creek as does the offstream Pine Coulee Reservoir, built in 1999. Flows on Beaver Creek show significant decreasing trends in annual natural flow and in most months, however, Willow and Pincher creeks indicate decreasing monthly trends in April, November and December. Trends in annual flows are not significant.

Water use is recorded for agricultural, municipal, commercial, industrial and other uses (including reservoir evaporative losses at Chain Lakes, and Pine Coulee and its Diversion Pond within the Willow Creek sub-basin. The agricultural sector is the largest user, with irrigation accounting for about 55% of the allocated water upstream of Claresholm and 82% upstream of Nolan. Actual water withdrawal is estimated to be about 80 to 85% of the total allocations. Willow and Pincher creeks have infrequent deficits to the IO, but frequent deficits to the WCO. Beaver and Pincher creeks have low levels of allocations and uses, however, deficits to both the IO and WCO are frequent on Beaver Creek.

The Beaver Creek sub-basin demonstrated a statistically significant trend toward decreasing flows. This trend could be the result of naturally high flow variability combined with the small size of the sub-basin, changes in land use, climate change, or a combination of these factors. Water quantity based on the selected indicators is rated as Fair.



Water quality is changing through the Foothills Sub-basins. Nutrients (nitrogen and phosphorus) exceeded guidelines in Beaver and Pincher creeks, as did TSS in Beaver Creek, during the floods experienced in 2005. These exceedances are likely due to agricultural activities and high surface runoff. Trends for these nutrients are increasing in upper Willow Creek and downstream of Pine Coulee Reservoir. In upper Willow Creek, there is little apparent link to current land use activities. Pine Coulee Reservoir appears to be a substantial source of nutrients. In recent years, total concentrations of fecal coliforms have exceeded guidelines in Trout and Meadow creeks, and less often in Pincher and Beaver creeks. Water quality indicators are rated as Fair.

Overall, the Foothills Sub-basins are rated as Fair.

SOUTHERN TRIBUTARIES SUB-BASINS

The Southern Tributaries Sub-basins are unique in the extent of protection afforded to the headwaters of the Oldman watershed. The extreme southwestern corner comprises Waterton-Glacier International Peace Park, which helps protect the unique and unusually diverse physical, biological and cultural resources found here.

Flows are heavily managed throughout the Southern Tributaries Sub-basins, and have been since the construction of diversion works began in 1899. Currently water from the Southern Tributaries Sub-basins supplies eight Irrigation Districts, including three Irrigation Districts located only partially within or completely outside of the area (Figure 3). Irrigation

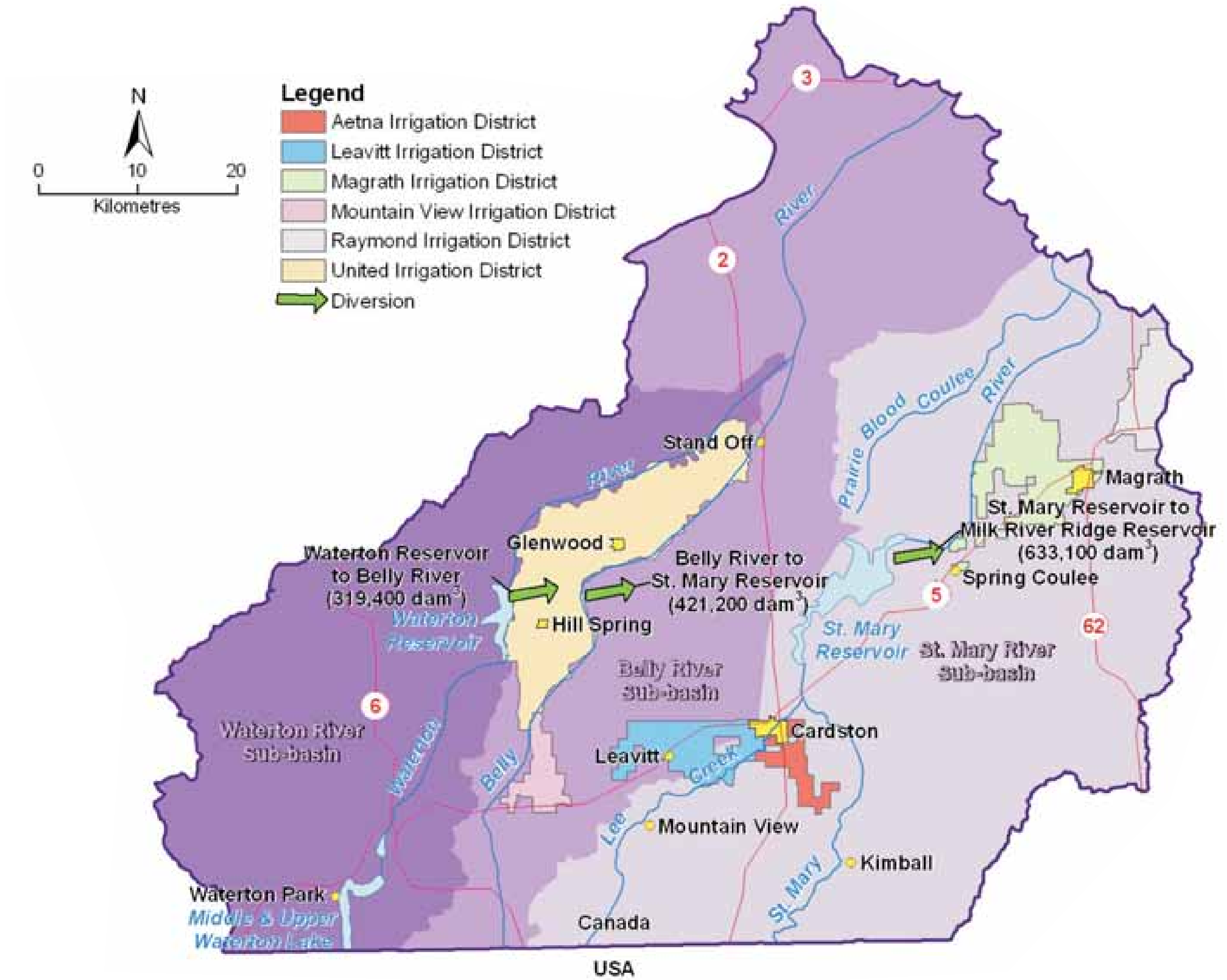


Figure 3: Irrigation Districts and Diversions in the Southern Tributaries Sub-basins

is the primary water use. Eleven reservoirs are located within the Southern Tributaries Sub-basins or within irrigation districts supplied from the Southern Tributaries. In addition to irrigation water use, nine communities are licensed to withdraw water from the Southern Tributaries Sub-basins for municipal, commercial and industrial use. Total water use allocations are much higher than actual use. If license holders were to withdraw the total amount of water that is allocated, water shortages would be more common.

Approximately 69% is affected by various land uses, with agriculture making up the largest component (66%). Soil erosion risk is rated as low throughout the area, except along the Belly River and east of Magrath where it is considered to be moderate. Riparian health is slightly better than the average for the Oldman watershed and is comparable to that found throughout Alberta. Terrestrial and riparian indicators are rated as Fair.

Natural flows on the Waterton, Belly and St. Mary rivers show a major peak in early June that is likely caused by a combination of meltwater from the winter snow pack and spring precipitation events. Recorded flows are approximately equal to natural flows upstream of major storage projects or diversions to irrigation districts but are severely impacted by flow regulation and diversions along the lower portions of the Waterton, Belly and St. Mary rivers.

Total allocations are about 75% of the median natural flow, however, actual water use (diversions minus return flows) is about 33%. Return flows from irrigation districts using waters of the Southern Tributaries sub-basins are not always available for use in the source stream, but almost all are available for use in either the Oldman River or South Saskatchewan River watersheds. There are minor deficits to IO and WCO upstream of storage projects and the Waterton-St. Mary Headworks System. Downstream of the Headworks System, deficits to the IO are minor, but the frequency of deficits to the WCOs increases substantially during summer months. Only about 51% of total allocations are being used, indicating there is expansion potential within existing allocations. Expansion of water use by users with high priority (senior) licences may increase deficits to instream flow needs and consumptive water users with junior priority licences. Water quantity indicators are rated as Poor.

The median annual total nitrogen concentrations on the Belly River, Lee Creek and St. Mary River have never exceeded the guideline of 1.0 mg/L. Decreasing trends in total phosphorus concentrations were observed in the Belly and St. Mary rivers between 1991 and 2000 at 80% and 90% confidence levels, respectively. This decreasing trend in the primary tributaries indicates an improvement in total phosphorus concentrations in the natural flow systems. Values for TSS within the Southern Tributaries Sub-basins are generally low. Fecal coliform counts vary throughout the Southern Tributaries Sub-basins; however, exceedances in median annual counts occur relatively frequently. Fecal coliform counts in Prairie Blood Coulee demonstrated an increasing trend at the 80% confidence level. Water quality indicators are rated as Fair.

Overall, the Southern Tributaries Sub-basins are rated as Fair.

PRAIRIE SUB-BASINS

The eastern portion of the Oldman watershed is a true prairie landscape with sunny, hot, dry summers, cold dry winters, and extreme temperatures. Precipitation ranges from 450 mm per year at Lethbridge to less than 300 mm per year at the confluence with the Bow River. Frequent windy conditions (gusts of 170 kph recorded at Lethbridge) reduce soil moisture, and productivity is limited without irrigation. The growing season can be 3 to 4 months long.

Within this prairie landscape, land use activities, mainly agriculture, affect 73% of the land base, and irrigation occurs on 12% of the cultivated lands. Irrigation holds 83% of the total licensed allocation of the Little Bow River near its mouth at the Oldman River. Soil erosion risk is moderate to severe and is primarily related to high winds and agricultural operations. Riparian health within the Sub-basins is lower than the average found throughout Alberta. The Prairie Sub-basins are experiencing substantial population growth, especially within and close to major urban centres. Terrestrial and riparian indicators are rated as Poor in the Prairie Sub-basins.

The area is dominated by poorly defined natural drainage, diversions into and out of the Sub-basins, and extensive irrigation infrastructure (canals, pipelines, reservoirs, and drains). All irrigation districts occupying the Prairie Sub-basins are supported by water from outside the watershed. None of these districts is licensed to withdraw naturally flowing water from the Prairie Sub-basins.

The Little Bow River and its primary tributary, Mosquito Creek, are the key natural drainages in the Prairie Sub-basins. Recorded flows on the Little Bow River exceed natural flows because of the large diversion volume from the Highwood River. The Little Bow River demonstrated a significant declining trend in reconstructed natural flows. This may reflect the possible effects of climate change or changing land use. Alternatively, the computation of natural flow may not be as accurate as it is in other areas in the Oldman watershed because of diversion into the Prairie Sub-basins and the high level of unmonitored water use. Water allocations (primarily irrigation with some municipal, commercial and agricultural uses) are about 300% of the median natural flow. Water use is about 270% of the median natural flow. When diversions from the Highwood River are included on the supply side, these percentages drop to about 70% and 60%, respectively.

Water diversions from the Highwood River (outside the Oldman watershed) are necessary to meet existing allocations plus WCOs within the Little Bow River sub-basin (IOs have not been established). Deficits to the WCO are minor, probably because natural flow is supplemented by diversions from the Bow River watershed. Currently water use is 87% of the licensed allocation. With so little difference between allocation and use, the potential for increased use within existing allocations is minimal. The current level of water use is sustainable only with diversions from the Highwood River. Indicators for water quantity are rated Fair to Poor.

Irrigation, agricultural and industrial uses are likely responsible for exceedances of the guidelines for nutrient concentrations and fecal coliform counts. This is also reflected in loadings for phosphorus, nitrogen, TSS, and fecal coliforms. Annual loadings for nitrogen, fecal coliforms, and TSS in the Little Bow River sub-basin are highly related to annual flows – this shows effects associated with watershed patterns rather than point source discharges of contaminants.

The upper reach of Little Bow River has generally increasing trends for all parameters. The middle reach shows increasing trends in all indicators except TSS. Further downstream nitrogen showed an increasing trend, with decreasing trends in total fecal coliforms, and no trends in the other two indicators (phosphorus and TSS). Mosquito Creek has different patterns, and generally no trends for indicators are visible. Overall, water quality in the Prairie Sub-basins is rated Fair to Poor.

Overall, the Prairie Sub-basins is rated as Fair to Poor.

OLDMAN RIVER MAINSTEM

The mainstem of the Oldman River extends about 330 km from its headwaters in the mountains near the continental divide to its confluence with the Bow River in the Prairie grasslands where the two rivers meet to form the South Saskatchewan River. The Oldman River contributes about 48% of the flow of the South Saskatchewan River at Medicine Hat. For the purposes of this report, the Oldman River mainstem terrestrial area is a 500-m wide corridor on either side of the Oldman River. Disturbances to this area can immediately affect water quantity and quality.

In its natural state, the Oldman River is characterized by high spring flows from mountain snowmelt and runoff and low late summer, fall, and winter flows, as the water source is reduced to groundwater baseflow and precipitation inputs. Of the total flow in the Oldman River, about 36% comes from the upper Oldman River (upstream of the Oldman River Dam) and upper tributaries (Castle and Crowsnest rivers), 32% from the Belly and Waterton rivers, 25% is contributed by the St. Mary River, and 7% from other tributaries, such as Pincher Creek, Willow Creek and the Little Bow River. Since 1991, the flow of the Oldman River has been regulated by the Oldman Reservoir, located near the transition from the mountains to the foothills at the confluence of the Crowsnest, Castle and Oldman rivers.

Through much of the mainstem, cottonwoods form the only forest in an otherwise grassland environment and they are important for wildlife, fish, recreation and aboriginal culture. Approximately 20% of the Oldman River mainstem is affected by human footprint. Agricultural activities make up the largest component (10%). Due to the risk of flooding, few dwellings or confined feeding operations occur in the valley. Erosion risk is rated low to negligible. Riparian health is below average for the watershed in part due to use of the area for winter grazing. Terrestrial and riparian indicators are rated as Fair.

In upstream reaches of the Oldman River, recorded flows are equivalent to natural flows because the rivers are unregulated and have low water demands. In the lower reaches of the Oldman River, human activities such as flow regulation, irrigation, municipal and commercial demands affect flow. Major storage and diversion works along the Oldman River include the Oldman River Dam and the Lethbridge Northern Irrigation District (LNID) diversion works. Flows downstream of the Oldman River Dam are quite different from natural flows because of these controls and withdrawals. Near the mouth of the Oldman River, the average annual recorded flow is about 64% of the average annual natural flow. No significant annual trends in annual natural flow exist in the Oldman River mainstem, however, probable decreasing trends occurred at several locations in April, November and

December. The river performs well in meeting the IOs throughout its length, and almost always meets WCOs upstream of the Oldman River Dam. However, deficits in meeting WCOs downstream of the Oldman River Dam occur in 15 to 20% of the months. Similar to the Southern Tributaries Sub-basins, the Oldman River mainstem is heavily allocated. At the mouth, allocations are about 60% and use is about 39% of median natural flow. The difference between allocation and use indicates that there is potential for expansion within existing allocations. Water quantity indicators are rated Poor.

Water quality within the Oldman River mainstem is a function of the combination of inputs from all of the tributaries. As stream volumes increase downstream, the concentration of these inputs is diluted and therefore reduced. Nutrients showed lower concentrations in the Oldman River compared to the tributaries. Total nitrogen concentrations are typically below water quality guidelines, and loadings generally decreased due to decreasing concentrations. Total phosphorus concentrations have decreased in recent years, and values are usually within the water quality guidelines. Total suspended solids concentrations are relatively low in the Oldman River mainstem, and values are lower than those in the tributaries. The water quality trends near Lethbridge and downstream from Taber have changed from a neutral or decreasing pattern in nitrogen and TSS in 1988 to 1997 to an increasing trend since 1998, and thus poorer water quality. Fecal coliform counts are variable along the Oldman River, but exceedances in median annual counts along the mainstem of the Oldman River are not common. The trend in fecal coliform counts changed from increasing from 1988-1997 to neutral in the next decade and shows considerable improvement in water quality.

Land use indicators show that riparian areas are not healthy which, in turn, affects water quality. Improved storm water management has occurred in some municipalities. Irrigation district and municipal water use efficiencies within the watershed have decreased water withdrawals and/or increased return flows to the mainstem. Water quality indicators are rated as Good to Fair.

Overall, the Mainstem Sub-basins are rated as Fair.




RECOMMENDATIONS AND BEST MANAGEMENT PRACTICES

Recommendations for the Oldman watershed have been organized into the following categories:

- *Planning* – This includes the ongoing watershed management planning processes that the Oldman Watershed Council (OWC) has implemented for several years. It also includes the municipal planning process.
- *Stewardship* – This too is ongoing, and incorporates community involvement, including education and awareness.
- *Reclamation and restoration*.
- *Data Gaps*, addressed in the main report.

Planning

Water management in the Oldman watershed must consider the impacts of both droughts and floods. Early awareness of significant stream flow and water quality trends is essential for preparing water management plans and adaptation measures to minimize impacts on users and environmental resources. Learning to survive on less water will be the challenge.

1. Develop adaptation plans to manage potential declining flows in Beaver Creek and Little Bow River sub-basins. Trends in other Sub-basins should be updated on a regular basis: continue to monitor diversion rates, timing of withdrawals, and return flow volumes within the watershed.
2. Undertake monitoring programs to support adaptive management for environmental protection and mitigation, such as the plan recommended by the Highwood Management Plan Public Advisory Committee to assess performance of the Highwood Diversion Plan and support adaptive adjustments.
3. Consider modifying allocations and other options to achieve sustainable water use levels in the future, especially within the Southern Tributaries Sub-basins and Oldman River mainstem.
4. Consider development of "Riparian Policies" throughout the watershed to protect areas that are key to managing water quality parameters, such as total suspended solids (TSS) and fecal coliforms.
5. Establish targets under a municipal planning framework for municipalities with increasing populations and land use pressures. These targets can establish short, medium and long-term goals or thresholds that reflect their capacity to supply municipal drinking water, and water for industrial or recreational purposes.
6. Update the State of the Watershed report on a periodic basis – every five years.

The use of Instream Objectives (IOs) and Water Conservation Objectives (WCOs) to monitor stream flows and determine whether or not the instream needs of the aquatic ecosystem are being met has proven to be a good management tool. However, several of the current IOs and WCOs could be adjusted within the Oldman watershed to provide a more accurate picture of actual supply and demand.

7. Currently, unregulated streams (e.g., Castle River and Lee Creek) are unable to meet IOs or WCOs that are set higher than natural flow. On such streams, instream targets should be limited to a realistic target value or natural flow, whichever is less.
8. On regulated streams, the IO and WCO could be set higher than natural flow to provide instream benefits beyond that of natural conditions or to mitigate human impacts. Such instream conditions could become targets for regulation of stream flow.

The Oldman watershed is closed to new surface water allocations, and this will increase demand for groundwater. Data on groundwater resources, water use, or water quality are generally not known for the Oldman watershed.

9. Use of groundwater as an indicator is recommended for future State of the Watershed reports.

Stewardship

10. Support implementation of good stewardship practices.

Nitrogen and phosphorus associated with human activities, such as municipal wastewater effluent and agricultural operations, enter surface waters as a result of insufficient treatment. Improving quality of surface waters can be accomplished by ensuring municipal wastewater is treated and reducing the amount of runoff and leaching directly into surface waters from feedlots and pastures. Advances in wastewater treatment technology in recent years have resulted in significant reductions from this source.

11. Support rural beneficial management practices: off-stream watering systems, riparian zone protection, buffer strips, manure incorporation.

12. Support urban beneficial management practices: storm water management; water conservation.

As population density increases, soil erosion risk increases. Soil erosion is a result of weather patterns and land use practices within a watershed. Land uses that expose the soil, such as cultivation, subdivision stripping and grading, logging, mining and temporary road construction, allow the rain, snow and wind to move sediments into the surface waters.

13. Areas of moderate to high risk of soil erosion may require additional land management practices to ensure the continued health of riparian and aquatic life. Soil erosion potential should be modeled at a scale relevant to individual activities.

14. Consider implementing and monitoring source and erosion controls for all new developments and in areas with exposed earth; moving livestock watering, holding, and overwintering areas away from stream banks; and minimizing the width of stream crossings.

15. Expand public education and awareness of water and water use within the Oldman watershed.

Reclamation and Restoration

Riparian health assessments are sporadic throughout the watershed. As more are completed, they provide the mechanism for highlighting areas of concern and focusing restoration efforts and best management practices.

16. Support the Cows and Fish program, especially in the Oldman River mainstem.

17. Implement drainage erosion control measures including revegetation and reforestation as soon as possible following surface disturbance.

18. Continue with beneficial management practices, including field shelter belts, avoidance of overgrazing, summer fallowing, and reduced tillage.

This State of the Watershed report provides the foundation for making future watershed management decisions. As stated in the Preface: “Watershed level work seems overwhelming because of the scale. However, there are ways to make watershed scale work more manageable. The first step might be to recognize that we can manage cooperatively what we can't individually.” This “community” approach is what will continue to connect us as we move toward our desired future for the Oldman watershed.

As residents of the Oldman Watershed, we are responsible for the health of our watershed and the quality of our water.

Our mission – to maintain and improve the Oldman River Watershed through partnerships, knowledge and the implementation and integration of sustainable watershed management and land use practices.

Become a member of the council, participate on a team, work in your community or raise your voice.

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Photos on the cover of the Oldman River – State of the Watershed Report are courtesy of Rochelle Coffey. Photos within the report are courtesy of Alberta Environment, Alberta Agriculture and Rural Development, Oldman Watershed Council, Rochelle Coffey, and residents of the watershed.

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