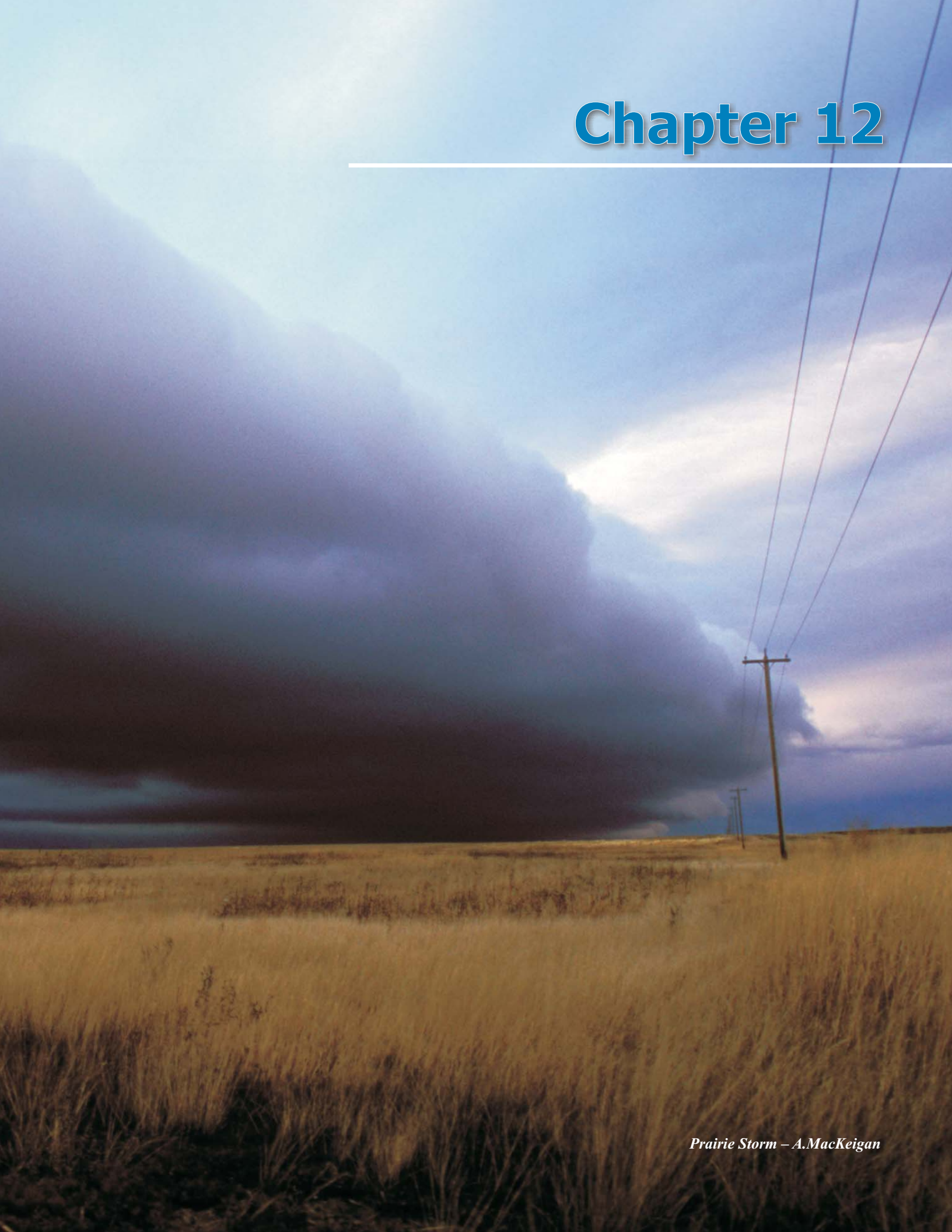


# Chapter 12

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# Chapter 12

## What Needs to Change?

### 12.1 Conclusions

The Bow River Basin is a large, diverse system that varies greatly along its length, both in terms of the status of its water resources and impacts from human activities. In some reaches of the Bow River, water quantity is adequate, water quality is improving and aquatic ecosystems are generally healthy. However, the health and status of the river deteriorates along its length and there are several serious issues of concern. This chapter identifies the greatest human impacts on the basin, including the most immediate threats and future challenges to its health.

#### Water Quantity

Streamflows in the headwaters of the Bow River are relatively unchanged, but the demand on water quantity in headwater communities continues to grow. Most of the Bow River is highly altered from its natural flows. Dams for hydroelectric generation, located in the upper reaches and major tributaries, store water during the spring and summer and release it during the year, reducing the spring and summer flows and increasing winter flows. In the lower reaches, water withdrawals for irrigation and municipal uses also reduce streamflows, particularly during the summer. Currently, there are insufficient flows to meet all the demands within the lowest reach of the Bow River, resulting in the degradation of aquatic and riparian habitats.

#### Water Use and Allocations

Irrigation districts and municipalities are allocated the majority of the licensed volume of the Bow River (approximately 76% and 18%, respectively), with additional licences for industry, recreational facilities and smaller irrigators, other agricultural users and communities. In general, peak demands for most users occur during the summer months. When the water is most required, the flows in the river may be too low to permit a full use of the licensed amount. If the water supply cannot satisfy the requirements of all licensees, water is allocated according to the principle of priority in time.

Many of the water licences for the Bow River were issued decades ago, when capacity and limits were not the concern they are today. Licences issued since the

early 1990s are subject to minimum flows for fish habitat being met before withdrawals from the Bow River are permitted.

Water conservation efforts are ongoing throughout the basin. Municipalities have implemented strategies that include education for residential indoor and outdoor water conservation, incentive programs for residents and industries, mandatory water metering, and detection and repair of leaks. The irrigation industry has increased the efficiency of its water use. The agricultural industry has initiated more sustainable practices to help reduce impacts. For example, previously cultivated marginal lands have been returned to pasture and wetland use. Zero or minimum tillage practices have been adopted to conserve moisture and reduce sediment runoff. Research into crop varieties and management practices to improve crop yields with less water is ongoing. The biggest change has been the increased efficiencies attained through relining of canals, installation of pipelines, and adoption of high-tech sprinkler systems.

#### Water Conservation Objectives

The South Saskatchewan River Basin Water Management Plan will recommend Water Conservation Objectives for specific reaches of the Bow River. These will attempt to define the desired balance between water consumption and environmental protection of the river. The Water Conservation Objectives will subsequently be established by the Alberta Government.

#### Climate Change

Warmer temperatures and receding glaciers within the basin during the last century may be the result of human-induced climate change. One scenario predicts climate change may cause lower spring floods and higher winter streamflows. Because glaciers add to the flows of the Bow River, continued glacial retreat would eventually result in the loss of their contribution. These changes could result in small changes in streamflow in typical years, but substantial declines in drought years in the upper reaches. Research into predicted impacts and potential solutions for climate change in the South Saskatchewan River Basin is ongoing.

## Water Quality

Human activities within the basin have greatly influenced water quality. The headwaters of the Bow River contain pesticides and persistent organic pollutants, the result of long-range atmospheric transport and deposition. Non-point source of pollution need to be identified. Water quality declines along the length of the Bow River, with higher concentrations of nutrients and pesticides in the lower reaches due to land use and disturbance, municipal and industrial effluents, and agricultural practices. Treatment upgrades of the effluents discharged by municipalities and industries have improved bacteria and nutrient concentrations during the last few decades. However, effluent quality will need to continually improve in order to meet the growing demands of future populations, and agricultural, industrial and recreational activities.

## Nutrient Enrichment

Municipal wastewater effluent is the largest point source contributor of nutrients to the Bow River. Moderate increases have resulted in the highly productive sportfishery downstream of Calgary, but excessive productivity can lead to poor water quality and negative changes to aquatic ecosystems. Ongoing upgrades to municipal wastewater and stormwater treatment are likely to result in continued improvements in water quality. The implementation of total loading limits in Calgary will set an upper limit for pollutant discharge, regardless of future increases in population and growth. Agricultural runoff also contributes nutrients in the lower reaches, increasing the productivity of the system.

## Riparian Areas

The health of riparian areas degrades along the length of the Bow River. During the past century, hydroelectric dams and water withdrawals have altered the natural flood regime of the river, negatively affecting riparian areas. Changes in seasonal inundation have resulted in the poor regeneration of cottonwood trees. If significant recruitment does not occur, the riparian forests, and the important wildlife habitat and structural function they provide, could be gone in the next 100 to 150 years. Invasive plants and weeds have become established throughout the riparian zone, particularly in the more heavily cultivated lower reaches of the river. Irrigation reservoirs and canals provide additional riparian and channel habitat, but cannot replace natural habitat within the basin. Educational programs are helping to alleviate the impacts of ranching and agricultural practices on

riparian areas, but only a historic flood regime may be able to restore the riparian areas along the lower Bow River.

## Wetlands

Throughout the basin, wetlands have been drained, tilled or filled to allow for rural and urban development and to enhance agricultural production. While many wetlands still remain in association with native grassland, information quantifying existing and drained wetlands is not available, making it difficult to manage this important resource. Some previously drained agricultural lands have been converted back to wetland use, but restoration cannot keep pace with the rate of wetland loss. Irrigation canals and reservoirs provide abundant staging and moulting habitat. Irrigation right-of-ways also offer nesting habitat, but their success in these areas is poor. Preservation and restoration of wetlands and associated habitats need to be raised to a higher priority. Recent progress includes the development of Canada's first wetland protection plan for a major urban center by the City of Calgary. Alberta Environment is helping to develop a Wetland Policy and Action Plan for the province.

## Fish Habitat Alterations

Fish habitat in the upper reaches is limited by the large daily fluctuations in streamflows and large seasonal fluctuations in reservoir water levels that result from hydroelectric facilities. In the mid and lower reaches, flows are re-regulated and municipal wastewater effluents stimulate biological production. These factors have improved fish habitat and have contributed to the Bow River's world-class sportfishery. However, several of the dams and weirs present barriers to fish movement along the river. Cumulative water withdrawals greatly reduce the flows of the river at the lowest reach, impairing fish habitat. Under lower flow conditions, water temperatures can rise and oxygen concentrations can drop, stressing fish. Heavy angling is another pressure facing fish populations. Continued improvements in weir design and effluent quality should improve some of these conditions, but the return to a more natural state would require substantial changes in water use.

## Fish Introductions

The distribution and populations of fish species within the Bow River Basin have changed during the last century, particularly in the upper and mid reaches of the river. Populations of the native cutthroat and bull trout have been substantially reduced and are currently

found only in the headwaters and in some tributaries. Introduced rainbow, brown and brook trout have largely replaced these native species. Some of the non-native fish introductions were accidental, while others were done purposefully to improve angling opportunities. Restoration programs to re-establish native populations are ongoing throughout the basin.

### Future Challenges

Because of the variability in natural flows of the Bow River, licences for water allocation have occasionally exceeded the actual availability in the river. The combination of increasing numbers of licences, increased use of allocated water by licensees, and low flow or drought years could affect many municipalities, industries and irrigators, as well as water quality and aquatic ecosystems. As the population in the basin grows, impacts such as stormwater runoff and additional demands for instream flows for assimilation of wastewater effluent will likely become greater challenges for urban areas and downstream users. The overall challenge will be to ensure adequate supplies of water for ecosystem requirements, as the demands on water for human uses continue to grow.

## 12.2 Recommendations

As discussed in Chapter 11, many positive changes and accomplishments have occurred throughout the basin since the 1994 State of the River Report was published. However, additional changes are required for the basin's water resources to be managed sustainably and effectively, now and in the future. The recommendations included in this chapter are not meant to be an exhaustive and all-inclusive list. Rather, this section focuses on a few key issues that were identified as high priorities for the BRBC during the compilation of this State of the Bow River Basin Report. While many of these recommendations suggest a leadership role by the provincial government, every person in the Bow River Basin has the opportunity to influence future watershed management. The six major recommendations are:

1. Development of the Bow River Integrated Watershed Management Plan
2. Appropriate use and sharing of technology
3. Preparation of a Water Balance Sheet
4. Continued research and monitoring
5. Public consultation and engagement
6. Pro-active contingency planning

### Integrated Watershed Management Plan

The South Saskatchewan River Basin Water Management Plan is currently being developed. As this project nears completion, the development of an Integrated Watershed Management Plan specifically for the Bow River Basin should be a priority. A source water protection strategy should be incorporated into this plan. The federal and provincial governments share jurisdiction over much of the headwaters of the basin. Communication among departments is essential to ensure that policies are integrated and comprehensive. Reaches on the Bow River should be organized based on sub-watershed boundaries and not the political, infrastructure or other boundaries of the past.

Enhanced coordination between land use policies and watershed management planning is needed. For example, enhanced water conservation and watershed management protection could be built into policies such as the Natural Resource Conservation Board guidelines, Forest Management Agreements, the Municipal Government Act, and Provincial Land Use Policies. These policies should be mandatory and enforceable.

### Use of Technology

Technologies, such as Geographic Information Systems (GIS), should be used as part of an overall strategy to apply the benefits of advanced graphic, database, programming and analytical tools to water management planning and resource assessment. There should be a greater focus on the sharing of state-of-the-art technologies, protocols, models, and digital data between agencies, including provincial and federal governments, universities, municipalities, and industry. These techniques should be applied to watershed management, land use management, and habitat and wildlife assessments throughout the basin. For example, while many of the wastewater treatment plants in the basin are state-of-the-art, further advances in technology will be required to maintain total loading limits as populations continue to grow.

### Water Balance Sheet

The generation of a complete Water Balance Sheet is essential for the future management of the Bow River's water resources. Alberta Environment currently uses a water balance model for the South Saskatchewan River Basin (the Water Resources Management Model) and a daily operation model for the Bow River. However, if the public is to be consulted in water management decisions within the basin, a more simple application and presentation of these tools is required. A full

accounting of the available water and the inputs (e.g. tributaries, precipitation, effluent and other discharges), outputs (e.g. evaporation and withdrawals) and storage within the Bow River Basin should be prepared. The account should include surface water and groundwater, as well as precipitation and glacial ice. Seasonal and annual variation of the water resource and its uses should also be incorporated.

In order for the water balance sheet to be as accurate as possible, the Government of Alberta should reinstate mandatory water use reporting for major water users. While this may not be feasible for the smaller, private licence holders, all larger private licences should submit annual water use reports. The ability to track actual consumption and return flows within the basin is essential for effective water use planning and allocation.

### Ongoing Research and Monitoring

Improved watershed management will rely on improvements in data collection and coordination. Research and monitoring should continue to focus on existing high priority areas of surface water quantity and quality. It is important to maintain, and in some cases, re-establish the water quality and streamflow monitoring stations that are, or have been, part of the federal and provincial networks. The following data gaps have been identified and should also receive attention:

- Groundwater data across the basin
- Land use data, particularly from agriculture and intensive livestock operations
- Impacts of non-point sources of pollutants on water quality across the basin
- Long-term water quality monitoring stations in Reaches 4 and 5
- Appropriate management of camping facilities and off-highway vehicles in public lands to prevent impacts on riparian areas and water quality
- Wetland inventory, including a drained wetland inventory on a scale suitable for planning
- Glyphosate should be included in water quality monitoring programs along the lower reaches of the river

There should be more frequent data collection and reporting and a greater basin-wide integration of water quality and quantity issues. Increased coordination between municipalities, federal and provincial governments, and non-government organizations are needed for more efficient data collection. Data sharing agreements should be developed in order to prevent

duplication of effort. While monitoring programs are dependent on each organization's objectives, monitoring protocols (frequency, variables, detection limits, etc.) should be standardized, where possible, to allow comparisons. For example, future calculations of the Alberta Water Quality Index for the Bow River should include the stations in the headwaters of the basin, not just the provincial stations. The collection and organization of water licensing information also requires standardization and better record keeping.

### Public Consultation and Engagement

An ongoing challenge is how best to get people involved and keep them involved in watershed management. An informed, engaged public is an essential component in the success of future watershed management planning. Well thought out, detailed and feasible water conservation programs can be developed, but in many cases they must be implemented by individual members of the public to be effective. When the public is consulted and involved in formulating these conservation programs, their interest and willingness to implement them will be that much stronger. In order to bring about positive changes, the public must be well informed of its role and capacity to influence, both negatively and positively, the state of the Bow River Basin's water resources. The many stewardship organizations, government bodies, community groups, academic institutions, and industries that operate within the Bow River Basin share a common goal of reaching the public, and their efforts should continue.

### Pro-active Contingency Planning

Contingency planning is critical to identify emerging issues and adequately deal with future changes to water supply and demands on its use. Water management planning and future water allocations and transfers should consider the impacts of global warming, drought, glacier shrinkage, and potential disasters, because it is likely available water resources will decrease.

## 12.3 How Can You Help?

### Rural Residents

Residents of farms and rural communities in the Bow River Basin need to be vigilant about their water supplies. If these water sources are not maintained properly, water quality and quantity can deteriorate, leading to health problems for their families and their livestock and crops. Unless your water supply comes from a municipally administered source, test all water

regularly and treat domestic water. Groundwater and surface water contamination can occur from leaking sewage systems, fertilizer or manure spreading, and pesticide spraying. These pose potential threats to your health and to your neighbour's health.

Other recommendations include:

- Make sure there are no cross connections between raw water and potable water supplies and install backflow prevention devices on all hydrants, pumps and faucets.
- Inspect and pump your septic system every 3 to 5 years at a minimum.
- Fix leaks quickly to prevent loss of water supplies.
- Where water supplies come from individual wells, make sure the wells are properly constructed. Seal abandoned wells and check that well caps are firmly sealed to the casings.
- Handle all agricultural chemicals, fuels and lubricants carefully to prevent contamination and follow minimum distance regulations and recommendations for separation of hazardous materials and water sources.
- Manage manure properly to avoid surface runoff and leaching of contaminants. Divert runoff from manure stockpiles into holding ponds and away from water bodies. Spread manure away from watercourses, leave a buffer strip of at least 30 metres from surface water and incorporate manure into soil within 48 hours of application.
- Fence off riparian areas and buffer zones, and provide off-site watering devices for livestock. Use alternative watering systems such as solar or nose-powered pumps to draw livestock away from waterways.
- Test your soil regularly for nutrient levels, so that you don't add excess nutrients or chemicals that will pollute surface water, groundwater, dugouts or wells.
- Control the timing and intensity of grazing to protect riparian areas.
- Reduce soil and wind erosion by planting permanent vegetative cover, shelterbelts and using reduced tillage.
- Irrigate cropland with treated industrial wastewater to conserve water. However, do not irrigate with wastewater when soil is frozen or snow covered, during intense or prolonged rainfall, and consider distances from seasonal drainage courses, surface water bodies and water wells.

More information on water sources and their protection is available through Alberta Agriculture, Food and Rural Development, Agriculture and Agri-Food Canada, Health Canada and the Alberta Environmental Farm Plan Company.

## Urban Residents

Residents of urban areas in the Bow River Basin can contribute substantially to improved water quality and ecosystem protection by decreasing their use of water and ensuring that lawn and garden chemical use is minimized. Ensure that pet wastes and leaks of gasoline, oil and other contaminants never enter the river through surface runoff. Studies show that urban residents often overuse lawn and garden chemicals and the excess goes directly into stormwater sewers. Stormwater runoff thus carries pollutants such as fecal bacteria, chemicals, lawn fertilizers, oil and sediments directly to streams and rivers, where they seriously harm water quality.

The way we design our urban landscape can play a significant role in the amount of water used and the quality of the water that is returned to waterways.

Recommendations include:

- Consider xeriscaping or low water use landscaping.
- When landscaping, limit the use of impenetrable surfaces. Use permeable paving such as wood decks, bricks, and concrete lattice.
- Gutters and down spouts should drain onto vegetated or gravel-filled seepage areas and not directly onto paved surfaces. Splash blocks help reduce erosion.
- Divert runoff from pavement to grassy, planted or wooded areas of your property, so stormwater can seep slowly into the ground.
- Encourage your local government to develop erosion and sediment control regulations or guidelines for construction sites in your community. Get involved in the planning and zoning processes to help make the decisions that shape urban development.

You can play a significant role in creating a sustainable urban landscape. More information on urban and suburban water issues and what individual residents can do to help is available online at [www.epa.gov/gmpo/pdf/NPS\\_Urban-facts\\_final.pdf](http://www.epa.gov/gmpo/pdf/NPS_Urban-facts_final.pdf).

## Get Informed and Involved

You can also help by learning more about water quality and quantity issues. A wealth of information on water and water issues is available from various organizations and on the Internet. Once you know about the issues, take action by contributing your time, expertise or money to one of many stewardship groups interested in the Bow River Basin.

## 12.4 Closing Statement

This State of the Bow River Basin Report has brought together information from a wide range of sources in order to provide a comprehensive, yet clear picture of the state of the basin and links to human activities. Additional effort and focus are required to ensure protection of the resources of the Bow River Basin. Resolution of watershed management issues is critical, as is the determination of the availability of flows for future allocations. Of great importance is the need to use water more efficiently. Communication and collaboration among those involved in watershed management are essential to ensure the responsible use and conservation of water resources in the basin.

State of the basin reporting is a link in bridging policy changes, new scientific information and public education. It is the aim of the BRBC to continue this reporting every five years, so changes to the basin can be identified and acted on more effectively. It is hoped these conclusions and recommendations provide focus and impetus to move forward. The BRBC looks forward to highlighting the gains made in basin-wide watershed management for the next State of the Bow River Basin Report.

