A TOOLKIT FOR PROTECTING SOURCE WATER QUALITY IN THE RED DEER RIVER WATERSHED

Red Deer River Municipal Users Group

November 2017

FOREWORD

In November 2003 the Government of Alberta released *Water for Life: Alberta's Strategy for Sustainability.* The government continues to implement this strategy today, with the same three key goals:

- Safe, secure drinking water supply
- Healthy aquatic ecosystems
- Reliable, quality water supplies for a sustainable economy.

One of the key directions of the strategy involves partnerships and collaboration whereby stakeholders (e.g. citizens, individual and sector water users, interest groups) are to actively participate in watershed management at various scales – watershed wide, sub-watersheds, municipal and local sites. As a water use sector, municipalities within the Red Deer River watershed are a significant water user.

Both the Alberta Urban Municipalities Association (AUMA) and the Alberta Association of Municipal Districts and Counties (AAMDC) recognize municipalities have key roles in water management and the protection water quality through responsible land use planning, environmental conservation and managing municipal water systems (water, wastewater and stormwater).

With the three goals of the provincial water strategy in mind, the Red Deer River Municipal Users Group formed in 2006. The initial purposes identified by the founding members of the Red Deer River Municipal Users Group were: (1) to provide a forum for municipalities to discuss water supply, water use and water quality, and (2) to serve as an advocate of municipal interests in the supply, use, delivery and quality of water. Through the years, these purposes have evolved into proactive elements as the members of the Red Deer River Municipal Users Group recognized leadership roles in certain water and related land use matters.

Through this *Toolkit for Protecting Source Water Quality in the Red Deer River Watershed*, the Red Deer River Municipal User Group is addressing source water protection as a matter of vital concern to the future well-being and sustainability of municipalities, and other water users. This is applicable to all municipalities within the watershed and to those communities outside the watershed that receive water from the Red Deer River through regional potable water systems.

The Toolkit report addresses 21 threats, both continuous and periodic, to source water and source water quality. The impacts of these threats trigger stress to aquatic and human communities and activities. To assist in addressing the threats, the Toolkit provides 39 'tools'. A number of threats have one related action tool, while others have a number of associated tools. Each threat does not necessarily apply to all communities and may be more serious for some and not so serious for others. Some threats are more urban or rural oriented, while others have broader regional or multi-municipal connections and implications.

A key purpose of the report is to stimulate every municipality to act, in one or more ways, and to continue to do so individually and collectively, to protect source water and its quality. The Red Deer River Municipal Users Group will encourage every municipality to consider threats to their source water, and to resolve to take action, sometimes alone and sometimes in collaboration with other communities, in order to reduce impacts on source water. Such action needs to be sustained if it is to be truly effective over time to protect source water quality.

A TOOLKIT FOR PROTECTING SOURCE WATER QUALITY IN THE RED DEER RIVER WATERSHED

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Page

FOREWORD

TABLE OF CONTENTS

Page

List of Maps

List of Figures

List of Tables

1. REPORT BACKGROUND AND INTENTIONS

1.1 Red Deer River Municipal Users Group (RDRMUG)

Around the time of the Province's adoption of the South Saskatchewan Water Management Plan in August 2006, municipalities from throughout the Red Deer River watershed began to meet regarding the long term availability of water to municipalities. Two factors prompted these meetings: (1) there would continue to be growing and competing demands for water, and (2) the South Saskatchewan Water Management Plan set limits to the amount of water that could be allocated from the Red Deer River (this limit being much lower than that for the Bow and Oldman River systems). Municipalities decided to form an association, which became official in May 2008 when the Bylaws of the Red Deer River Municipal Users Group were approved by the Provincial Corporate Registry.

The purposes of Red Deer River Municipal User Group are to:

(a) Provide a forum for municipalities to discuss water supply, water use and water quality, and
(b) Serve as an advocate of municipal interests in the supply, use, delivery and quality of water.

In doing so, the goals of the RDRMUG are the same as the Province's as expressed in the *Water for Life Strategy*:

1. Safe, secure drinking water
2. Reliable, quality water supplies for a sustainable economy, and
3. Healthy aquatic ecosystems.

Currently, the Red Deer Municipal Users Group (RDRMUG) has 35 members (see Appendix A). Member municipalities must be located within the Red Deer River basin or rely on the Red Deer River for their water supply. There are 81 municipalities wholly or partially located in the Red Deer River Watershed and/or receive water from the Red Deer River. Of these, 16 are rural municipalities and 65 are urban municipalities (3 cities, 20 towns, 32 villages, 10 summer villages).

1.2 Interest in Source Water Protection

Recently, the Alberta Water Council expressed the importance of source water protection and the need for integrated action to protect source waters, or in more general terms - to protect water quality. There are three reasons why municipalities need to be concerned about the quality of source waters, and thus the need to act to protect source water quality.

(1) As demands, both within and outside the Red Deer River Basin, for water from the Red Deer River increases and the amount of water available for future allocation to municipalities in turn decreases, there is a growing need for municipalities to be jointly vigilant on the quality and quantity of water in the Red Deer River, as well as the use of water.

(2) The cost to supply and maintain potable water to residents and businesses continues to greatly increase. Not only do municipal water systems require the injection of funds to maintain and upgrade the delivery system, but more and more regional cooperation in the supply of safe, potable water offers effective alternatives to the many water supply and quality issues that municipalities face, not only today but also in the future.

(3) Sustainable communities (environmentally, socially and economically) are dependent on the availability and provision of safe, secure potable water. It is becoming increasingly necessary to monitor water quality and to address activities that affect water quality, including point source and non-point source pollution, in order to maintain and, wherever possible, enhance the water quality in the Red Deer River and its tributaries.

As outlined in Section 5 of this report, municipalities have important roles in protecting source water and its quality.

1.3 Toolkit Report Purposes

The purposes of the Toolkit for Protecting Source Water Quality in the Red Deer River Watershed are:

1. to broaden and improve an understanding of the importance of the quality of source water
2. to clarify the values of a watershed (regional) approach
3. to identify many of the threats to the quality of source water within the watershed
4. to outline municipal roles in source water and source water quality protection
5. to introduce tools municipalities may use to protect source water quality
6. to emphasize municipalities throughout the watershed have already acted in many ways to protect the quality of source water
7. to encourage more action by municipalities to protect source water quality
8. to provide recommendations for consideration by the Red Deer River Municipal Users Group regarding follow-up actions.

2. THE RED DEER RIVER WATERSHED

2.1 Watersheds

A watershed is an area of land that feeds all groundwater and surface water flowing into a body of water. It combines with other watersheds to form a network of rivers and streams that progressively drain into larger areas (see Figure 1). Crests of mountains, hills and undulating prairies determine the boundary of a watershed.

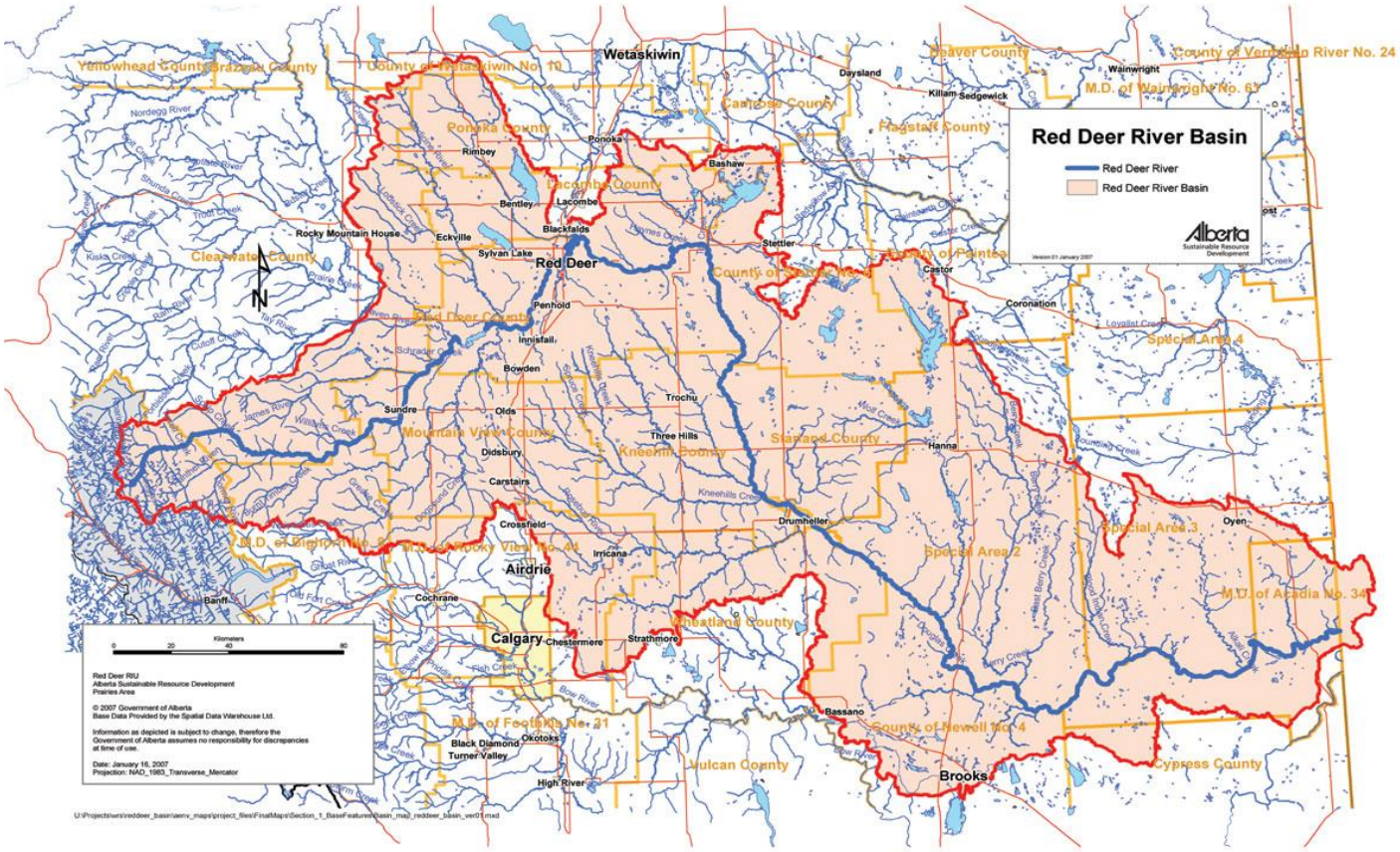
Figure 1

2.2 The Red Deer River Watershed

The Red Deer River watershed is shown on Map 1. It encompasses 49,650 km² (19,170 sq. miles), traversing central Alberta from within Banff National Park to just east of the Saskatchewan border, where it meets the South Saskatchewan River.

The river travels 724 km (452 miles) and descends 1,358 m (4,455 ft) in its journey from the Drummond Glacier in Banff National Park to its confluence with the South Saskatchewan River in Saskatchewan. In doing so it traverses through a sequence of landscapes - mountains, foothills, prairie parkland and dry grass prairie, including the internationally recognized Alberta badlands.

Map 1 Red Deer River Watershed



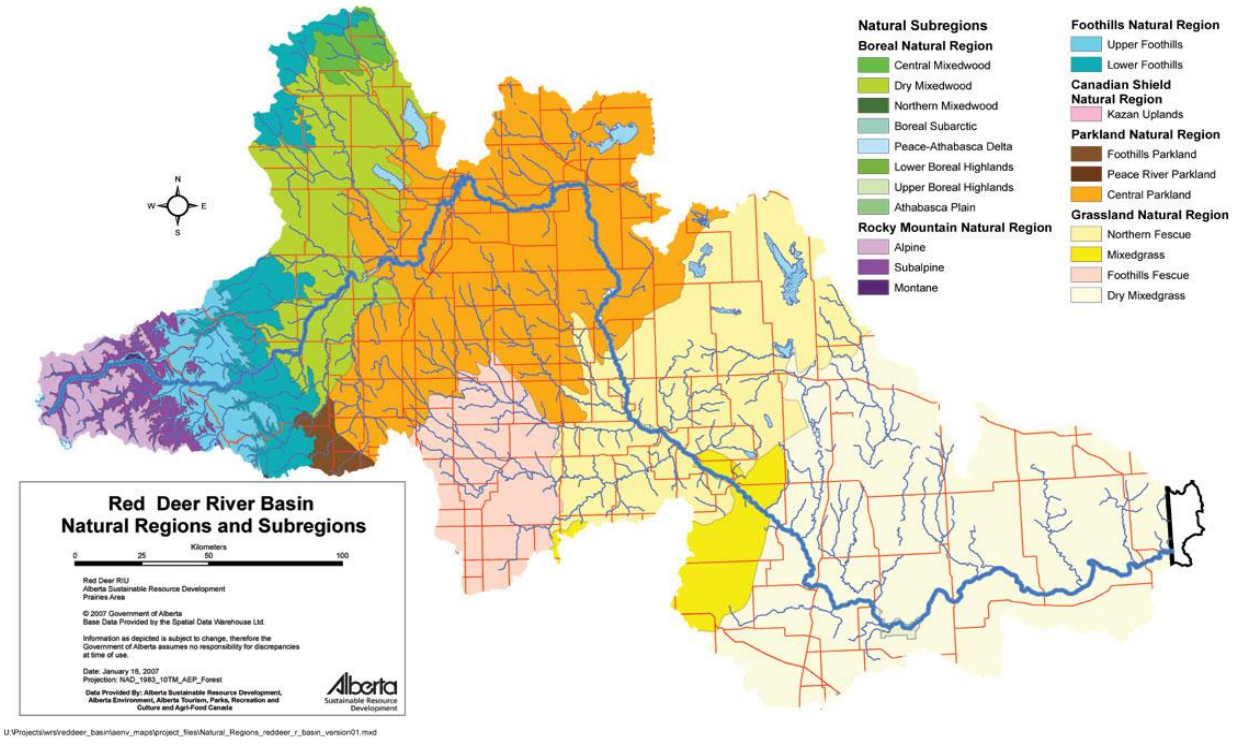
Within the Red Deer River watershed there are 5 natural regions, being the Rocky Mountains, Foothills, Boreal Forest, Parkland and Grasslands (see Map 3). The Alberta government adopted the Natural Regions classification to identify representative ecosystem and biodiversity elements of importance to protected areas. The classification system emphasizes overall landscape patterns, which largely reflect climate, yet may be influenced by geological and soil factors.

Within the five major natural regions, there are 12 sub-regions, being:

- Rocky Mountain Natural Region, with two sub-regions:
  Alpine and Sub-alpine;
- Foothills Natural Region, with two sub-regions:
  Upper Foothills and Lower Foothills;
- Boreal Forest Natural Region, with two sub-regions:
  Dry Mixedwood and Central Mixedwood;
- Parkland Natural Region, with two sub-regions:
  Central Parkland and Foothills Parkland;
- Grassland Natural Region, with four sub-regions:
  Northern Fescue, Foothills Fescue, Dry Mixedgrass and Mixedgrass.

Map 2 shows the natural sub-regions within the Red Deer River watershed. Each of these sub-regions contributes differently to the flow of the Red Deer River and its quality. A description of the natural sub-regions can be found in the Red Deer Watershed Alliance 2009 report titled Red Deer River Watershed.

Map 2 Natural Regions

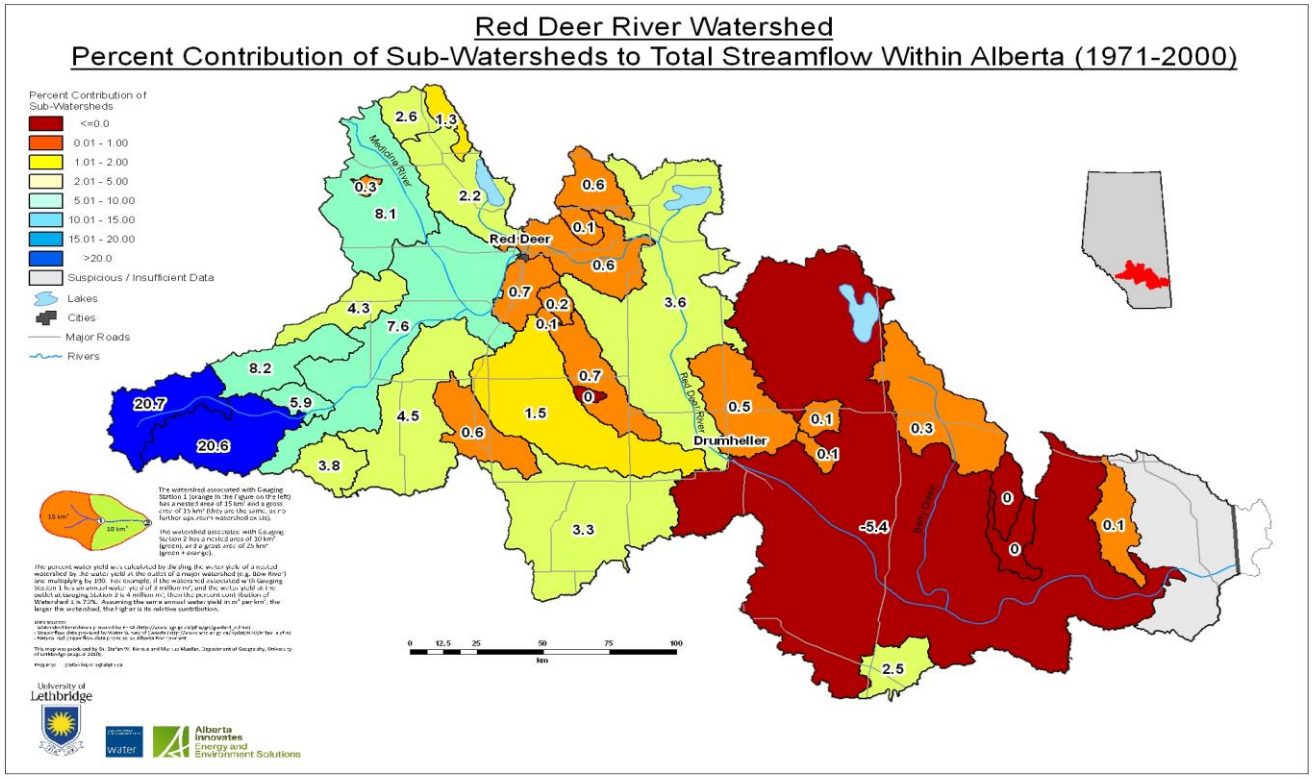


2.3 Sources of Water in the Red Deer River Watershed

Various areas of the Red Deer River watershed contribute significant differences to the flow of the Red Deer River. Map 3 shows the great range of contributions to the river by sub-watersheds.

As shown on Map 3, two western alpine and sub-alpine areas form the headwaters of the Red Deer River and a number of its upstream tributaries. This very small but mountainous area contributes 41.3% of the annual flow of the Red Deer River. The many foothill and boreal forest sub-watersheds tributaries also contribute substantially to the flow of the Red Deer River such that at the Blindman River confluence, just downstream from the City of Red Deer, the aggregate contribution of the 'upstream' sub-watersheds to the flow of the Red Deer River is about 90%. Thus, the tributary streams in the drier eastern half of the watershed contributes less than 10% to the total flow of the Red Deer River.

Map 3 Sub-Watershed Contributions to Total Red Deer River Stream Flow



3. SOURCE WATER PROTECTION

3.1 What is Source Water?

Source water is any untreated water found in rivers, streams, reservoirs, lakes and aquifers used for the supply of raw water for drinking water systems and for use by industries, irrigators and other water users.

Note: for this report the terms 'source water' and 'water' are often used interchangeably. The word 'water' includes 'source water' such that 'water quality' entails 'source water quality' and 'water supply' includes 'source water supply'.

3.2 The Importance of Protecting Source Water and Its Quality

Alberta's *Water for Life Strategy* states: "In Alberta, our quality of life, and life itself, depends on having a healthy and sustainable water supply for the environment, for our communities and for our economic well being."

The Alberta Urban Municipalities Association (AUMA) recognizes the vital importance of water, both quality and quantity to municipalities, in its *Municipal Water Primer and Discussion Paper.* It emphasizes:

> "No water, no municipality. Water is the lifeblood of municipalities. It is essential to all five elements of municipal sustainability:
>
> - Economic viability depends on the availability of water for local residential, commercial and industrial development as well as for large-scale energy projects that fuel the province's economy.
> - Environmental integrity is dependent on healthy aquatic ecosystems. Aquatic environments provide a source of potable water, a buffer against extreme weather events, and a home for diverse species.
> - Social well being relies on having a safe, secure supply of water for drinking and other basic needs.
> - Cultural vibrancy is enhanced by the beauty of healthy aquatic ecosystems and the recreational opportunities they provide.
> - Governance is defined and legitimized in part by the ability of municipalities to provide water services to residents safely and efficiently."

These five key elements are significant to all municipalities – both rural and urban.

3.3 Why a Watershed Approach To Source Water Protection

As observed in Section 1.1, there are 81 municipalities wholly or partially located in the Red Deer River watershed and/or have the Red Deer River as their source for municipal water of which there are 50. Other major water users of Red Deer River water are industry and agriculture. These major water users rely on water, and its quality, mostly sourced in the upstream portions of the watershed distant from their locations.

During its journey eastward to Saskatchewan, the Red Deer River is the recipient of increasingly more of the effects of land use practices and return water that affects the quality of water in the river. Generally stated, the City of Red Deer's source water is estimated to come from about 30% of the area of the watershed. For the Town of Drumheller the source area is estimated to be about 60 percent of the watershed while for an irrigator near the Saskatchewan border it is 100%. Source water quality at Red Deer is affected by land use practices, water use and resource management upstream from the City. While these also are

relevant to downstream source water quality, downstream water users have their source water quality affected by such things as urban stormwater and sanitary wastewater returns, industrial return flows, additional farm run-off, etc.

The Red Deer River is the source water for a considerable portion of the population and non-farm economic activity in the basin (the other source s groundwater). A watershed approach for source water protection, and thus source water quality protection, in the Red Deer River watershed makes common sense. The health of the Red Deer River is the report card of the collective impact of land and water users within the watershed. As such, source water protection is a primary reason for integrated watershed management throughout the Red Deer River basin. Protecting source water and improving human practices that impact water quality will yield report cards worthy of merit.

3.4 Source Water Protection: a Component of Drinking Water Safety Plans

Ensuring drinking water quality is about much more than water from the treatment plant to the tap. It has to do with protecting source waters – the water that reaches the treatment plant. Source water protection planning can be both a site-specific and area wide process. Designed to maintain or improve the conditions of water sources through proactive actions, a multi-barrier approach is most common (see Figure 2).

In the Draft Guide to Source Water Protection Planning in the South Saskatchewan Region (Alberta), Alberta Environment and Parks writes: "Source water protection plans vary widely in their details, but their foundational elements are relatively consistent. Source water protection plans are commonly focused on ensuring safe, secure drinking water supplies . . . . Although the protection of drinking water quality is the main focus . . . it is important to consider both the quality and quantity of water needed for consumption and a variety of other human uses, as well as for maintaining ecosystem health. Headwaters protection is an important consideration in this process."

The multi-barrier approach to drinking water safety is an integrated system of procedures, processes and tools that collectively prevent or significantly reduce the contamination of drinking water from source to tap in order to reduce risks to public health. Figure 2 shows the five sequential and related aspects to ensure safe drinking water. The five components are: protect the water source; treat the water; maintain the potable water delivery system; monitor water quality and quantity; and implement management and emergency response plans.

Being the subject of this report, it is emphasized that source water protection is the first step in the multi-barrier approach to ensuring safe, secure drinking water.

Figure 2 Multi-barrier Approach to Drinking Water Safety

Source water protection planning has much to offer to protect the quality of water in rivers, lakes, wetlands and aquifers. The legislative framework for source water protection is shown in Table 1. It involves provincial, regional (including multi-municipal) and municipal levels of interest. It does not show that a considerable portion of the 'action' is at the local (sub-municipal) level.

Table 1 Source Water Protection Framework

Scale	Mechanism	Policy
Provincial	Acts and regulations (e.g. Water Act, EPEA, ALSA)	Policies and strategies (e.g. Water For Life)
Regional	Regional Plans and frameworks	Guidelines and standards
Watershed	Water Management Plans	Watershed management plans
Multi-Municipal	Intermunicipal Development Plans	Source water protection plans Drinking water safety plans
Municipal	Municipal Development Plans Intermunicipal Development Plans Collaborative Frameworks	

Source: adapted from Alberta Environment and Parks. 2015. DRAFT Guide to Source Water Protection Planning in the South Saskatchewan Region.

3.5 Source Water Protection Planning Process

The source water protection planning process has five essential components, being:

- Engage communities through partnerships and a common vision
- Delineate the source water area boundaries
- Identify threats
- Develop an action plan, and undertake action(s)
- Evaluate the results of the actions and adapt the plan.

This Toolkit report addresses the third and fourth components. It identifies 21 threats to source water and its quality and provides 39 'tools' to address these threats.

4. THREATS TO RED DEER RIVER WATERSHED SOURCE WATER QUALITY

4.1 What is a Threat?

There are many academic and government reports and papers regarding source water protection planning. Pertaining to water quality problems, many different terms are used to broadly describe what are problems. These terms include: hazard, risk, issue, concern and threat, among others. The *Guide to Source Water Protection Planning in the South Saskatchewan Region (Alberta)* defines two of the terms, as follows:

> Hazards are anything that can impact or harm a water source
> Risks are the probability of something happening, measured in terms of the likelihood and impact.

This Toolkit Report views hazards to be influences on water quality that, if they take place, are more on the extreme side of impacts that occur occasionally, as opposed to consistently. As well, if a hazard is anything that can impact a water source, then farming is hazardous, as are forestry, all industrial plants, patterns of human settlement and even sport fishing.

This report chose to use the term 'threat', which of course includes what may be deemed as hazards. As such, the definition of a threat for the purposes of this report is:

Threat: anything that can negatively impact source water (quantity or quality).

The measurement of the risk of a threat is applicable. It concerns the likelihood of a threat and the severity of its impact. This is relevant to establishing a priority action plan to address those threats which are deemed to be of the highest risk.

4.2 Identified Threats in the Red Deer River Watershed

The Red Deer River Municipal Users Group (MUG) recognizes it is important to conserve the health of the Red Deer River watershed, since the health of the watershed impacts the quality of source water entering municipal (communal) water systems and private (individual) water wells in both rural and urban areas.

MUG member municipalities have identified a series of threats to source water quality in the Red Deer River watershed. These were identified based upon the members' experiences through living in the watershed, dialogue with others throughout the watershed and province, previous issues considered by the MUG, their working relationship with the Red Deer River Watershed Alliance (including study of the Alliance's *Blueprint* report) and research on source water quality influences. It is important to note that the threats identified herein are based on personal perspectives, and while useful for guiding future source water protection directions, they should not be taken as a definitive or science-based ranking of threats.

Thirty-four (34) threats were identified, these being:

1. Climate change
2. Drought
3. Flood
4. Wildfire
5. Loss of natural cover
6. Development on sensitive lands
7. Wetland drainage/alteration
8. Impact on recharge areas
9. Riparian area loss
10. Erosion
11. Silt/Sedimentation (river and lake)
12. Urban development
13. Rural non-farm development
14. Impervious surfaces
15. Flood plain development
16. Wastewater and stormwater returns
17. Waste (solids) disposal
18. Farm run-off (manure, etc)
19. Irrigation return flow
20. Forestry operations (Green Area)
21. Sand and gravel operations
22. Non-energy industrial development
23. Oil and gas operations
24. Pipeline breaks/spills
25. Fuel handling and storage
26. Off-road vehicle activity
27. Heavy metals
28. Pesticides (urban applications)
29. Pharmaceutical discards
30. Road salt
31. Watercourse crossings
32. Linear infrastructure (roads, pipelines)
33. Snow storage
34. Groundwater contamination

In May 2017, the members of RDRMUG were requested to rate the significance of each threat relative to their perceived negative impacts on the quality of source water. The responses to each threat were simply rated on a scale of high, medium and low. Admittedly, what is reported herein is a snapshot assessment of threats. However, it provides basic direction on where municipalities may wish to focus follow-up research to identify tools to address threats to source water quality.

4.3. Top Threats Identified by the Red Deer River Municipal Users Group

Table 2 presents the top rated threats identified by all municipalities (rural and urban combined), and the top rated threats by urban municipalities and by rural municipalities. As rated by all municipalities, the top ten threats are: development on sensitive lands; drought; groundwater contamination; wildfire; wetland loss and alteration; riparian area loss; wastewater/stormwater returns; pipeline breaks/spills; urban development; and farm run-off.

Because of their different perspectives, the rural and urban representatives had differing 'top tens'. While a number of threats were common to combined urban and rural top ten list, some different threats formed the 'top ten' of the rural and urban lists. The other threats in the top ten rural representatives list were: silting and sedimentation; erosion; rural non-farm development; watercourse crossings and linear infrastructure. The different threats in the urban representatives top ten list included: solid waste disposal; fuel handling and storage and pesticides. Thus, of the 34 threats, eighteen were included in the three top ten lists. Interestingly, only two – groundwater contamination and riparian area loss – were on all three lists. Seven were on two lists: development on sensitive lands; drought; wildfire; wetland loss and alteration; wastewater/stormwater returns; urban development; and farm run-off.

The ten threats which received the lowest ranking regarding perceived threats to source water quality were: forestry operations; irrigation return flows; off-road vehicle activity; non-energy industrial development; sand and gravel operations; impervious surfaces; snow storage; heavy metals; flood plain development; and oil and gas operations.

TABLE 2 TOP THREATS BY SCORE ACROSS THE ENTIRE WATERSHED

Rank	ALL URBAN AND RURAL (19)		ALL RURAL (8)		ALL URBAN (11)	
1	Development on sensitive lands	65	Wildfire	33	Development on sensitive lands	41
2	Drought	65	Drought	32	Urban development	41
3	Groundwater contamination	63	Silting and sedimentation	30	Wastewater/stormwater returns	41
4	Wildfire	62	Erosion	28	Wetland loss/alteration	37
5	Wetland loss/alteration	61	Riparian area loss	26	Solid waste disposal	37
6	Riparian area loss	61	Rural non-farm development	26	Pipeline breaks/spills	37
7	Wastewater/ stormwater returns	59	Farm run-off	26	Groundwater contamination	35
8	Pipeline breaks/spills	59	Watercourse crossings	26	Riparian area loss	35
9	Urban development	57	Linear infrastructure	26	Fuel handling and storage	35
10	Farm run-off	57	Groundwater contamination	26	Pesticides (urban)	35

While not shown on Table 2, when comparing the top ten threats of all 'downstream' municipalities (generally in the eastern portion of the watershed) with the top ten threats of all 'upstream' municipalities (those in the western portion of the watershed), only four threats were

common to both: development on sensitive lands; farm run-off; wetland loss/alteration; and riparian area loss.

A number of threats received the most number of 'high' significance ratings, these being: 9 high ratings – drought; 8 high ratings – groundwater contamination; 7 high ratings – pipeline breaks/spills; 6 high ratings – wetland loss/alteration and urban development; and 5 high ratings – loss of natural cover, development on sensitive lands, riparian area loss, farm run-off and pesticides.

Municipal representatives on RDRMUG requested many of these issues be addressed in the toolkit, some in combination with others. The toolkit attends to the following 21 threats:

1. development on sensitive lands/loss of natural cover
2. drought
3. groundwater contamination
4. impact on recharge areas
5. wildfire
6. wetland loss and alteration
7. riparian area loss
8. wastewater returns
9. stormwater returns
10. urban and rural development
11. farm drainage and run-off
12. road salt
13. snow storage
14. climate change
15. floods
16. floodplain development
17. sand and gravel operations
18. off-road vehicle activity
19. loss of woodlands
20. solid waste disposal
21. irrigation return flow.

5. MUNICIPAL ROLES IN PROTECTING SOURCE WATER QUALITY

5.1 Introduction to Municipal Involvement

Because water is vital to municipal well being, both the rural and urban municipal associations in Alberta address municipal roles in water management.

The Alberta Association of Municipal Districts and Counties (AAMDC) points out the roles of municipalities in water management and protecting water quality. In its Position Statement on Water, the AAMDC notes:

- "Municipalities are responsible for land-use planning and environmental decisions where water bodies or wetlands are factors.
- Municipalities play a role in managing water systems that impact residents, business and industry.
- Municipalities should have equitable opportunity to economic development benefits without being impeded by water access issues.
- Water is a limited resource in high demand by multiple stakeholders including municipalities, industry and the environmental sector. Good communication and coordination is essential to enhancing effective water management practices.
- Effective service delivery requires strong working relationships with the provincial government (e.g. Alberta Water Council), neighbouring municipalities, regional commissions, regulatory bodies and related service providers
- Effective collaboration requires specific roles. Decision makers must acknowledge and work with municipalities in their role as a primary authority regarding local water management. Similarly, municipalities must keep current and comply with the regulatory framework.
- To promote sound environmental stewardship, it is necessary to have coordinated legislation and jurisdiction surrounding the protection of water bodies and the environmentally sensitive areas adjacent to them."

The Alberta Urban Municipalities Association (AUMA) emphasizes: "One of the most important ways that we can effectively manage our water is to change the way we manage our land. Land use has many impacts on our watersheds, from encroachment of development on riparian areas and wetlands, to creation of impervious surfaces that cause stormwater issues, to environmentally damaging uses that leach contaminants into our groundwater. It is vitally important to combine land use management with watershed management to ensure that both our land and water are protected."

5.2 Key Roles

Municipalities have key roles to play in protecting source water quality. These key roles are:

1. wetland, riparian land and aquatic habitat protection
2. point source and non-point source pollution management
3. land use planning
4. management of land use impacts,
5. drinking water, wastewater and stormwater management, and
6. the promotion of land and water stewardship.

Each of these roles is addressed in a number of ways (some more than others) in Section 6 of this report.

5.3 Working Together Is Important

While municipalities can achieve much in acting individually, when acting through regional or sub-watershed cooperation, most of these roles will be much more effective in protecting source water quality. As such, municipalities – especially when working in concert with each other and other partners – can do much to protect source water quality within a watershed through the land use planning roles and tools provided in the Municipal Government Act (e.g. municipal land use plans, growth strategies and subdivision and development authority) and other acts and regulations. These include: *Environmental Protection and Enhancement Act*, Potable Water Regulation, *Water Act*, *Public Health Act*, Nuisance and General Sanitation Regulation, *Alberta Land Stewardship Act*, Private Sewage Disposal Systems Regulation, *Public Lands Act* and Alberta Wetland Policy.

6. ACTIONS TOOLKIT

6.1 Significance of the Threats Addressed in the Toolkit

Climate Change

While debate continues about climate change if human activities, especially economic development, are increasing the rate of climate change, it is evident that the Alberta climate is changing, and very likely will continue to do so. In the past few years Alberta's costliest natural disasters have taken place – floods, wildfires and windstorms, and potentially will be more frequent. Rising temperatures, precipitation increases (including major storms) and fluctuations in precipitation patterns are predicted to continue. Each has significance for source water quality and settlement patterns, whether through river flooding, rising lake levels, stormwater flooding, increased erosion, water turbidity and decreased biodiversity. Any or all of these affect the economy, infrastructure, operation, livability and sustainability of a municipality and region, including the availability of source water and its quality. Municipal governments have the responsibility of ensuring the safety, health and welfare of their communities both now and in the future. Preparing for climate change is a matter of risk management and good governance.

Drought

Too often Albertans, including those in the Red Deer River watershed, feel there is an abundance of water, not only now but far into the future. Frequent flooding since 2005 has served to bolster this view. Nonetheless, drought in southern Alberta is a cyclical reality, often with long lasting negative impacts. Two examples of drought periods are: (1) during the time of the Palliser Expedition (1857–1860) Alberta was in the midst of a drought such that Palliser reported the area was unsuitable for development, and (2) the drought of the 'dirty thirties', which is especially memorable. Shorter term 'droughts' also occur. 1984 was the driest year since 1916 and in 2009-2010 because of low water flows communities in central Alberta declared states of emergency. Impacts most often in the past have been mostly on agriculture, such that Alberta has an Agricultural Drought Risk Management Plan. While any future drought will be highly impactive on agricultural production, it can also affect water availability to communities, businesses, recreation facilities and many other water users by limiting, and even in cases, eliminating water supplies.

Flooding

The devastating floods of 2013 are reminder of the impact of rivers when flowing at a 1 in 200 year and greater flood level. Over 30 urban and rural municipalities were impacted across a broad swath of Alberta from Red Deer south in three major sub-watersheds – the Red Deer, Bow and Oldman. Okotoks, High River, Calgary, Canmore and the Siksika Nation were among the hardest hit, but impacts were extensive along those three rivers and their tributaries. More than 125,000 people needed to be evacuated, over 14,000 homes and 1,600 small businesses were impacted. Over 985 km of roads were affected, including up to 300 bridges and culverts which required to be inspected. Among many other impacts, floods result in greatly reduced water quality due to erosion and overland drainage which significantly raise sediment loads in the rivers, thus negatively affecting the physical, chemical and biological qualities of river water. These greatly challenge the abilities of communities to provide potable water during times of floods.

Wildfire

As evidenced by wildfires the Town of Slave Lake and Fort McMurray, and most recently in communities in Central British Columbia, wildfires can have multiple, devastating effects on communities. While wildfires most often are associated with urban communities within or adjacent to forested landscapes, they can occur in prairie communities as well. These have been less common over the last century. However, with the changing climate and the presence of urban communities, country residential subdivisions and recreation resorts in wooded environs, the risk of woodland wildfire continues to grow. Prairie (grassland) wildfires are also a concern as recently evidenced in the Bindloss area of the lower Red Deer River watershed. Wildfires can significantly disrupt family lives, economies and communities by damaging, or worse yet decimating, homes, businesses and strategic infrastructure, as well as leave long impacts on the social, economic and environmental fabric of affected communities (e.g. Slave Lake and Fort McMurray). As found out in the Fort McMurray area, fire retardant sprays and sediments from exposed soils and ash impact water quality.

Impact on Recharge Areas and Aquifers

Recharge areas are important in sustaining a healthy watershed and replenishing aquifers that serve as groundwater sources for some urban municipalities and countless private wells for farms and rural residences. In Central Alberta, development and growth (mostly urban growth that relied on groundwater as a water source) led to groundwater shortages when withdrawals exceeded the capacity of the aquifer to replenish itself. As population and business development continued, the groundwater capacity was unable to safely meet current demands and certainly not the demand from future growth. This has led to the provision of lengthy regional potable water distribution systems through much of the Red Deer River watershed. Groundwater contamination is another potential impact of land use development and resource activity. The remediation of contaminated groundwater is exceedingly expensive. Contamination events can lead to the shut down of wells, and the expense of their replacements, as well as costs to clean up contaminated land.

Groundwater Contamination

Within the Red Deer River Watershed there are a number of urban communities and rural hamlets that have groundwater as their water source. The security of groundwater quantity and quality is of vital importance to the sustainability of these settlements. When groundwater is compromised, these communities (including residences, businesses and

farms, municipal facilities, schools and hospitals) are significantly impacted. The most notable example in Canada is that of Walkerton where groundwater was contaminated, leading to some deaths, many ill people, judicial examinations of the causes and costly undertakings to restore a healthy water supply and public confidence in provincial oversight of the management of municipal water systems.

Development on Sensitive Lands and Natural Areas

Past, present and future population and economic growth in Alberta has, does and will impact the province's natural biodiversity. As people find places to live, grow crops, harvest forests, develop energy resources, recreate and the many other activities of the modern world, the impact on the natural systems, including habitat, continues to broaden, and often intensify. Properly functioning natural systems create the air we breathe, break down our wastes, provide our food, purify our drinking water and ultimately supply all the materials we require for living. Habitat loss, through destruction, degradation and fragmentation, is a major threat to source water and its quality. Effects often are greatest where major natural areas and sensitive habitats are impacted by land development, whether it be to water, soils, vegetation, wildlife, waterfowl, birds, ecosystem sustainability, micro-climates, aesthetics and many other aspects of these features. Without limiting what are sensitive lands, these include floodplains, recharge areas, wetlands, riparian lands, woodlands, natural areas and hazard lands.

Wetland Loss and Degradation

Wetlands include bogs, fens, swamps, marshes and shallow open water. Throughout Alberta's settlement history, wetlands have been subject to loss and degradation by a myriad of human activities, including urban expansion, farming, forestry, oil and gas development, mining and recreation. Wetlands provide numerous benefits through the many roles they perform. Most germane to this report are their roles related to water quantity and quality. Wetlands store and slowly release surficial runoff, thus providing for flood mitigation. They act as natural filtration systems, cleansing surface water prior to entering streams and groundwater systems. They also function, in many places, as groundwater recharge features. The loss and degradation of wetlands has increased the magnitude of floods in Alberta and decreased the quality of water entering into and flowing within major streams and rivers, while reducing natural biodiversity and habitat for plants, birds, mammals and fish.

Riparian Land Loss and Degradation

Riparian lands are the interface, or transition, between upland and aquatic ecosystems, wherein water and land interact. Riparian areas have a number of important functions related to source water and its quality. Riparian lands help to stabilize the banks and shorelines of rivers and lakes, serve to maintain water quality by acting as interceptors of solids and contaminants and serve to manage flood waters. To function effectively, riparian lands need to be healthy since healthy riparian lands are more resilient to natural forces, such as floods, and can assist in recharging shallow aquifers and help maintain groundwater quality. The removal or degradation of riparian vegetation frequently leads to slope instability, erosion and sedimentation, shoreland alteration and surface and groundwater pollution, as well as the loss of habitat. All of these have negative effects on source water and its quality.

Wastewater Return

With the growth of the economy and population of Alberta there will continue to be an increase of municipal wastewater effluent that is returned to streams and rivers. Wastewater returns are one of the major threats to water quality. While Canadian standards for the management and treatment of effluent are high, both human use of aquatic resources and ecosystem health may still be affected by the discharge of treated wastewater. Impacts can lead to added costs to agricultural, industrial and municipal users for treatment of unacceptable water; restrictions on fish consumption; restrictions on drinking water consumption; restrictions on recreational water uses; nutrient enrichment leading to eutrophication or undesirable algal growth; degradation of aesthetics; depletion of dissolved oxygen and thermal enhancement leading to the degradation/loss of fish and wildlife habitat and reduced aquatic and wildlife populations. The Red Deer River, and especially its tributaries that receive treated wastewater, are not large volume waterways which are subject to seasonal flow variations and temperatures which affects their assimilative capacity.

Stormwater Return

By flowing over surfaces, stormwater collects pollutants, including sediments, nutrients, pathogens and toxins and transports them to receiving waterways (rivers and streams) and water bodies (ponds, lakes and wetlands). Where natural vegetation and soil structure once allowed the gradual absorption and slow through-put of rain and snowmelt, paved streets and buildings speed delivery of both water and pollutants to our waterways. With the expansion of developed areas and larger major storms, increased stormwater leads to more erosion, pollutant loading, degradation of receiving water and adverse impacts to aquatic habitat. While run-off from each source may seem insignificant, the pollutants aggregate in storm drain systems thus impacting the quality of receiving waters. Contaminants accumulated during dry periods are picked up by the next rainfall and quickly moved to the drainage system. This is when discharges can be most dangerous, because "first flush" concentrations of toxins are high. The concentration of development in urban centres is a major source of undesirable stormwater, stormwater also comes from greenfield developments and highways and rural roads. Although the environment has some inherent natural ability to mitigate and adapt to the impacts of pollution, stormwater runoff management is required (Note: agricultural farm runoff is addressed elsewhere).

Solid Waste disposal

The disposal of solid waste is one of the outcomes of the population growth and settlement. Landfills are often expansive and always costly (site purchase and planning/engineering, construction, operation and reclamation), while also eliminating potential economic generating land use options for the site. Even after the closure of a landfill, there is a minimum 25 year care period. Solid waste may discharge pollutants to land (e.g. air borne garbage), water (e.g. leachate generation, surface water runoff) and air (smell, the discharge of greenhouse gases which contribute to the cycle of climate change). Landfills also can be aesthetically challenging.

Urban and rural non-farm development

Urban and rural non-farm growth and development have significant impacts on the resources within the Red Deer River watershed, including water. Impacts on water resources

stem from the variety of human activities in increasingly dense and expanding communities, including for example their growing interconnectedness by means of roads, utility systems, live/work place relationships and reliance on the Red Deer River for source water. Urban impacts are more concentrated, but rural communities have trends toward more focused development areas, both residential and business oriented.

Floodplain Development

Floodplains, especially gravel-bed floodplains, have a high diversity of habitats which are significant for nutrient cycling, vegetation productivity and source water. Floodplain development has implications beyond flood risk, including impacts on hydrological resilience and aquatic system health. As well, development within floodplains can result in damage to infrastructure and property (both private and public), as well as injury and possibly loss of life. Alberta has experienced these circumstances especially through the major floods of the past ten years or so, as evidenced in Calgary, High River and Okotoks, and even Sundre and Drumheller within the Red Deer River Watershed. It is at the municipal level that flood risk identification and the implementation of flood mitigation measures ultimately takes place. Municipal governments, though land use planning and zoning regulations, have a significant role in managing risks from floods and conserving the hydrological functions of floodplains,

Farmland Drainage and Run-off

While effective and profitable operation of farms requires many activities involving the landscape, including soil and water, these activities can impact water quality through water runoff and seepage reaching streams, ponds and groundwater. The impacts are affected by sediments, nutrients fertilizers, pesticides, oil products and others. Extreme impacts lead to water contamination, including drinking water from wells.

Sand and Gravel Operation

The potential impacts of sand and gravel mining are many, including negative impacts on surface water, groundwater, drainage patterns, soil and slope stability, plant life, wildlife habitat, and wildlife species. With regard to water, impacts through erosion, mismanaged wash water and excessive stormwater can lead to increased sediments and contaminants reaching surface water. Groundwater can be impacted through removing protective overburden and mining within aquifers. Water quality impacts can result from fuel spills and other hazardous material discharges associated with vehicles and equipment at the mining site.

Woodland Impact

Wooded areas (forests, woodlots, shelterbelts, tree stands) serve significantly to sustain source water – both surface and groundwater. Negative influences on woodlands, including but not limited to over-harvesting, indiscriminant activity, clearing riparian lands and steep slopes, natural pests (e.g. pine beetles) and fires impact the amount, rate and quality of water reaching streams and rivers thus promoting flooding, increased sedimentation and less groundwater infiltration. The extensive forests of the Eastern Slopes contribute the majority of the water in the Red Deer River system, and thus often receive most of the attention regarding the conservation of woodlands. But woodlots on the rural prairies and woodlands in urban centres also are important to water sustainability at the local level, but also play roles in downstream water availability and quality.

Off Road Vehicle Activity

With the rising popularity of off-road vehicle recreation, there has been a parallel increase in the extent and density of impacts on land vegetation, streams, wetlands and other sensitive resources. While there are responsible recreators, there are those who deface stream banks, create mud bogs out of small streams and wetlands, disturb or destroy sensitive fish habitat, create hardpan create indiscriminant trails and leak petroleum products into the water system, all to the detriment of water quality and aquatic habitat.

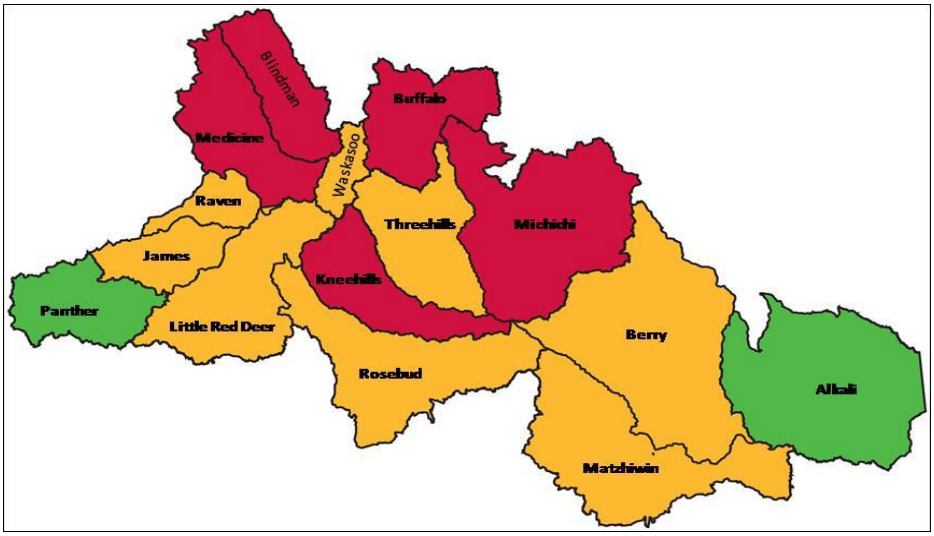
Irrigation Return Flows

Within the Red Deer River watershed, by volume of water licenced irrigation is the largest water allocation sector. Through withdrawals, like all other users irrigation impacts the amount of available source water, especially during the height of the irrigation season and when reservoirs are being refilled. Return flows impact the quality of what is someone's source water. Impacts from irrigation return flows on the quality of the Red Deer River mostly come from the 'flow through' waters of the very large Western Irrigation and Eastern Irrigation District, both which use Bow River water to irrigate extensive lands within the Red Deer River watershed. While 2014 sampling results for return flow locations for these two districts indicated the water quality (as measured against provincial standards) was excellent, return flows generally have poorer quality than source waters and usually contain phosphorus, nitrogen, pesticides and may contain coliforms.

6.2 A Snapshot of the Effects of Impacts

In its background work leading to the preparation of an Integrated Watershed Management Plan for the Red Deer River Watershed, the Red Deer River Watershed Alliance assessed the health of 15 sub-watersheds. As shown on Map 4, only two sub-watersheds have a good rating, while eight have a fair rating and five a poor rating.

Map 4 Sub-watershed Health Assessment



Note: green – good'; gold – fair; red – poor.
Source: Red Deer River Watershed Alliance. State of the Watershed Report

6.3 Opportunities for Municipalities to Address Water Security and Quality Threats

All three levels of government have responsibilities regarding the management and conservation of strategic natural resources, including water. Municipalities have key roles through their responsibility to manage land uses and a number of water related services to residents and businesses. The wise management of land uses is vital to prudent watershed management, thus in turn to the availability of water and its quality for environmental, social and economic purposes. A healthy Red Deer River is the report card of the effectiveness of land and watershed management throughout the Red Deer River basin.

Therefore, it is essential that municipalities, individually and in concert with other municipalities and partners, consider threats to source waters as a threat to their sustainable well-being. In doing so, municipalities need to consider various threats to water security and how to address the threats that affect the source water (quantity and quality) they use for municipal purposes. They also need to consider how they use water and the quality of the water they return to the river, since it becomes part of downstream municipalities' source water and part of the water crucial for maintaining a healthy aquatic ecosystem. Because more and more communities have the Red Deer River as their source of potable water, municipalities need to act not only individually, but also collaboratively.

Section 5.2 listed the key roles municipalities play in protecting source water quality, in great part by addressing threats to source water through a series of actions. Section 6.4 outlines a series of 39 tools that may be used to address and manage 21 threats. Neither all the threats nor all the tools are applicable to any community. Each municipality should consider what threats are applicable to their well being and what tools would be useful to adopt and act upon.

6.4 Tools

Table 3 lists the 21 threats to source water security (including quality) addressed in this report, together with a series of 39 tools municipalities may use to respond to and/or manage the threats.

TABLE 3
SOURCE WATER SECURITY: THREATS AND TOOLS

THREAT		TOOLS	
1	Climate change	Climate Change Adaptation Plan	1
2	Drought	Water Conservation Plan	2A
		Drought Preparedness Plan	2B
		Natural Water Retention Plan	2C
		Water Storage Strategy	2D
3	Floods	Flood Management Strategy	3A
		Flood Control Evaluation Study	3B
4	Wildfire	Community Wildfire Protection Plan	4
5	Impact on recharge areas	Protection of Significant Recharge Areas & Aquifers Guidance Report	5
6	Groundwater contamination	Wellhead Protection Zones Risk Management Plan	6
7	Development on Sensitive Land and Natural Areas	Environmental Conservation Plan	7A
		Development Guides	7B
8	Riparian area loss and degradation	Riparian Land Conservation Action Plan	8A
		Stream/Lake side protection areas	8B
9	Wetland loss/alteration	Wetland Conservation Action Plan	9
10	Wastewater	Wastewater Treatment Master Plan	10A
		Wastewater Treatment Facility Optimization	10B
11	Stormwater	Stormwater Management Plan	11A
		Stormwater Wetland Management Guide	11B
12	Waste disposal	Municipal Waste Management Plan	12A
		Regional Waste Management Approach	12B
		Biosolids Production	12C
		Biogas Production	12D
13	Road salt	Salt Management Plan	13
14	Snow storage	Snow Storage Facility Plan	14
15	Urban and rural development	Municipal Development Plan (Update)	15A
		Community Sustainability Plan	15B
		Smart Growth	15C
		Low Impact Development	15D
		Green Acreages	15E
16	Flood plain development	Floodplain Mapping and Regulations	16A
		Floodplain Management Strategy	16B
17	Farmland Drainage and Run-off	Environmental Farm Plan	17
18	Sand and gravel operations	Extraction Area Land Use District and Regulations	18
19	Loss of Woodlands	Dialogue and Action on Forest Management in the Eastern Slopes	19A
		Urban Forest Management Plan	19B
		Woodlot Management Plan	19C
20	Off-Highway vehicle activity	Awareness and Enforcement	20
21	Irrigation Return Flows	Dialogue and Action of Irrigation Return Flows	21

Threat 1 – Climate Change	**Climate Change Adaptation Plan**	**Tool #1**
References	▪ Municipal Climate Change Action Centre. Climate Resilience for Alberta Municipalities. 2014. ▪ ICLEI-Canada (Local Governments for Sustainability) Changing Climate, Changing Communities: Guide and Workbook for Municipal Climate Adaptation. ▪ Canadian Institute of Planners (prepared by Beate Bowron and Gary Davidson) 2011. Climate Change Adaptive Planning: A Handbook for Small Canadian Communities. ▪ West Coast Environmental Law. Preparing for Climate Change: An Implementation Guide for Local Governments in British Columbia. ▪ King County Strategic Climate Change Action Plan Section Two: Preparing for Climate Change Impacts. 2015. ▪ Town of Black Diamond and Town of Turner Valley. Climate Resilience Action Plan. 2016.	
Key Purpose	To enable municipalities, and their residents and businesses, to prepare for and respond to threats posed by climate changes, and in doing so: 1. engage the community 2. define the community and broader area context of climate change 3. identify the aspects and threats of climate-related change 4. assess the threats by evaluating the risks 5. identify opportunities to prepare for and respond to climate change 6. develop a risk management strategy and actions 7. implement mitigation and adaptation measures.	
Major Aspects	▪ Identify and engage stakeholders ▪ Undertake research to confirm, add to and better define threats, including their potential impacts ▪ Assess community vulnerability (the likelihood and consequences - including severity) of the threats ▪ Prioritize the risks and identify optional actions ▪ Establish an action plan ▪ Implement, monitor/evaluate and adapt the plan.	

MUNICIPAL CHECKLIST						**Tool #1**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 2 – Drought	**Water Conservation Plan**	**Tool #2A**
References	▪ The POLIS Project on Ecological Governance. Water Conservation Planning Guide For British Columbia's Communities. ▪ City of Red Deer. Water Conservation, Efficiency and Productivity Plan. ▪ City of Charlottetown. Water Conservation Plan. ▪ City of Guelph. Water Conservation and Efficiency Strategy Update. ▪ Town of Okotoks. Water Conservation, Efficiency and Productivity Plan.	
Key Purpose	To provide long term strategies in a coordinated plan to improve municipal (or regional) water use efficiency, including the reduction of waste water, through addressing potential actions by all water users – municipal, residential, commercial, industrial, recreational, agricultural, etc.	
Major Aspects	▪ Specify community planning goals ▪ Compile a community water system profile ▪ Forecast demands ▪ Set targets for future water sustainability ▪ Identify, evaluate and select conservation measures, including but not limited to: targets and water saving actions for the residential, industrial, commercial, municipal and institutional sectors; promoting water-wise awareness ▪ Address operational, financial, regulatory, educational and awareness tools ▪ Implement the strategies and measures ▪ Monitor the conservation actions ▪ Adapt and expand the plan.	

MUNICIPAL CHECKLIST						**Tool #2A**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also	Recommend to Watershed Group to consider/undertake				
	Not applicable but	Recommend to Watershed Group to consider/undertake				
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 2 – Drought	**Drought Preparedness Plan**	**Tool #2B**
References	▪ Global Water Partnership Central and Eastern Europe. Guidelines for preparation of Drought Management Plans. 2015. ▪ Battle River Watershed Alliance. Drought Adaptation and Management Policy Advice. 2013. ▪ EPA. Drought Response and Recovery: A Basic Guide for Water Utilities. 2016.	
Key Purpose	To provide practical guidelines and directions to manage, and when necessary adapt, to drought to ensure water sustainability to reduce economic, environmental and social vulnerability to drought. Water sharing should be an element of the plan. The plan can be on a municipal, sub-watershed or watershed basis. In Alberta the preparation of these plans relies on considerable involvement by various provincial government departments as the Province is the water management authority.	
Major Aspects	▪ Recognize drought is an important water management issue ▪ Establish the involvement of wide range of key stakeholders to prepare the plan in consultation with water users throughout the plan area ▪ Define the objectives of the drought preparedness plan ▪ Collect key base information on water users, water availability (including period of low flow) and future projection on water use and flow regimes ▪ Identify and consider optional actions to prepare for and recover from drought ▪ Prepare, adopt and implement the Drought Preparedness Plan ▪ Monitor the plan's effectiveness and improve with adaptive actions.	

MUNICIPAL CHECKLIST						**Tool #2B**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also	Recommend to Watershed Group to consider/undertake				
	Not applicable but	Recommend to Watershed Group to consider/undertake				
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 2 – Drought	**Natural Water Retention Plan**	**Tool #2C**
Reference	▪ European Union. Natural Water Retention Measures. 2017.	
Key Purpose	To modify the amount of water entering a river system and its transport through the system, thus moderating flood and drought events, through: ▪ safeguarding and enhancing the water retention abilities of landscapes, soils and aquifers ▪ restoring ecosystems, natural features and water courses characteristics ▪ using more natural processes within built environments and by doing so reduce the impact of climate change on water resources and improve water quality. A Natural Water Retention Plan should be a major component of an Integrated Watershed Management Plan.	
Major Aspects	To outline and encourage the implementation of a wide range of measures that cover a suite of actions and address a host of landscapes and land uses. The measures consist of two general types, one applied to ecosystems and the second to land uses and water management. (1) Direct modification/restoration of ecosystems ▪ rivers ▪ wetlands ▪ lakes ▪ and their connections (2) Change and adaptation in land uses and water management ▪ agriculture ▪ forestry ▪ urban and rural development ▪ resource development.	

MUNICIPAL CHECKLIST						**Tool #2C**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 2 – Drought	**Water Storage Strategy**	**Tool #2D**
References	▪ Wyoming Water Commission. Wyoming Framework Water Plan Volume II – Planning Recommendations. 2007. ▪ Wyoming Governor's Office. Leading the Charge: Wyoming Water Strategy. 2015. ▪ Wyoming Water Development Office. Snake/Salt River Basin Plan Update. 2014.	
Key Purpose	To prepare a watershed water storage strategy to meet the variety of identified long term water needs. In this regard it is important to recognize that flood and drought planning are interconnected, perhaps receiving an equal amount of attention. The water storage strategy would become an integral part of a water management strategy.	
Major Aspects	▪ Identify the issues ▪ Assemble a strategy team of key stakeholders ▪ Confirm a planning process ▪ Document surface water resources (supplies) ▪ Document water uses by sector ▪ Present projected water uses by sector ▪ Outline potential impacts of climate change on flow regimes (water availability) ▪ Identify potential water storage sites ▪ Evaluate potential water storage sites based on a set of established criteria ▪ Indicate how water storage would fit in with a water management plan ▪ Present Water Storage Strategy document.	

MUNICIPAL CHECKLIST						**Tool #2D**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 3 - Floods	**Flood Management Strategy**	**Tool #3A**
References	▪ Fraser Basin Council. Introducing the Lower Mainland Flood Management Strategy. ▪ Fraser Basin Council. Lower Mainland Flood Management Strategy: Phase 1 Summary Report. 2016.	
Key Purpose	To better protect the community from the risk of a major flood through strengthening flood management infrastructure, improving flood management policies and procedures to increase community resilience and reduce vulnerability.	
Major Aspects	▪ Document past flood events and impacts ▪ Develop better modeling and data management capacity ▪ Develop and analyze a variety of flood scenarios ▪ Identify the risks associated with each scenario ▪ Assess flood vulnerabilities, consequences and cost, including a catastrophic flood ▪ Evaluate the effectiveness of current flood protection infrastructure ▪ Evaluate the effectiveness of flood protection policies and plans ▪ Identify, evaluate and recommend priorities for improved flood mitigation ▪ Identify, evaluate and recommend flood management options ▪ Increase public awareness ▪ Seek funding commitments and implement the strategy.	

MUNICIPAL CHECKLIST						**Tool #3A**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 3 – Floods	**Flood Control Evaluation Study**	**Tool #3B**
References	▪ Alberta Watersmart. The 2013 Great Alberta Flood: Actions to Mitigate, Manage and Control Future Floods. August 2013. ▪ City of Mississauga. Flood Control Evaluation Study. 2012.	
Key Purpose	To identify and address food prone sites (lands) and to assess alternative solutions, the objectives being to reduce the occurrence of flooding, to reduce the extent of erosion, and to improve water quality and habitat conditions.	
Major Aspects	▪ Review past flood events ▪ Identify the flooding and erosion problems ▪ Examine and evaluate existing infrastructure, including flood mitigation infrastructure, affected by flood events ▪ Forecast future flood events, including extreme events ▪ Evaluate the impacts of forecast future flood events ▪ Identify alternative opportunities to address the problems ▪ Evaluate the alternatives ▪ Develop a preferred list of municipal actions ▪ Provide private land owners with adaptation/mitigation actions ▪ Finalize the Flood Control Evaluation Study.	

MUNICIPAL CHECKLIST							**Tool #3B**
Your Municipal Priority	Not applicable			High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider		Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake				
	Not applicable but		Recommend to Watershed Group to consider/undertake				
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend		Participate in Watershed group

Threat 4 - Wildfire	**Community Wildfire Protection Plan**	**Tool #4**
References	▪ Alberta Government. Guidebook for Community Protection: A Guidebook for Wildland/Urban Interface Communities. 2013. ▪ Athabasca County. FireSmart Community Mitigation Strategy (FireSmart Plan Update). 2010. ▪ Town of Whitecourt. FireSmart Community Protection Plan: Wildfire Mitigation Strategies. 2011. ▪ Texas A&M Forest Service. Community Wildfire Protection Plan Guide. 2012.	
Key Purpose	The key purpose of a Community Wildfire Protection Plan is to mitigate losses from wildfire while maintaining ecosystem health important for forestry, farming, potable water availability, recreation and other staples of community life. Through the plan, educating residents and businesses about wildfire prevention is an important side benefit. A complete Community Wildfire Protection Plan includes: 1. Wildfire Preparedness Guide, being an operational guide used for responding to wildfires 2. Wildfire Mitigation Strategy, which outlines FireSmart actions intended to reduce wildfire risks and their impacts. If a community has a low or moderate wildfire risk, a Wildfire Preparedness Guide may be all that is required.	
Major Aspects	▪ Assemble key stakeholders committed to preparing a plan with community input ▪ Identify wildfire hazards ▪ Identify vegetation and building structure options for mitigation ▪ Develop a community risk assessment ▪ Establish community priorities and recommendations ▪ Develop an action plan (FireSmart Community Plan) ▪ Implement the plan and monitor it's effectiveness.	

MUNICIPAL CHECKLIST						**Tool #4**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 5 – Impacts on Recharge Areas and Aquifers	**Protection of Significant Recharge Areas and Aquifers Guidance Report**	**Tool #5**
References	▪ Lake Simcoe Region Conservation Authority. Guidance for the protection of significant groundwater areas (SGRAs) in the Lake Simcoe watershed. 2014. ▪ South Georgian Bay-Lake Simcoe Source Protection Committee., 2015. Approved Assessment Report: Lakes Simcoe and Couchiching-Black River Source Protection Area Part 1. ▪ Global Water Partnership. The links between land use and groundwater.	
Key Purpose	To identify significant groundwater recharge areas and provide guidance for their protection in order to safeguard the quantity and quality of groundwater sources of municipal drinking water and systems that support sensitive areas, such as streams and wetlands.	
Major Aspects	▪ Recognize the two types of significant groundwater recharge areas (significant groundwater recharge areas and ecologically significant groundwater recharge areas) and their importance ▪ Describe the characteristics of the watershed area under study ▪ Identify drinking water systems, including their source water aquifers, within the study area ▪ Research and map significant groundwater recharge areas ▪ Identify vulnerable areas (wellhead protection areas, intake protection zones, highly vulnerable aquifers, significant groundwater recharge areas) ▪ Identify/inventory potential threats to groundwater quality and quantity ▪ Assess the hazard of the threats to aquifers ▪ Calculate threat scores (the product of the hazard score - how bad is the threat) and the vulnerability score (how vulnerable is the land) ▪ Identify highly vulnerable aquifers and land areas most at risk to groundwater contamination activities ▪ Advise mandatory and voluntary policies that serve to protect, improve and restore significant groundwater recharge areas in order to reduce risks to groundwater.	

MUNICIPAL CHECKLIST						**Tool #5**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 6 - Groundwater Contamination	**Wellhead Protection Zones Risk Management Plan**	**Tool #6**
References	▪ Conservation Ontario. Wellhead Protection Areas. ▪ Nova Scotia Environment. Developing a Municipal Source Water Protection Plan: A Guide for Water Utilities and Municipalities Step 2 Delineate a Source Water Protection Area Boundary. ▪ Township of Selwyn. Memorandum re: Source Water Protection Official Plan and Zoning Bylaw Amendments. ▪ Township of Selwyn. Bylaw Number 2016-021 (to establish Source Water Protection Areas).	
Key Purpose	To protect municipal groundwater sources from threats, especially significant threats, leading to pollution and contamination of source water through studies, public consultation and policy adoption. The creation and implementation of wellhead protection zones serves to advise, and where appropriate, regulate land use activities that could become potential contributors of contaminants which could reach the municipal water supply source. Protecting the area around a well helps to protect a healthy water supply. Implementing the objectives of wellhead protection zones is through policy adoption in municipal development plans and intermunicipal development plans, which are implemented by regulations in the Land Use Bylaw(s).	
Major Aspects	▪ Identify wellheads and determine their protection area ▪ Describe the characteristics of the wellhead protection area, including current land uses, the nature of the landscape and soils ▪ Identify land use activities, and examples thereof, that may pose as potential threats to municipal water supplies ▪ Evaluate the risk posed by each threat ▪ Identify more vulnerable areas within the wellhead protection area ▪ Determine the threats (could be all) that are to be addressed and priority vulnerable areas (could be entire protection area) ▪ Adopt a Wellhead Protection Zone Risk Management Plan that includes policies to be added to the community development plan (and intermunicipal development plan if applicable), including a policy that identifies the wellhead protection zone, and the related provisions to be included in the Land Use Bylaw(s) to implement the policies. Policies and regulations may be area specific and land use specific.	

MUNICIPAL CHECKLIST						**Tool #6**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 7 – Development on Sensitive Land and Natural Areas	**Environmental Conservation Master Plan**	**Tool #7A**
References	▪ City of Calgary. Natural Area Management Plan. ▪ Parkland County. Parkland County Environmental Conservation Master Plan Phase 1 Background Technical Report. 2014. ▪ Parkland County. Parks, Recreation and Culture Master Plan. 2017. ▪ South Okanagan-Similkameen Conservation Program. Town of Oliver. A Guide to Development of Sensitive Areas. ▪ City of Maple Ridge. Environmental Management Strategy. 2014.	
Key Purpose	To conserve and manage environmentally sensitive areas, including watersheds, hazard lands, natural areas and at-risk landscapes in order to protect the viability of these resources as an integral part of the settlement fabric of an area, be it a watershed, a sub-watershed, a municipality (urban and rural), a specific landscape feature or a site. As such, the plans promote the understanding of sensitive environments (what, where and why they are significant), challenges to their viability, opportunities to conserve them and promote community involvement therein.	
Major Aspects	▪ Outline the roles and importance of environmentally sensitive areas within the context of the plan area and their contributions to well-being of the area and the community (communities) in which they are located ▪ Identify the environmentally sensitive areas (features, locations) ▪ Outline the susceptibility of the sensitive area to surface disturbance and its inherent resiliency or ability to be restored back to functioning pre-disturbance ecological condition ▪ Assess the level of significance (overall importance of an area regardless of sensitivity/resilience) of the sensitive area ▪ Consider connectivity (linkages among sensitive areas) ▪ Identify beneficial management practices ▪ Establish an action plan, including priorities ▪ Implement and monitor the effectiveness of the plan strategies, policies and the related bylaws and regulations arising there from.	

MUNICIPAL CHECKLIST						**Tool #7A**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 7 – Development on Sensitive Land and Natural Areas	**Development Guides**	**Tool #7B**
References	▪ British Columbia Ministry of Water, Land and Air Protection. Environmental Best Management Practices for Urban and Rural Development. 2004. ▪ City of Kelowna. Natural Environment DP Guidelines. 2012 ▪ City of Abbotsford. Natural Environment Development Permit Guidelines. 2016. ▪ South Okanagan-Similkameen Conservation Program. Town of Oliver. A Guide to Development of Sensitive Areas	
Key Purpose	To protect environmentally sensitive areas as functioning ecosystems and in doing so promote healthy watersheds and the associated benefits for human health and sustainable environments.	
Major Aspects	▪ Determine if there are environmentally sensitive features on or near the proposed development site ▪ Ensure all the environmentally sensitive features are identified ▪ Identify the risks to environmental integrity of the sensitive area and/or its sensitive features should development be approved (during and post development/construction) ▪ Direct the proposed development away from the area/site should municipal plans/policies indicate the form of proposed development (if any) is not appropriate ▪ Identify the protection/conservation measures (best management practices) to be undertaken if development is to be approved ▪ Ensure the development is designed and managed to allow the continuation of the ecological processes essential for ecological sustainability of the sensitive features ▪ Determine if suitable actions could be undertaken to restore (even partially) the ecological functions of the sensitive features, and if so, direct that these be part of the development approval.	

MUNICIPAL CHECKLIST						**Tool #7B**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 8 – Riparian area loss and degradation	**Riparian Land Conservation Action Plan**	**Tool #8A**

References	▪ Alberta Water Council. Riparian Land Conservation and Management Report/ Recommendations. 2013. ▪ Fiera Biological Consulting for Alberta Water Council. Riparian Lands in Alberta: Current state, conservation tools and management approaches. ▪ Fish and Wildlife Compensation Program. Riparian and Wetlands Action Plan – Draft. 2014. ▪ Town of Cochrane. A Wetlands and Riparian Areas Conservation and Management Plan for Cochrane Alberta. 2008. ▪ City of Edmonton. Development Setbacks from River Valley/Ravine Crests (Policy C542A). 2016. ▪ Aquality Environmental Consulting Limited. Developers Guide to the Riparian Land Matrix Model for the Municipal District of Foothills. 2010.
Key Purpose	To provide directions for the community and individual landowners to consider and employ a suite of management techniques to conserve, and where appropriate re-establish, riparian lands, and in doing so to increase community knowledge of riparian lands (what they are) and their environmental, economic and social values
Major Aspects	▪ To identify what generally constitutes riparian lands within the community ▪ To evaluate the health of riparian lands ▪ To outline various approaches and tools available to conserve riparian lands (scientific, economic, social, legislative) ▪ To establish a defensible method for securing riparian lands as municipal (public) land ▪ To prepare a municipal action plan that addresses both municipal (public) and private landowner roles and proposed actions ▪ To identify and undertake priorities for municipal actions ▪ To encourage conservation actions by private owners of riparian land ▪ To monitor and measure the effectiveness of the actions in reaching desired outcome.

MUNICIPAL CHECKLIST						**Tool #8A**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 8 – Riparian area loss and degradation	**Stream/Lake side protection areas**	**Tool #8B**

References	▪ District of Hope: Integrated Official Community Plan.2016 (see Section C – Streamside Protection Area). ▪ Alberta Sustainable Resource Development. Buffalo Lake Integrated Shoreland Management Plan. 2011.
Key Purpose	To protect riparian environments, including natural habitat, ecosystems and biological diversity, along rivers, streams, lakes, ponds and wetlands to conserve natural settings, wildlife corridors, fish habitat, scenic amenities and water quality.
Major Aspects	▪ To establish a minimum width of the protected area, with provisions for the municipality to extend the width based upon site factors (e.g. slope, floodplain) ▪ To establish minimum setbacks from top-of-bank, wetlands, shoreline , with provisions for the municipality to extend the width based upon site factors (e.g. slope, instability, floodplain) ▪ To require any proposed development within the protection area to be assessed by a qualified environmental professional to indicate if the land may be developed and under what conditions ▪ To establish provisions that the municipality may permit development within the protected area subject to the preparation of an assessment report by a qualified professional, which may need the concurrence of an affected government department ▪ To encourage the municipality to require a qualified professional to monitor and advise the developer regarding on-site work and/or certify the project has been undertaken in accordance with the provisions of the assessment report.

MUNICIPAL CHECKLIST						**Tool #8B**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also	Recommend to Watershed Group to consider/undertake				
	Not applicable but	Recommend to Watershed Group to consider/undertake				
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 9 – Wetland loss/alteration	**Wetland Conservation Action Plan**	**Tool #9**

References	▪ Alberta Environment and Parks. Alberta Wetland Policy. 2013. ▪ City of Calgary. Calgary Wetland Conservation Plan. 2004. ▪ Strathcona County. Municipal Policy Handbook: Wetland Conservation. ▪ Alberta NAWMP Partnership. Making Wetlands Work in Your Municipality. 2016 ▪ Fraser Valley Conservancy. Maclure Wetland Management Plan. 2015.
Key Purpose	To conserve, restore, protect and manage wetlands to sustain the benefits they provide to the environment, society and economy. To achieve this goal, the plan should focus on four outcomes: 1. To protect wetlands of the highest value for the long-term benefit they provide 2. To conserve and restore wetlands in areas where losses have been high 3. To manage landscapes to avoid and minimize wetland loss and degradation, and if necessary, replacing lost wetland value 4. Wetland management considers regional context
Major Aspects	▪ Identify wetlands and evaluate them on five criteria: Biodiversity, Water Quality Improvement, Flood Reduction, Human Value, Abundance ▪ The primary and preferred response is to avoid impacts to wetlands. Where avoidance is not possible, then minimize impacts on wetlands. As a last resort, and where avoidance and minimization efforts are not feasible or prove ineffective, wetland replacement is required ▪ Encourage a broader understanding of the importance of wetlands and promote wetland stewardship.

MUNICIPAL CHECKLIST						**Tool #9**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 10A – Wastewater	**Wastewater Treatment Master Plan**	**Tool #10A**
References	▪ City of Guelph. Guelph Wastewater Treatment Master Plan. 2009. ▪ Stantec Consulting Ltd. (for the Town of Okotoks). Town of Okotoks Wastewater Treatment Plant – Regional Wastewater Pipeline Feasibility Study: Final Report. 2016. ▪ Federation of Canadian Municipalities. Facility upgrades help Cranbrook enhance Agricultural Production: Case Study. 2017. ▪ Ontario Ministry of Environment and Climate Change. Determination of Treatment Requirements for Municipal And Private Sewage Treatment Works.	
Key Purpose	To provide long term direction for wastewater treatment plant planning and implementation.	
Major Aspects	▪ Describe the current plant features, functions and capacities ▪ Identify current plant deficiencies ▪ Project future capacity needs based on population and economic growth projections ▪ Consider potential future legislative requirements regarding levels of and aspects of treatment ▪ Identify alternatives for plant upgrades, including beneficial practices and effective new technologies ▪ Determine the preferred solution(s) and, if necessary back-up options ▪ Examine alternate methods of implementing the preferred solution(s) ▪ Consider costing and phasing ▪ Prepare the Master Plan, including the rationale, planning design and consultation process.	

MUNICIPAL CHECKLIST						**Tool # 10A**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also	Recommend to Watershed Group to consider/undertake				
	Not applicable but	Recommend to Watershed Group to consider/undertake				
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 10 – Wastewater	**Wastewater Treatment Facility Optimization**	**Tool #10B**
References	▪ National Research Council- Federation of Canadian Municipalities. Wastewater Treatment Plan Optimization. 2003. ▪ MacKinnon Engineering. Process Optimization	
Key Purpose	To optimize the performance of a wastewater treatment facility in order to maximize the capacity of the existing facility, improve effluent quality, thus reducing the impact on receiving waters, and reduce operating costs through more efficient use of chemicals, power and/or labor.	
Major Aspects	▪ Establish objectives ▪ Evaluate the facility to establish benchmark conditions by reviewing the treatment process and equipment, including the testing thereof ▪ Evaluate the process control, instrumentation and monitoring processes ▪ Assess the usage of chemicals ▪ Assess operator knowledge ▪ Determine performance limiting factors ▪ Identify and prioritize opportunities for optimization through improved operations and maintenance practices, instrumentation, control and automation, and process modifications to address the limiting factors; ▪ Recommend an implementation program ▪ Implement operational changes ▪ Conduct follow-up monitoring ▪ Document the benefits (achievements) of operational changes.	

MUNICIPAL CHECKLIST						**Tool #10B**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 11 – Stormwater	**Stormwater Management Plan**	**Tool #11A**
References	▪ Alberta Government. Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems: Part 5 Stormwater Management Guidelines. ▪ City of Calgary. Stormwater Management and Design Manual. 2011. ▪ City of Spruce Grove. Storm Water Management.	
Key Purpose	To protect watershed health by designing and managing stormwater drainage to address the quality of stormwater and the rate and volume of water during storm events discharging into the receiving waterways. This is to be achieved by utilizing updated designs and best management practices for source controls, site design and lot development, conveyance systems (including ponding) and end of pipe practices.	
Major Aspects	▪ Establish principles and objectives ▪ Establish levels of service (minor events, major events) ▪ Consider planning levels – Broad: river basin and watershed plans; Intermediate: master and staged drainage plans; Site: subdivision and development site servicing plans ▪ Runoff and design storm analysis ▪ Minor and major system component designs ▪ Development site servicing standards and requirements ▪ Stormwater pond and wetland designs and standards ▪ Water quality targets, modeling ▪ Encourage/require best management practices for pollution prevention (e.g. use of fertilizers, pesticides); source control/design (e.g. landscaping, green roofs); site control (buffers and filters); end-of-pipe (e.g. wet ponds) ▪ Erosion and sediment control ▪ Operating, maintenance and monitoring requirements ▪ Technical requirements.	

MUNICIPAL CHECKLIST						**Tool #11A**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 11 – Stormwater	**Stormwater Wetland Management Guide**	**Tool #11B**
References	▪ City of Calgary. Principles for Stormwater Wetlands Management in the City of Calgary. 2009.	
Key Purpose	To promote sound practices in the assessment of potential stormwater wetland sites (features) and the planning, design and management of stormwater wetlands.	
Major Aspects	▪ Selection of Appropriate locations/features – considering the status of the site (e.g. protected or not; land use plans); biophysical impact assessment) ▪ Stormwater wetland design objectives ▪ Conceptual planning and design (e.g. water quantity and quality; wetland conceptual layout; stormwater consideration; vegetation and landscape; amenities and access) ▪ Detailed design and construction considerations ▪ Operation and maintenance considerations ▪ Develop and monitor the stormwater wetland. ▪ Adapt design features if necessary.	

MUNICIPAL CHECKLIST						**Tool #11B**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 12 - Waste Disposal	**Municipal Waste Management Master Plan**	**Tool #12A**
References	▪ City of Red Deer. Waste Management Master Plan. 2013. ▪ British Columbia Ministry of Environment. A Guide to Solid Waste Management Planning. 2016.	
Key Purpose	To set out both strategic and detailed directions to manage waste with the intent to reduce the amount of waste per capita sent to the landfill through waste reduction and diversion actions, with the input, support and involvement of residents and businesses through out the community. Managing waste also includes regional linkages.	
Major Aspects	▪ Advance waste reduction education and promote overall approaches through: government leadership, community engagement and community based social marketing, branding, public spaces recycling, zero waste events ▪ Residential waste reduction/diversion through: backyard composting, grasscycling and xeriscaping, organics collection, bi-weekly collection, enhanced curb recycling, user pay/volume limits, enhanced multi-family area servicing ▪ Industrial, commercial and institutional waste reduction through: information dissemination, recognizing high achievements in waste diversion, food waste diversion, enhanced recycling, expand acceptable waste for diversion ▪ Infrastructure enhancement through: automated cart-based garbage collection, organics processing facility ▪ Regulation options through: differential tipping fees, disposal bans for waste materials that have collection and processing infrastructure in place, mandatory residential recycling and source separation, require businesses to participate in applicable diversion programs ▪ Residuals management through: landfill long term site design and operations plan including a capital cost program, airspace consumption analysis, operations considerations ▪ Monitoring and reporting.	

MUNICIPAL CHECKLIST						**Tool #12A**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also	Recommend to Watershed Group to consider/undertake				
	Not applicable but	Recommend to Watershed Group to consider/undertake				
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 12 - Waste Disposal	**Regional Waste Management Approach**	**Tool #12B**
References	▪ Capital Region Waste Minimization Advisory Committee. Alberta. ▪ Capital Region Integrated Waste Management Plan: Phase 1 Report. 2013.	
Key Purpose	To provide a framework to guide regional waste management over the long term to achieve the following goals: 80% diversion/recovery and 20% landfill disposal while meeting the provincial goal of 500kg/per capital per year of municipal solid waste. Increased waste diversion has environmental, economic and social benefits.	
Major Aspects	Policy and programming research, assessment and recommendations for: ▪ Residential, institutional, commercial, light industrial and construction waste sectors ▪ Opportunities to reduce waste generation ▪ Efficient options for the reuse of waste materials ▪ Increased emphasis on recycling ▪ Opportunities for education ▪ Innovative recovery and disposal options ▪ Most efficient use of present and future regional waste management infrastructure ▪ Consistent monitoring, measuring and reporting framework.	

MUNICIPAL CHECKLIST							**Tool #12B**
Your Municipal Priority	Not applicable			High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider		Start	Progressing		Complete
	While applicable also	Recommend to Watershed Group to consider/undertake					
	Not applicable but	Recommend to Watershed Group to consider/undertake					
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend		Participate in Watershed group

Threat 12 - Waste Disposal	**Biosolids Production (Municipal and Regional)**	**Tool #12C**
References	▪ The Roadrunner. Biosolids Management in North Battleford. Fall 2015. pp. 29-31.	
Key Purpose	To convert biosolids waste into a beneficial product in a way that will meet regulatory guidelines, be environmentally responsible and fiscally prudent while providing a proven, year-round management program, as well as a marketable product that is registered with the Canadian Food Inspection Agency (CFIA) and by diverting waste that otherwise would be buried in a landfill.	
Major Aspects	A patented, low pressure, low heat, thermal hydrolysis processing system (licensed by Lystek International Inc., of Cambridge, ON.) that involves placing the biosolid material into an enclosed reactor, where a combination of heat (steam injection), high speed shearing and the addition of alkali (potassium hydroxide) are simultaneously applied to the material to break down cell structure and kill pathogens. The end product is a CFIA-registered fertilizer that can be sold to generate revenue. ▪ New plant/system or retrofitted into a community's existing biosolids management building without major renovations. ▪ Fully automated system ▪ Monitoring linked to overall Wastewater Treatment Plan system ▪ Lined and covered product reservoir ▪ Marketing plan.	

MUNICIPAL CHECKLIST							**Tool #12C**
Your Municipal Priority	Not applicable			High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider		Start	Progressing		Complete
	While applicable also	Recommend to Watershed Group to consider/undertake					
	Not applicable but	Recommend to Watershed Group to consider/undertake					
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend		Participate in Watershed group

Threat 12 - Waste Disposal	**Biogas Production**	**Tool #12D**
References	Lethbridge Biogas.	
Key Purpose	To convert biosolid waste into electricity with the residue waste converted into fertilizer.	
Major Aspects	▪ Raw material building containing pre-storage tanks (for liquids) and an in-floor hopper (for solids), equipped with an odour control system ▪ anaerobic digesters equipped with 4 agitators and a double membrane to store the extracted biogas ▪ biogas treatment system to condition and additionally treat with activated carbon ▪ specialized gas engines designed for lower methane gas applications ▪ connections to the Alberta power grid ▪ residue digested material is formed into organic fertilizer and re-loaded within the receiving/ unloading building.	

MUNICIPAL CHECKLIST						**Tool #12D**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also	Recommend to Watershed Group to consider/undertake				
	Not applicable but	Recommend to Watershed Group to consider/undertake				
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 13 - Road salt	**Salt Management Plan**	**Tool #13**
References	▪ City of Barrie. Salt Management Plan. 2016. ▪ Town of St. Mary's. Salt Management Plan. 2015. ▪ Transportation Association of Canada. Synthesis of Best Practices: Road Salt Management.	
Key Purpose	To provide a policy and procedure framework to ensure the safety of road users while also ensuring that the management of road salt used during winter operations meets Environment Canada's objectives. To continuously improve the winter road maintenance through using road salt in an environmentally responsible manner. To minimize environmental effects on the environment through the handling, storage and application of road salt, based on the following key principles: safety, environmental protection, continued improvement, fiscal responsibility, efficient transportation systems, accountability, measurable progress, organization based, communication, knowledgeable and skilled workforce.	
Major Aspects	▪ Policies for Winter maintenance – salt and sand storage; salt and sand spreading practices according to type of material, weather, road temperature, etc.; anti-icing; pre-wetting; salt and sand loading; snow storage and disposal; salt brine production and storage; treated salt use and storage ▪ Salt vulnerable areas – maps of vulnerable areas and description of winter maintenance practices (e.g. alternate treatments) in the vicinity thereof ▪ Operational practices and strategies - weather monitoring, anti-icing program, pre-wetting, load records ▪ Monitoring and Updating – use of GPS to track truck speed and location; start and finish times; wing and plow activation status; winter material accumulations tracking; spreader controls (on or off and application rate); electronic calibration of spreaders; improved record keeping; training ▪ Keep in tune to future initiatives and needs.	

MUNICIPAL CHECKLIST						**Tool #13**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 14 - Snow storage	**Snow Storage Facility Plan**	**Tool #14**
References	▪ Transportation Association of Canada. Synthesis of Best Practices: Snow Storage and Disposal. 2013. ▪ City of Cornwall. Salt Management Plan and Snow Disposal Facility. 2009.	
Key Purpose	To locate a snow storage and disposal facility where operations will minimize impacts on the environment and control nuisance effects, including dust, noise, litter, lights, visual intrusions while providing for safe site access and egress.	
Major Aspects	▪ Needs assessment – volumes of snow to be stored (average and peak); cost of snow removal, storage and site maintenance ▪ Determine size of site required; consider if more than one site is more appropriate ▪ Identify candidate sites – assess size; access and egress; potential conflicts with adjoining and nearby lands; environmental issues, surface quality; site hydrogeology; near to groundwater recharge areas, salt vulnerable area ▪ Assessment and evaluation: snow hauling distances; snow hauling routes; site access and egress; site size; past and current land use; surrounding land uses; current zoning; sub-surface conditions ▪ Design of selected site(s): truck routes; snow loading areas; access to electric power; management/security building location; accessible monitoring points; maintenance access for collection, treatment and discharge areas; buffers ▪ Base construction (for weight and flow of melt water) ▪ Snow pile management – dumping location, pile formation ▪ Meltwater management – drainage design, ponding areas, outlets all with appropriate permits ▪ Site security and environmental controls ▪ Site operation manual, including clean-up and any required remediation, and training requirements ▪ Monitoring and record keeping	

MUNICIPAL CHECKLIST						**Tool #14**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 15 - Urban and rural development	**Municipal Development Plan (Update)**	**Tool #15A**
References	▪ North Saskatchewan Watershed Alliance. Municipal Guide: Planning for a Healthy and Sustainable North Saskatchewan River Watershed. Edmonton AB. 2008. ▪ University of New Hampshire. Preparing a Conservation Plan. ▪ City of Edmonton. The Way We Green: The City of Edmonton's Environmental Strategic Plan.	
Key Purpose	To maintain the ecological health of a community through reviewing and updating the Municipal Development Plan so it addresses comprehensively the conservation of the multiple facets of the environment and encourages the community to work together with neighbouring communities at intermunicipal and watershed levels to sustain the environment, including source waters. Municipalities should work together through intermunicipal development plans.	
Major Aspects	▪ A clear vision on a conserved environment, based upon it's importance to community sustainability ▪ An expression of community values, concerns and desires ▪ An inventory of environmental features and resources, their attributes ▪ To identify challenges to conserving the various elements of the environment ▪ Policies to conserve trees, parks and natural areas ▪ Policies to conserve water ▪ Policies to minimize impacts by land use activities on water quality and the sustainability of ecosystems ▪ Policies to protect water from adverse impacts, including on riparian lands and wetlands ▪ Policies to grow 'green' ▪ Policies to engage collaboratively with neighbouring communities and others within the watershed ▪ Policies to implement conservation through voluntary means, by landowners, community groups, businesses, etc. and regulatory means such through the Land Use Bylaw and special plans, regulations and bylaws.	

MUNICIPAL CHECKLIST						**Tool #15A**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 15 - Urban and rural development	**Community Sustainability Plan**	**Tool #15B**

References	▪ City of Airdrie. AirdrieONE Sustainability Plan. ▪ City of Kimberley. Imagine Kimberley: Integrated Community Sustainability Plan. 2011. ▪ Regional District of Bulkley and Nechako. Sustainable Rural Land Development Checklist. ▪ County of Lethbridge, Integrated Community Sustainability Plan. 2009.
Key Purpose	To guide the community to a desirable and sustainable future by recognizing that economic, environmental and social issues are interdependent such that the plan provides strategies and directions to implement, monitor, review and adapt the plan.
Major Aspects	▪ State a community vision for the long term future ▪ Enunciate community values ▪ Engage the community in plan preparation ▪ Define sustainability pillars – normally governance, economic, environmental, social and cultural ▪ Identify the environmental resources (e.g. land/soil, water, vegetation, ecosystems, open spaces, etc.) of major importance and key actions to sustain these in balance with economic and social interests ▪ Identify sustainable initiatives ▪ Identify actions to implement the initiatives and actions ▪ State actions to monitor, review, report on and adapt the plan.

MUNICIPAL CHECKLIST						**Tool #15B**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also	Recommend to Watershed Group to consider/undertake				
	Not applicable but	Recommend to Watershed Group to consider/undertake				
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 15 - Urban and rural development	**Smart Growth**	**Tool #15C**
References	▪ Smart Growth Canada (website).	
Key Purpose	To infuse principles of smart growth into community statutory and other plans to promote more livable and sustainable communities, in part by preserving open spaces and parkland and protecting critical habitat; improving transportation choices, including walking, bicycling, and transit; promoting redevelopment; and reducing impervious cover, which improves water quality.	
Major Aspects	▪ Housing Choice - Create a range of affordable, quality housing ▪ Vibrant, Walkable Complete Communities - Foster development that creates vibrant, unique, walkable complete communities where uses like residential and commercial are mixed to create attractive places to live, work and play ▪ Smart Building Design - Encourage building designs that contribute to the context of a pedestrian-oriented neighbourhood and use green building technologies ▪ Renew Existing Communities - Direct development away from unsettled areas; encourage growth and renewal in existing communities ▪ Green Infrastructure - Utilize green infrastructure to save money and protect the environment ▪ Green Space, Farmland and Ecologically Sensitive Areas - Preserve and enhance these features ▪ Broad-Scale, Integrated Planning - Undertake this for cities and towns and adjacent areas in a way that integrates land use and transportation planning for the entire region ▪ Transportation Options - Provide varied transportation options and infrastructure for walking, bicycling, car pooling, car sharing, scooters, public transit and others ▪ Community Involvement - Encourage effective community involvement early in the process to find unique solutions that fit with the community's vision of itself ▪ Focus on Implementation - Utilize planning processes, tools and incentives to facilitate private sector investment and ease of navigation in achieving smart growth solutions.	

MUNICIPAL CHECKLIST						**Tool #15C**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 15 - Urban and rural development	**Low Impact Development**	**Tool #15D**
References	▪ City of Edmonton. Low Impact Development Best Management Practices Design Guide. 2014. ▪ Toronto and Region Conservation Authority. Low Impact Development Stormwater Management Planning and Design guidelines. 2010.	
Key Purpose	To work with nature to manage stormwater through one or a combination means: preserving natural site features, small scale integrated stormwater management control dispersed throughout the site, minimizing impervious areas and their connectivity, controlling stormwater as close to the source as possible, prolonging stormwater runoff flow, paths and times, and creating multifunction landscapes.	
Major Aspects	▪ Design developments to use best management practices by utilizing natural processes: absorption, infiltration, evaporation, evapotransporation, filtration by plant materials and soil layers, pollutant uptake by vegetation, and biodegradation of pollutants by soil microbial communities ▪ Site design cognizant of site characteristics and climate conditions ▪ Site design to minimize land and vegetation disturbance; capitalize on the natural hydrology when locating roads, building and drainage features; utilize natural soil, subsoil and vegetation; minimize soil compaction and impervious areas; reduce or prevent stormwater runoff during small storm events; provide treatment for stormwater as close to the source as possible; incorporate multi-purpose landscapes that use water as a resource rather than a nuisance. ▪ Integrate into the development as many best management practices as possible.	

MUNICIPAL CHECKLIST						**Tool #15D**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 15 - Urban and rural development	**Green Acreages**	**Tool #15E**
References	▪ Land Stewardship Centre. The Green Acreages Guide Primer. ▪ Alberta Agriculture. Beneficial Management Practices: Environmental Manual for Alberta Farmsteads. 2006.	
Key Purpose	To encourage owners of acreages to identify and undertake stewardship actions and continued practices to conserve the environment assets, including ground and surface water resources within and around country living acreages.	
Major Aspects	▪ Assess and map the natural and built assets of the property and those nearby ▪ Identify goals and desired outcomes ▪ Manage runoff to minimize/eliminate water contamination ▪ Ensure water wells are properly designed, drilled and constructed ▪ Do not apply pesticides or fertilizers near wells, dugouts and other surface water ▪ Maintain a natural buffer along lakeshores, steams and wetlands ▪ Balance the retention of wooded areas and shelterbelts with other site needs ▪ Plant to attract pollinators ▪ Limit habitat that attracts scavengers and problem wildlife ▪ Design and manage the landscape to discourage weed growth and erosion, while minimizing on outdoor water use ▪ Manage pastures so they are not overgrazed.	

MUNICIPAL CHECKLIST							**Tool #15E**
Your Municipal Priority	Not applicable			High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider		Start	Progressing		Complete
	While applicable also	Recommend to Watershed Group to consider/undertake					
	Not applicable but	Recommend to Watershed Group to consider/undertake					
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group	

Threat 16 – Flood Plain Development	**Floodplain Mapping and Regulations**	**Tool #16A**
References	▪ Government of Canada. Federal Floodplain Mapping Framework Version 1.0. 2017. ▪ City of Prince Albert. Proposed Official Community Plan Policies for Flood Risk Areas. 2015. ▪ Government of Ontario. Ontario Regulation 156/06 Nickel District Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.	
Key Purposes	Floodplain mapping delineates lands along rivers, lakes and oceans that are subject to flooding, provides key information to understand where floods are likely and estimated to occur and assists the formulation of actions to mitigate the impacts of floods (injury, loss of life, property damage, land and infrastructure damage; riparian land loss/damage; impacts on hydrological functions of the floodplain). Policies and regulations for identified floodplain areas function to preclude flood vulnerable development. They also serve to mitigate the impacts of floods on prior development within the floodplain and to conserve the hydrological functions of the floodplain.	
Major Aspects	▪ Undertake floodplain hazard mapping to delineate the floodways and flood fringes of various flood event magnitudes, including the 1:100 year event, 1:200 year event and 1:500 year event ▪ Include policies in municipal statutory plans (intermunicipal development plans, municipal development and where applicable area structure plans) that officially recognize the floodplain maps, provide policies regarding the forms and types of development that are precluded from floodways and the forms and types of development that may be permitted in floodways and flood fringes subject to conditions and special considerations to be added to the development application process ▪ In the Land Use Bylaw include floodway maps as an overlay district and the regulations pertinent to development in floodplains.	

MUNICIPAL CHECKLIST						**Tool #16A**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 16 – Flood Plain Development	**Floodplain Management Strategy**	**Tool #16B**
References	▪ Fraser Basin Council. Lower Mainland Flood Management Strategy. Phase 1 Summary Report. 2016. ▪ Regional District of Central Okanagan. Regional Floodplain Management Plan: Phase 1 2016. ▪ Queensland Reconstruction Authority. Planning for stronger, more resilient floodplains Parts 1 and 2.	
Key Purpose	To set the vision and land use direction for the planning scheme and forms the basis for ensuring that appropriate development occurs within the planning scheme area, including how a community responds to flood risk through better understanding flood vulnerabilities and hazards, and current flood policies, practices and infrastructure.	
Major Aspects	▪ Draft a vision for the future and desired outcomes ▪ Identify the flood prone areas ▪ Research prior floods and their impacts ▪ Prepare and analyze flood scenarios (e.g. 1:00, 1:200 1:500 year flood events) ▪ Assess flood vulnerabilities (damages to land, buildings, infrastructure, economic opportunity losses (direct and indirect) ▪ Assess: consequences = exposure + vulnerability - tolerance ▪ Determine risk levels for flood prone sub-areas ▪ Review current flood protection infrastructure and flood event practices and procedures ▪ Review and strengthen where necessary land use planning approaches, policies and regulations ▪ Undertake risk assessment analysis ▪ Develop strategy and action plan, including goals, policy directions, actions (and those who are responsible), funding strategy and monitoring/reporting.	

MUNICIPAL CHECKLIST						**Tool #16B**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 17 – Farmland Runoff	**Environmental Farm Plan**	**Tool #17**
References	▪ Agricultural Research and Extension Council of Alberta. Alberta Environmental Farm Plan web site. 2016. ▪ George Morris Centre. Potential Role of the Ontario Environmental Farm Plan in Responding to the Sustainability Demands of the Agri-food Supply Chain. ▪ Ontario. Info Sheet #21 Stream, Ditch and Floodplain Management. 2013.	
Key Purpose	To promote a higher percentage of farmers to adopt and put into practice environmental farm plans through encouraging farm operators to increase their environmental awareness by identifying the environmental attributes and strengths of the farm, identifying areas of environmental concern and evaluating farming practices, leading to the preparation of realistic actions to improve environmental conditions while assisting the profitability of the farm.	
Major Aspects	Process to address the whole farm – two workshops; farm review; develop action plan, peer review of draft action plan, implement the plan. Plan addresses, where applicable: ▪ Soil and site evaluation ▪ Water wells and treatment of household water ▪ Pesticide, fertilizer and petroleum products storage and handling ▪ Disposal of farm wastes ▪ Livestock yards and confinement areas ▪ Storage, use and management of manure and other organic materials ▪ Horticultural production and field crop management ▪ Silage storage ▪ Milk centre wash water ▪ Nuisances ▪ Water and energy efficiency ▪ Soil management ▪ Crop nutrient management ▪ Stream, ditch, floodplain, wetland management ▪ Woodlands and wildlife.	

MUNICIPAL CHECKLIST						**Tool #17**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 18 – Sand and Gravel Operations	**Extraction Area Land Use District and Regulations**	**Tool #18**
References	▪ Saskatchewan Department of Municipal Affairs. Planning Handbook. 2012. ▪ Louisiana Government. Recommended Best Practices: Nonpoint Source Pollution Sand & Gravel Mining Industry. ▪ British Columbia Ministry of Energy and Mines. Aggregate Operators Best Management Practices Handbook for British Columbia Volume II: Best Management Practices. 2002. ▪ Parkland County. Land Use Bylaw. 2009 (updated). ▪ Mountain View County. Land Use Bylaw Section 14.2 Aggregate Extraction/Processing District.	
Key Purpose	To provide for the removal, extraction, processing and transport of sand and gravel in manners observant of the landscape, resources including water on the site and nearby properties and adjacent land uses.	
Major Aspects	▪ Create a land use district in which sand and gravel extraction is a permitted or discretionary use ▪ Enunciate appropriate development standards, including but not limited to parcel size and setbacks ▪ Provide requirements for development permit applications, including but not limited to site location and area, existing land use and site features, details of the proposed uses (type of excavation, specific area and depth to be mined), effect on existing drainage patterns, environmental safeguards, reclamation plan including contouring, drainage and subsequent land use ▪ Required information to include: a plan showing existing land use, vegetation and other site features; a plan showing the boundaries of the excavation and depth thereof; a plan showing pre and post elevations and cross sections; a description of the proposed operation including a list of best management practices to be used (including those which address protecting water resources), the proposed timing and phasing program; anticipated impacts on nearby land and landowners, including proposed actions to minimize these impacts.	

MUNICIPAL CHECKLIST						**Tool #18**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 19 – Loss of Woodlands	**Dialogue and Action on Forest Management in the Eastern Slopes**	**Tool #19A**
References	▪ Alberta Agriculture and Forestry. Forest Management Plans – Forest Management (web page). ▪ West Fraser Timber Co. Ltd., Responsibility Report (March 14, 2016). ▪ West Fraser Timber Co. Ltd. Albert Woodlands Stewardship Report 2012. ▪ West Fraser Timber Co. Ltd. Water (web page).	
Key Purpose	Because the Eastern Slopes provide most of the source water within the Red Deer River watershed and forestry is a key economic activity, it is important that: municipalities throughout the watershed better understand forest industry actions to sustain the environment (forest, water, habitat, wildlife, etc.); and that the forest industry communicates with municipalities throughout the entire watershed regarding sustainable forest management and environmental responsibilities, including water conservation and the protection of source water quality. It is equally important that the forest industry listen and meaningfully respond to the questions, ideas and concerns of municipalities as an integral part of forest land use planning and operations.	
Major Aspects	▪ One RDRMUG meeting annually dedicated to land use management in the Eastern Slopes, with a primary presenter being the forest industry ▪ Special issue meeting of the RDRMUG related when so required ▪ Inviting input by the forest industry of any subsequent action by the RDRMUG regarding source water protection ▪ Education tours/field trips for on-site learning about forests, forest management, the multiple use of forests and conservation measures, including source water protection.	

MUNICIPAL CHECKLIST						**Tool #19A**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 19 – Loss of Woodlands	**Urban Forest Management Plan**	**Tool #19B**

References	▪ City of Edmonton. Urban Forest Management Plan. 2012. ▪ City of Mississauga. Urban Forest Management Plan. 2014.
Key Purpose	To monitor, maintain, protect and enhance the urban forest so the trees and woodlands remain environmentally effective and efficient. Municipalities have key roles in managing the 'forests' (woodlands and trees) on public land, to encourage the general public to be more aware of the value of trees and woodlands in the community and to interact with 'forests' on public land so as to not harm them but to serve to sustain them, as well as trees and wooded areas on their own properties so the urban forest will continue to be a social, health, economic and environmental benefit to future residents and visitors.
Major Aspects	▪ To define the urban forest ▪ Undertake canopy cover mapping, data assembly and analysis ▪ Identify the values and benefits of urban forests ▪ Identify challenges to urban forest sustainability ▪ Engage the community in defining an urban forest vision and desired outcomes ▪ Review current programs and practices ▪ Identify best practices and opportunities to act upon to reach the vision and desired outcomes ▪ Identify recommended objectives, strategies and actions ▪ Provide an implementation guide, including the phasing of actions.

MUNICIPAL CHECKLIST							**Tool #19B**
Your Municipal Priority	Not applicable			High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider		Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake				
	Not applicable but		Recommend to Watershed Group to consider/undertake				
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend		Participate in Watershed group

Threat 19 – Loss of Woodlands	**Woodlot Management Plan**	**Tool #19C**
References	▪ Alberta. Woodlot Management Guide for Alberta. 2015. ▪ Ontario Stewardship Councils. A Landowners Guide to Forest Management Basics.	
Key Purpose	To encourage owners of lands with woodlots to establish an action plan to conserve and sustain the woodland resources so they continue to meet the desires of owning the property, which may include one or all of: to enjoy a quiet, scenic place to live, to derive income through the harvesting of timber or firewood, to recreate or to maintain habitat for wildlife.	
Major Aspects	▪ A well thought out planning process, including set goals and objectives; identify resources – the forest; develop a management plan (and a business plan if applicable); implement actions and monitor their effectiveness; adapt the plan as necessary ▪ Goals and objectives are to be related to needs and desired outcomes ▪ Utilize the services of foresters, financial advisors, etc. to assist in management planning ▪ Map the property – boundaries, built features and sensitive features ▪ Research guidelines, regulations and bylaws to determine what may be done, not be undertaken and to conserve special features ▪ Identify the woodlot resources and required equipment, labour and finances to manage the woodlands and technical services to assist ▪ Prepare a written plan that clearly outlines actions, including if appropriate priorities and phasing ▪ Address in the plan conflicting objectives and how to address these (e.g. healthy stands of woods along a stream) ▪ Record activities to demonstrate the plan is being followed and to serve to review the effectiveness of the plan.	

MUNICIPAL CHECKLIST							**Tool #19C**
Your Municipal Priority	Not applicable			High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider		Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake				
	Not applicable but		Recommend to Watershed Group to consider/undertake				
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend		Participate in Watershed group

Threat 20 – Off-Highway Vehicle Activity	**Awareness and Enforcement**	**Tool #20**
References	▪ Clearwater County. Welcome To Our Backyard. 2014. ▪ Strathcona County. Off Highway Vehicles (brochure). ▪ Athabasca County. Off-highway Vehicle Bylaw 005-2017. ▪ Alberta Off-Highway Vehicle Association. Implementing the AOHVA 4-Point Plan for Environmentally Responsible OHV Use. 2017. ▪ Alberta Wilderness Association. Position Statement: Motorized Vehicles on Public Land. 2016.	
Key Purpose	To promote effective collaboration among the Province, municipalities, off-highway vehicle dealerships and users of off-highway vehicles so off-highway vehicle users better understand and become more committed to environmental stewardship, while also putting in place infrastructure (trails and campsites), regulations and enforcement measures to facilitate and promote increased environmental stewardship.	
Major Aspects	▪ Adopt an Off-Road bylaw to regulate and control the operation of off-highway vehicles, including where in the municipality the use off-highway vehicles are not permitted ▪ Make available, with and through other partners, public education information and programs for the general public, but especially the users of off-highway vehicles to be better aware of the proper and safe use of off-highway vehicles, including responsibility to safeguard sensitive landscapes and resources ▪ Make available information that the improper use of public land may be subject to a fine while the unauthorized use of private land constitutes trespass ▪ Collaborate with the Province to better monitor and enforce off-highway vehicle use on public lands ▪ Encourage the development of an expanded and improved off-highway trail system to assist recreators from using lands not suitable for off-highway recreation use.	

MUNICIPAL CHECKLIST						**Tool #20**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

Threat 21 – Irrigation Return Flows	**Dialogue and Action on Irrigation Return Flows**	**Tool #21**

References	▪ Alberta Government. Water Quality in Alberta's Irrigation Districts 2011 to 2015: 2014 Progress Report – Summary.
Key Purpose	Because the quality of the lower portions of the Red Deer River have received the cumulative impacts of human and natural influences, it is important that the irrigation return flows minimize further impacts on the quality of the Red Deer River for downstream users and the aquatic ecosystems. The purposes of dialogue would be: (1) To provide opportunities for municipalities throughout the Red Deer River Watershed to better understand the beneficial aspects of the irrigation industry and the actions taken by the industry in past years to more efficiently use water and minimize impacts of water quality and (2) to promote continued improvements to conserve water and protect water quality water, where appropriate through collaborative efforts to achieve these objectives.
Major Aspects	▪ One meeting of the RDRMUG at least every second year with representatives of the irrigation industry to discuss the irrigation industry and its use and impacts on the Red Deer River ▪ Special issue related meetings of the RDRMUG and the irrigation industry when so required ▪ Inviting input by the irrigation industry in any subsequent action by the RDRMUG regarding source water protection ▪ Education tours/field trips for on-site learning about irrigated water use/applications, water conservation measures, wetland and riparian land impacts, water quality testing of return flow conveyances (e.g. stream, canals).

MUNICIPAL CHECKLIST						**Tool #21**
Your Municipal Priority	Not applicable		High	Medium		Low
Your Municipal Action Status	Applicable so:	Consider	Start	Progressing		Complete
	While applicable also		Recommend to Watershed Group to consider/undertake			
	Not applicable but		Recommend to Watershed Group to consider/undertake			
Your Municipal Follow-up	None required	Budget	Implement	Monitor/ evaluate	Review/ amend	Participate in Watershed group

7. MUNICIPALITIES IN THE RED DEER RIVER WATERSHED HAVE NOT BEEN IDLE

7.1 Some Actions to Date

Within the Red Deer River watershed, municipalities have not been idle regarding the management of watershed areas in ways that serve to protect source water quality. A number of essential municipal roles are fundamentally related to watershed management. These include, but certainly are not limited to:

- Wastewater treatment systems (municipal and regional) that meet provincial standards for return flows
- Stormwater systems and programs that are being improved to reduce the impact of runoff into rivers and streams
- Rainwater harvesting, which is being encouraged by many municipalities for the on-site use of rainwater (e.g. gardens) thus reducing flows into stormwater systems and the use of municipal water
- Snow removal storage areas designed to capture pollutants (for safe disposal) during snow melt so the pollutants do not reach rivers and other water bodies.

Municipalities within the watershed also have undertaken many other programs regarding watershed management. While there are many municipal actions to care for land and water, some of these include:

- Land stewardship e.g. Red Deer County – Alternative Land Use Services (ALUS) and Green Acreages; Mountain View County – Riparian and Ecological Enhancement Program; Clearwater County – Welcome to Our Back Yard and Caring for My Land; Special Areas – Minimal Disturbance on Native Range Lands; County of Newell – on farm water management program; MD of Acadia Valley and Stettler County – riparian health assessment programs
- Environmental farm planning assistance e.g. Red Deer County, Clearwater County
- Environmental master plans e.g. Lacombe County; City of Red Deer
- Environmentally Sensitive Areas studies e.g. Red Deer County, Stettler County
- Water Conservation plans e.g. City of Red Deer Water Conservation, Efficiency and Productivity Plan
- Municipal Development Plans (many communities) that address the conservation of sensitive environmental features and the appropriate use of land therein and nearby
- Municipal Sustainability Plans e.g. Towns of Sylvan Lake, Town of Blackfalds, Town of Sundre, Town of Olds
- Special land use district e.g. Ponoka County – Watershed Protection District
- Floodplain land use regulations e.g. Town of Drumheller, City of Red Deer, Town of Sundre
- Assisting the formation and operation of the RDRWA, including membership on the Board of Directors.

There are many beneficial watershed and source water protection management practices remaining to be considered, and applied where appropriate, by communities within the Red Deer River watershed. These practices occur elsewhere in Alberta, other Canadian provinces, other places in North America and around the world.

Of course, learning is the first step – the application of learned beneficial practices is the second key step, followed by monitoring and adaptation.

8. OBSERVATIONS, CHALLENGE AND RECOMMENDATIONS

8.1 Observations

Of the three subwatersheds that contribute to the South Saskatchewan River, the Red Deer River watershed is the largest, encompassing 49,650 km² (19,170 sq. miles). While much larger than the Bow River and Oldman River watershed areas, because the mountainous headwater area of the Red Deer River is significantly smaller than the other two watersheds, the Red Deer River contributes only about 20% to the flow of the South Saskatchewan River.

There are 81 municipalities wholly or partially located in the Red Deer River watershed and/or have the Red Deer River as their source for municipal water. Of these, 16 are rural municipalities and 65 are urban communities. More than 50 have the Red Deer River as its source for municipal water (note: many smaller urban communities and most portions of rural municipalities rely on groundwater).

Water availability is critical to the social, economic and environmental health of municipalities. Thus, surface and groundwater source water protection is vital to communities to ensure there is sufficient water to meet municipal needs throughout the watershed far into the future. Since poor water quality detrimentally impacts aquatic ecosystems and requires greater treatment costs to provide potable water, it is paramount that municipalities act in many ways to minimize impacts on source water, including the quality of source water.

There are many threats, both natural and human induced, to source water security and source water quality within the Red Deer River watershed. Of the 34 threats initially identified by the Red Deer River Municipal Users Group, this report addresses 21 threats, including the relevance of each threat in terms of its impacts to source water and water quality. Some threats are regional (watershed and sub-watershed) in nature, while others are more local and site specific in nature. Certainly, not all threats are relevant to every community.

It is vitally important that municipal land use management strategies, plans and actions integrate the consideration of impacts on source water quality and quantity, both surface and ground water. Integrated action is essential to ensure that both land and water are conserved for the sustained benefit of the municipalities, including their residents and businesses, and the health of the environment. In this regard municipalities have three key spheres of influence in protecting source water and its quality:

1. the sphere of the watershed – managing land use through land use planning, managing land use impacts, deterring point source and non-point source pollution and conserving wetlands, riparian lands and aquatic habitat
2. the sphere of the water – managing water use and quality through water conservation and utilizing high standards of drinking water, wastewater and stormwater management, and
3. the sphere of education - promoting of land and water stewardship.

It is incumbent on municipalities to take part in source water protection, preferably through each of the three spheres of influence. Most are already doing so in one or more ways.

But, municipalities can and should do more.

8.2 Challenge

This report challenges communities throughout the Red Deer River watershed to prioritize land and water management policies and practices to enhance water security and quality within the Red Deer River watershed. While individual actions by each community are important, so too are collective actions through municipalities working together.

This Toolkit report prompts municipalities to reflect on the strategic importance of water to their community and to recognize they have important roles in safeguarding source water and its quality, not only for their own use, but also the use of other municipalities and other water users, and the environment. The Toolkit report identifies a variety of tools to address threats to source water. Each tool indicates how the application of the tool will attend to one or more threats to promote source water security and source water quality. Recognizing the current and future impacts of threats, municipalities - individually and collectively - throughout the watershed need to reflect on these and respond appropriately.

8.3 Recommendations

One of the purposes of Red Deer River Municipal User Group is to serve as an advocate of municipal interests in the supply, use, delivery and quality of water. While municipal needs are at the heart of this purpose, Red Deer River Municipal User Group municipalities recognize the fundamental need of all water users to have access to clean water, including but not limited to the agricultural community, industry, recreators and aquatic life. Access to, and the wise use of, water is critical to sustain the economic, social and environmental fabrics of the Red Deer River watershed.

As an association of municipalities in the Red Deer River watershed, the Red Deer River Municipal User Group has no authority to undertake specific land use and water management actions to ensure there is safe, secure drinking water and reliable quality water supplies for a sustainable economy and healthy aquatic ecosystems. However, in performing a needed advocacy role, the Red Deer River Municipal User Group can serve to encourage others to act to prudently manage land and water to safeguard the supply and quality of water and to promote water literacy through meaningful forums and reports that promote action, by municipalities and others. As such, the Red Deer River Municipal Users Group offers the following recommendations:

8.3.1 Red Deer River Municipal Users Group

That the Red Deer River Municipal Users Group (RDRMUG):

- distribute the Toolkit for Protecting Source Water Quality in the Red Deer River Watershed to all municipalities in the watershed, as well as those outside the watershed who use Red Deer River water and/or return water to the Red Deer River
- encourage each municipality to prioritize land and water management policies and practices to enhance the security and quality of source water within the Red Deer River watershed
- encourage, and assist as able, the Red Deer River Watershed Alliance, to advance the Red Deer River Integrated Watershed Management Plan, including provisions to protect source water and its quality
- identify an action plan, including prioritizing key actions, for the Red Deer River Municipal Users Group, in association with the Red Deer River Watershed Alliance, to further the protection of source water and its quality and to increase water literacy

throughout the watershed; this may be based in part on the Oldman Watershed Council "Water Charter" program which draws municipalities together to provide a synergy for each municipality to identify and commit to source water protection actions
- consider, with other partners, the rolling out of education and training opportunities for municipal officials and staff.

8.3.2 Red Deer River Watershed Alliance

The Red Deer River Watershed Alliance has included source water protection as a key component and recommendation in *Blueprint,* an Integrated Watershed Management Plan*,* and in doing so recognizes the initiative of the Red Deer River Municipal Users Group to address the need to protect source water.

That the Red Deer River Watershed Alliance:
- collaborate with the Red Deer River Municipal Users Group on an action plan to protect source water, and its quality, in the Red Deer River watershed
- work with municipalities to explore and advance source water protection efforts
- continue to pursue with a range of partners the implementation of Recommendation 6 in *Blueprint*: "Identify and address risks to source waters, including water used as a source of drinking water."

8.3.3 Regional Water and Wastewater Commissions

That the Regional Water Commissions and Regional Wastewater Commissions:
- collaborate with municipalities and other regional partners to improve understanding throughout the watershed of the importance of source water, the quality of source water and what can be done to protect this strategic resource
- continue to review and update treatment processes so the effects on the receiving 'source waters' are minimized.

8.3.4 Municipalities

That each municipality:
- become more familiar with the importance of protecting source water and source water quality, and municipal roles therein
- consider the relevance and significance of each threat each tool worksheet Sections 6.1 to 6.3 in the Toolkit Report
- Assess each 'tool' in Section 6.4 of the Toolkit Report and determine what action is (or actions are) most applicable. In doing so municipalities are encouraged to:
    1. consider the relevance of each tool
    2. fill out the Municipal Checklist at the bottom of each tool worksheet in Section 6.4;
    3. transfer the information each from tool worksheet to the Tool Assessment Worksheets at the end of the Toolkit Report;
    4. evaluate/prioritize the threats and action tools most relevant to the municipality and overall watershed needs
    5. determine a municipal action plan to assist in improving the security of source water and its quality; and
    6. implement, monitor and update the municipal action plan.
- collaborate with other municipalities, water users and the activities impacting source water in order to maximize the benefits by joint actions.


Source
Water
Protection
Starts
with
YOU!

APPENDIX A

Red Deer River Municipal Group Member Municipalities

Acadia Valley, Municipal District
Acme, Village
Alix, Village
Big Valley, Village
Blackfalds, Town
Bowden, Town
Carstairs, Town
Clearwater, County
Consort, Village
Crossfield, Town
Delburne, Village
Didsbury, Town
Donalda, Village
Drumheller, Town
Halkirk, Village
Hanna, Town
Innisfail, Town
Kneehill, County
Lacombe, County
Linden, Village
Mountain View, County
Newell, County
Olds, Town
Oyen, Town
Paintearth, County
Red Deer, City
Red Deer, County
Special Areas
Starland, County
Stettler, County
Stettler, Town
Sundre, Town
Sylvan Lake, Town
Three Hills, Town
Trochu, Town

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_____ **OVERALL THREAT ACTION EVALUATION WORKSHEET**

Municipality **(1)**

TOOL		Climate Change Adaptation Plan	Water Conservation Plan	Drought Preparedness Plan	Natural Water Retention Plan	Water Storage Strategy	Flood Management Strategy	Flood Control Evaluation Strategy	Community Wildfire Protection Plan	Protection of Significant Aquifers
Tool No.		1	2A	2B	2C	2D	3A	3B	4	5
Priority Rating	Not applicable									
	High									
	Medium									
	Low									
Action Status If Applicable	Consider									
	Start									
	Progressing									
	Complete									
	And Refer									
Not Applicable	Refer									
	Don't refer									
Follow-up	None									
	Budget									
	Implement									
	Monitor									
	Review									
	Participate with others									

_____ **OVERALL THREAT ACTION EVALUATION WORKSHEET**

Municipality **(2)**

TOOL		Wellhead Protection Risk Management. Plan	Environmental Conservation Management plan	Development Guidelines	Riparian Land Conservation Action Plan	Stream/Lake side Protection Area	Wetland Conservation Action Plan	Wastewater Treatment Master Plan	Wastewater Treatment Facility Optimization	Stormwater Management Plan
Tool No.		**6**	**7A**	**7B**	**8A**	**8B**	**9**	**10A**	**10B**	**11A**
Priority Rating	**Not applicable**									
	High									
	Medium									
	Low									
Action Status If Applicable	**Consider**									
	Start									
	Progressing									
	Complete									
	And Refer									
Not Applicable	**Refer**									
	Don't refer									
Follow-up	**None**									
	Budget									
	Implement									
	Monitor									
	Review									
	Participate with others									

_____ **OVERALL THREAT ACTION EVALUATION WORKSHEET**

Municipality **(3)**

TOOL		Stormwater Wetland Management Guide	Municipal Waste Management Master Plan	Regional Waste Management Approach	Biosolids Production (Municipal and Regional)	Biogas Production	Salt Management Plan	Snow Storage Facility Plan	Municipal Development Plan (Update)	Community Sustainability Plan
Tool No.		11B	12A	12B	12C	12D	13	14	15A	15B
Priority Rating	Not applicable									
	High									
	Medium									
	Low									
Action Status If Applicable	Consider									
	Start									
	Progressing									
	Complete									
	And Refer									
Not Applicable	Refer									
	Don't refer									
Follow-up	None									
	Budget									
	Implement									
	Monitor									
	Review									
	Participate with others									

_____ **OVERALL THREAT ACTION EVALUATION WORKSHEET**

Municipality **(4)**

TOOL		Smart Growth	Low Impact Development	Green Acreages	Floodplain Mapping and Regulations	Floodplain Management Strategy	Environmental Farm Plan	Extraction Area Land Use District and Regulations	Dialogue and Action on Forest Management in	Urban Forest Management Plan
Tool No.		**15C**	**15D**	**15E**	**16A**	**16B**	**17**	**18**	**19A**	**19B**
Priority Rating	**Not applicable**									
	High									
	Medium									
	Low									
Action Status If Applicable	**Consider**									
	Start									
	Progressing									
	Complete									
	And Refer									
Not Applicable	**Refer**									
	Don't refer									
Follow-up	**None**									
	Budget									
	Implement									
	Monitor									
	Review									
	Participate with others									

_____ **OVERALL THREAT ACTION EVALUATION WORKSHEET**

Municipality **(5)**

TOOL		Woodlot Management Plan	Off Highway Vehicle Awareness and Enforcement	Dialogue and Action on Irrigation Return Flows						
Tool No.		19C	20	21						
Priority Rating	Not applicable									
	High									
	Medium									
	Low									
Action Status If Applicable	Consider									
	Start									
	Progressing									
	Complete									
	And Refer									
Not Applicable	Refer									
	Don't refer									
Follow-up	None									
	Budget									
	Implement									
	Monitor									
	Review									
	Participate with others									