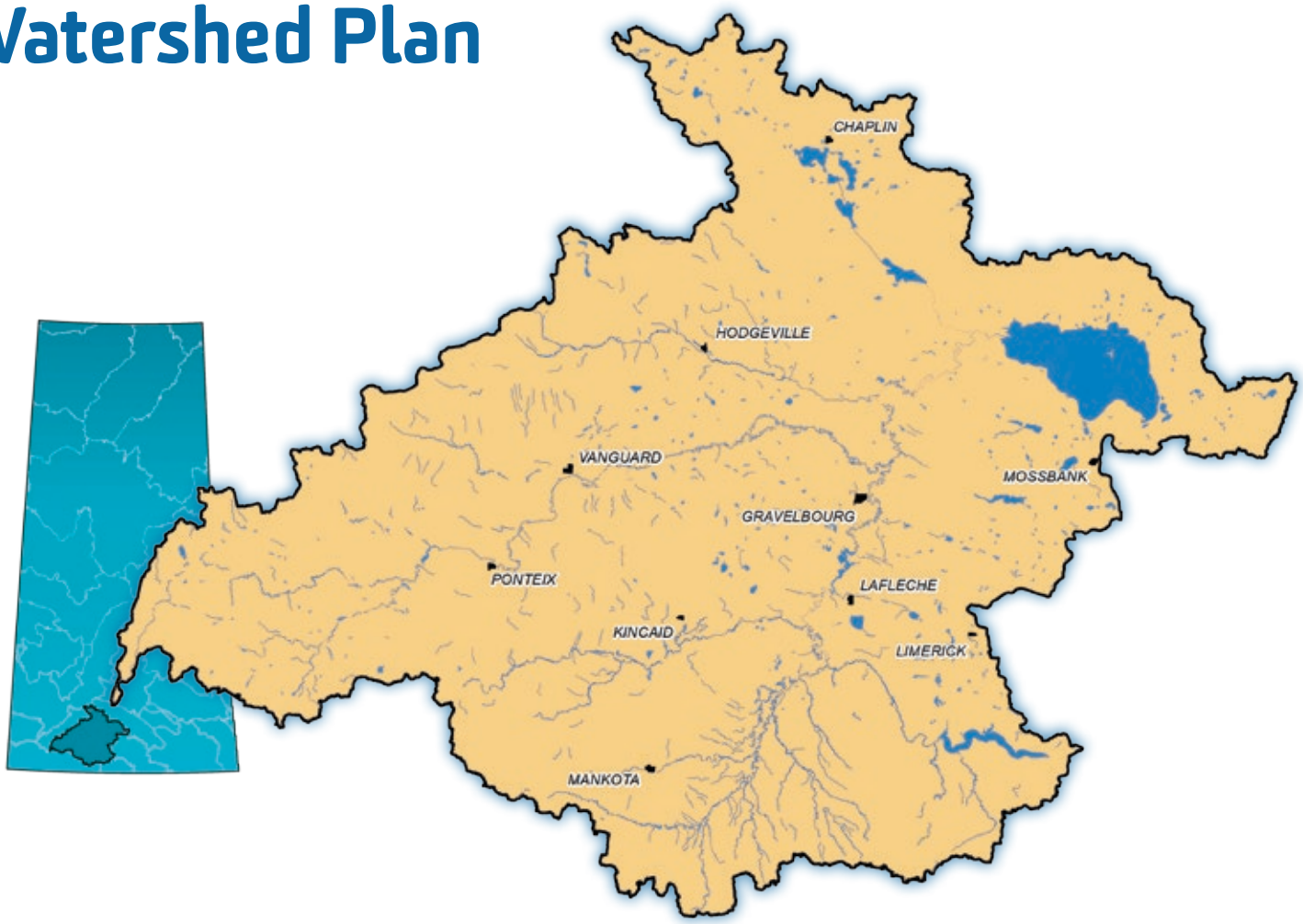
SASKATCHEWAN

Water Security Agency

November 2014

Old Wives Lake Watershed Plan



OWWA
Old Wives Watershed Association

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Message from the President, Water Security Agency

Saskatchewan has set out its goals for water management in the 25-Year Saskatchewan Water Security Plan which was released in October 2012. The 25-Year Plan sets out seven goals that support its stated vision: *Water supporting economic growth, quality of life and environmental well-being*.

The Water Security Agency was created to lead implementation of the 25-Year Plan and integrates all aspects of water management to ensure sustainable water supplies, safe drinking water, safe and effective infrastructure, and protection of water quality and aquatic habitats.

The watershed and aquifer planning program directly supports Goal 3 of the 25-Year Plan, "Protection of Water Resources," and action area 3.4, "Source water protection planning."

The planning program establishes partnerships between government, industry and communities in working toward water security at the watershed level within Saskatchewan.

The Old Wives Lake Watershed Plan addresses safe drinking water, ecosystem health, extreme climate moisture event preparedness and the sustainable use of water. Implementation of these strategies is very important to achieve water security for the Old Wives Lake Watershed.

Publication of the Old Wives Lake Watershed Plan is a significant accomplishment and I congratulate the members of the watershed advisory committee, the technical advisory committee, the staff and board of the Old Wives Watershed Association and the Watershed Planning staff for developing this plan. I especially want to recognize the considerable volunteer efforts in the development of the plan and for the continuing efforts now being dedicated toward plan implementation. Thank you for your commitment to effective water management.

Wayne Dybvig, President

Water Security Agency

Message from the Old Wives Watershed Association

The Old Wives Watershed Association (OWWA) is pleased to share with you the Old Wives Lake Watershed Plan. The dedicated effort of individuals throughout the entire watershed over the past two years has culminated in the publication of this plan today.

Over the past ten years, the OWWA has grown from the Wood River Riparian Authority into a larger organization with a more comprehensive mandate. The OWWA has matured from an organization that delivered agri-environmental programming to producers in a portion of the watershed to working with urban municipalities and youth across the entire watershed. As the OWWA evolved, so did the need for a Watershed Plan. Urban and rural municipalities, individuals, board members and dedicated employees worked hard to initiate the Old Wives Lake Watershed Plan.

The publication of the plan is not the end, but rather a renewed beginning. The actions identified in this plan will help achieve the objectives and address the water-related issues identified by those involved in the planning process. These actions will be achieved through active partnerships with local governments, individuals and area organizations. Sustained support from the Provincial Government is critical for the successful implementation of the plan.

In closing, the OWWA presents you with a challenge to become active and engaged in what is happening in the watershed while appreciating those people who are managing our land and water resources. Show support for OWWA initiatives that seek to enhance water security in OUR watershed.

Sincerely,

Board of Directors

Old Wives Watershed Association

1. Executive Summary

The Old Wives Lake Watershed Plan (Plan) is the twelfth in the suite of plans produced under the Saskatchewan Water Security Agency's (WSA) watershed and aquifer planning program. The Old Wives Lake Watershed (Watershed) is located in southwestern Saskatchewan and is part of the Missouri River Basin. It is approximately 16,850 km^2 and is bordered to the east by the Moose Jaw River Watershed and to the west by the Swift Current Creek Watershed. The Watershed is one of the few in the province that is closed to surface water outflow, which means that water only exits through evapotranspiration, groundwater recharge and consumption.

The WSA's watershed planning process is based on extensive collaboration between local stakeholders and government and non-government agencies. Between the fall and winter of 2011, the WSA Planning Team led the formation of a Watershed Advisory Committee (WAC) comprised of local stakeholders, and a Technical Advisory Committee (TAC) comprised of technical experts from government and non-government agencies.

WAC meetings were held between June 2012 and June 2014, to facilitate the development of the Plan. During that time, WAC members were presented with technical information and they identified water-related issues and engaged in the development of the core elements of this plan—the vision, goals, objectives and key actions. In this manner, the overall direction for the Plan was established by the WAC members through the identification of interests and issues that shaped the Plan's vision and goals.

With the vision and goals established, the Planning Team engaged TAC members to undertake the development of objectives and key actions that would achieve the vision and the goals. These components were primarily the responsibility of the TAC members, but to ensure there was support for all core elements of the plan from both WAC and TAC members, the Planning Team facilitated the integrated review and refinement of all core elements. This collaborative decision-making process is an enhancement to the watershed planning model first utilized in the development of the Lower Qu'Appelle River Watershed Plan.

The output of this collaborative effort between the WAC and TAC members and the Planning Team is the Old Wives Lake Watershed Plan that consists of the core elements of the vision, six goals, 16 objectives and 34 key actions.

Vision

Sufficient water quality and adequate water supplies that meet the current and future community, economic and ecosystem needs in the Old Wives Lake Watershed

Goal 1 **Safe drinking water is available to watershed residents in a sustainable manner**

Goal 2 **Thomson Lake is a source of quality water for watershed residents and provides recreational opportunities**

Goal 3 **Riparian and aquatic ecosystem services provided by the Wood River, Notukeu Creek, Wiwa Creek and their tributaries are enhanced**

Goal 4 **Habitat diversity to maintain or increase migratory bird and species at risk populations**

Goal 5 **Water and watershed infrastructure is managed proactively to address drought and excessive moisture events**

Goal 6 **Water use is efficient and fair and considers all stakeholders and their needs, including domestic, agricultural and industrial, and future economic development**

The Plan's 16 objectives and 34 key actions create an integrated and comprehensive strategy to achieve the vision and goals. These objectives and key actions primarily seek to address known water-related issues and also to promote data collection to fill knowledge gaps to support future decision-making.

The watershed planning process identifies and explores threats to water quality, water quantity and the aquatic ecosystem. To enhance the focus of the planning process on source water protection, the Planning Team initiated a community-based source water protection planning exercise in two watershed communities. The Planning Team partnered with the Old Wives Watershed Association (OWWA) in the development and delivery of the pilot projects, with the goal of building capacity in the OWWA toward the development of additional community-based source water protection plans during the watershed plan implementation phase.

The publication of this plan establishes a foundation to guide local water management; however, the success of the Old Wives Lake Watershed Plan will ultimately be measured by the degree to which it is successfully implemented. The OWWA is a locally based watershed stewardship group that will lead plan implementation by continuing to foster partnerships with local stakeholders and government and non-government agencies established throughout the planning process.

2. Introduction

Water sustains all life and supports human economic, social and environmental well-being. Simply put, the importance of water cannot be overstated. Access to water by all members of society, and the availability of sufficient water supplies and suitable water quality to meet the broad spectrum of water uses, is a universal goal for water management. The variable nature of Saskatchewan's climate has a significant influence on water management and extreme climate events, such as drought and floods, create challenges in the pursuit of this goal.

Water management is a provincial responsibility and the WSA is the key agency tasked with managing the province's water resources to ensure safe drinking water sources and reliable water supplies for economic, environmental and social benefits for Saskatchewan people.

In support of this mandate, the WSA leads the implementation of the 25-Year Saskatchewan Water Security Plan, which establishes a long-term strategy to manage water supplies to support growth, protect water quality and respond effectively to floods and drought. The following seven goals are the core elements of the plan:

- Sustainable Supplies
- Safe Drinking Water
- Protection of Water Resources
- Safe Dams
- Flood and Drought Damage Reduction
- Adequate Data, Information and Knowledge
- Effective Governance and Engagement

The watershed and aquifer planning program is one of the many WSA programs that support the achievement of the 25-Year Saskatchewan Water Security Plan and the WSA mandate. Watershed planning is accomplished through collaborative effort among government and non-government agencies and local stakeholders. The planning process identifies and explores threats to water quality and quantity, and threats to the aquatic ecosystem, and provides a forum for local stakeholders to develop a plan to address these threats and contribute to water security.

The watershed planning process relies on collaboration with and expertise from government and non-government agencies. These technical experts assemble information to target areas of concern, inform discussion among partner agencies and stakeholder representatives, present options to address issues, answer questions from WAC members, and engage in decision-making in the development of the actions contained within a plan.

Once a plan is developed, a non-profit, community-based organization is formed to lead its implementation. To date, 11 watershed stewardship groups, including the OWWA, have been formed and are currently implementing a watershed or aquifer plan.

These watershed stewardship groups receive technical support from the federal and provincial government and non-government organizations, receive core funding from the WSA, and strive to access additional funding from local, provincial and regional funding organizations. This support is critical to plan implementation as it allows the watershed stewardship groups to hire additional staff and finance projects and programs in addition to the basic operations that the WSA grant permits.

The Old Wives Lake Watershed

The Watershed is located in southwestern Saskatchewan and is part of the Missouri River Basin. It is approximately 16,850 km^2 and is bordered to the east by the Moose Jaw River Watershed and to the west by the Swift Current Creek Watershed. The Watershed is one of the few in Saskatchewan that is closed to surface water outflow, which means that water only exits through evapotranspiration, groundwater recharge and consumption.

The Rush Lake Basin west of Chaplin Lake was excluded from the planning area. This area was previously included in the Swift Current Creek Watershed Plan published in 2009, since water from the Swift Current Creek can be diverted into the Rush Lake Basin for irrigation.

Figure 1: Old Wives Lake Watershed

The largest stream in the Watershed, the Wood River, originates along the southern boundary of the Watershed. Flowing northeast, it ultimately drains into Old Wives Lake or into Chaplin Lake through an engineered diversion. A channel between the Wood River and Chaplin Lake is controlled in order to divert water to the lake for salt production at the Saskatchewan Mining and Minerals Inc. sodium sulphate plant. Notukeu Creek, another significant watercourse, flows in an easterly direction from the western slopes of the Watershed to its confluence with the Wood River north of Gravelbourg. Russell and Mosquito Creeks are tributaries to Notukeu Creek. Wiwa Creek, the other main tributary to the Wood River, follows an easterly course from its origins southeast of Swift Current to its confluence with the Wood River north of Gravelbourg. Pinto, McDonald, Six Mile, Lynthorpe and Flynn Creeks are other tributaries to the Wood River that contribute water from the southern portion of the Watershed.

Wood River south of Mankota

Wood River downstream from the Lafleche Dam

Wood River near Coderre

In addition to the naturally occurring water bodies, there are a number of man-made reservoirs. Thomson Lake, formed by the Lafleche dam on the Wood River, is the largest fresh water body in the Watershed and serves as the source of drinking water for the communities of Gravelbourg and Lafleche. There are seven reservoirs located in the Watershed: Admiral, Cadillac, Gouverneur, Russell Creek, Braddock, Summercove and Kincaid.

The Watershed has an estimated population of 9,300 residents, and includes 32 rural municipalities, 17 towns, villages, and organized hamlets, and one First Nation. Economic activity in the Watershed is dominated by agriculture. Additional information on the biophysical and socio-economic characteristics of the Watershed is provided in Section 4.2 *Watershed Characterization*.

3. Planning Process

The WSA follows the *Protecting our Water: A Watershed and Aquifer Planning Model for Saskatchewan* (Model) to guide watershed planning. The Model focuses on protecting water at the source through an approach known as source water protection,[1] an essential component of any strategy to minimize contamination risks in a drinking water system. In addition to focusing planning efforts on source water protection in the strict sense, the Model is designed to allow participants in the planning process to explore and address a suite of water-related issues including water quality and quantity, water demands, flooding and drought, climate change, the protection of riparian and wetland areas, and the maintenance of biodiversity.

Watershed planning is a collaborative process of building partnerships between local stakeholders and government and non-government technical experts. Members of the WAC serve to represent local stakeholders during the planning process, members of the TAC provide technical content to support and engage in decision-making and the Planning Team works collaboratively with both the WAC and the TAC to facilitate, focus and guide plan development.

The WAC members represented the interests of their organizations, provided valuable local knowledge, identified local issues, and engaged in decision-making toward the development of the Plan. The WAC for the Old Wives Lake Watershed was comprised of representatives from rural and urban municipalities, regional parks, agricultural producer associations, a water utility board, a weed management area and the OWWA, an existing watershed stewardship group, based in Gravelbourg. Since the OWWA was established prior to the initiation of the Plan, OWWA board members were represented on the WAC, and OWWA staff partnered with the Planning Team to support the development of the Plan.

The TAC was comprised of federal, provincial and non-government agency representatives that regulate, manage, protect, as well as enhance the current state of knowledge of Saskatchewan's natural resources. TAC members supported the development of technical background information, delivered technical presentations and engaged in decision-making toward the development of the Plan. Staff from three WSA divisions with expertise in drinking water, water quality, and surface and ground water served as TAC members. Agencies external to the WSA represented on the TAC included the following:

- Agriculture and Agri-Food Canada
- Ducks Unlimited Canada
- Environment Canada
- Fisheries and Oceans Canada
- Five Hills Health Region
- Ministry of Agriculture
- Ministry of Economy
- Ministry of Government Relations
- Nature Conservancy of Canada
- Saskatchewan Wildlife Federation

The Planning Team was comprised of two representatives from the WSA who managed the overall planning process by engaging and collaborating with the WAC and TAC. Key Planning Team responsibilities included compiling and presenting technical background information, leading WAC and TAC meetings, and facilitating the development of the Plan. A list of the WAC members, TAC members and the Planning Team is provided in Appendix A.

Milestones

The development of the Plan occurred over a period of three years; the active planning process took approximately two. Preparatory work, including the formation of the TAC and WAC and the collection of background information, began in August 2011.

The background folio is a document fundamental to the watershed planning process as it supports the development of the Plan by characterizing the Watershed in terms of water supply and use, water quality and ecosystem health. The document was prepared by the Planning Team, and it served to develop a common understanding of the Watershed among the planning participants.

Watershed Advisory Committee Meetings

The first WAC meeting was held in June 2012. Members of the WAC were presented with an overview of the planning process and then engaged in an initial discussion of local water-related concerns. The WAC members also received a terms-of-reference document outlining the principles of the planning process, an explanation of the consensus-based, decision-making process and a description of the roles and responsibilities of the WAC, TAC and Planning Team. These terms of reference were adopted at a subsequent WAC meeting. The WAC meetings held between July 2012 and June 2014 focused on the delivery of the planning themes and the development of the core elements of the Plan.

Planning Themes

The information compiled in the background folio was presented to the members of the WAC in a series of meetings based on the planning themes:

- The State of the Watershed Report
- Watershed Characterization
- Water Supply and Use
- Water Quality and Source Water Protection
- Ecosystem Services
- Water Governance

Information within these themes was presented and discussed at WAC meetings held between August 2011 and June 2013. The State of the Watershed Report theme utilized results from the 2010 State of the Watershed Report; a report published by the WSA that benchmarks watershed health in Saskatchewan. The Watershed Characterization theme provided an overview of the Watershed's biophysical and socio-economic characteristics. The Water Supply and Use, Water Quality and Source Water Protection, and Ecosystem Services themes provided opportunities for WAC members and the Planning Team to focus discussions on local water-related issues and develop strategies to address them in the Plan. Lastly, the Water Governance theme served to clarify water governance in Saskatchewan and across Canada. Canadian and provincial/territorial water governance is a complex topic and a thorough understanding assisted in clarifying the role for the Plan and the OWWA. Specific background information contained in the State of the Watershed Report, or presented in the Watershed Characterization, Water Quality and Source Water Protection, and Ecosystem Services themes is provided in Section 4 *Planning Themes*.

Decision-Making Process and Plan Development

The WAC meetings held between June 2012 and June 2013, utilized an interest-based process—a group facilitation process that promotes open, honest and persuasive communication, and the development of respect and trust.[2] This process is based on the identification of issues (a problem or concern) and interests (the values that drive the issue). This approach is beneficial in achieving consensus as it seeks to create a solution that can accommodate the greatest number of participant interests.

Over the course of eight meetings, the Planning Team facilitated the identification of water-related issues and interests through input from WAC members. The results were then categorized and prioritized by the WAC in preparation for the development of the Plan's vision and goals.

As depicted in Figure 2, the development of the Plan's vision, goals, objectives and key actions is a collaborative process between the WAC, the TAC and the Planning Team. The overall direction for the Plan was established by the WAC members through the development of the vision and goals; while the development of the objectives and key actions were the primary responsibility of the TAC members. The Planning Team facilitated the review and refinement of all four core elements of the plan to ensure support from both WAC and TAC members. This approach served to increase the involvement of TAC members in the drafting of measurable and achievable objectives and key actions that strive to support long-term provincial water management goals in an integrated manner. Between February and June 2013, the Planning Team initiated a series of vision development and goal setting meetings. The specific interests and issues utilized in the development of each goal are discussed in Section 7 *Watershed Plan Goals, Objectives and Key Actions*.

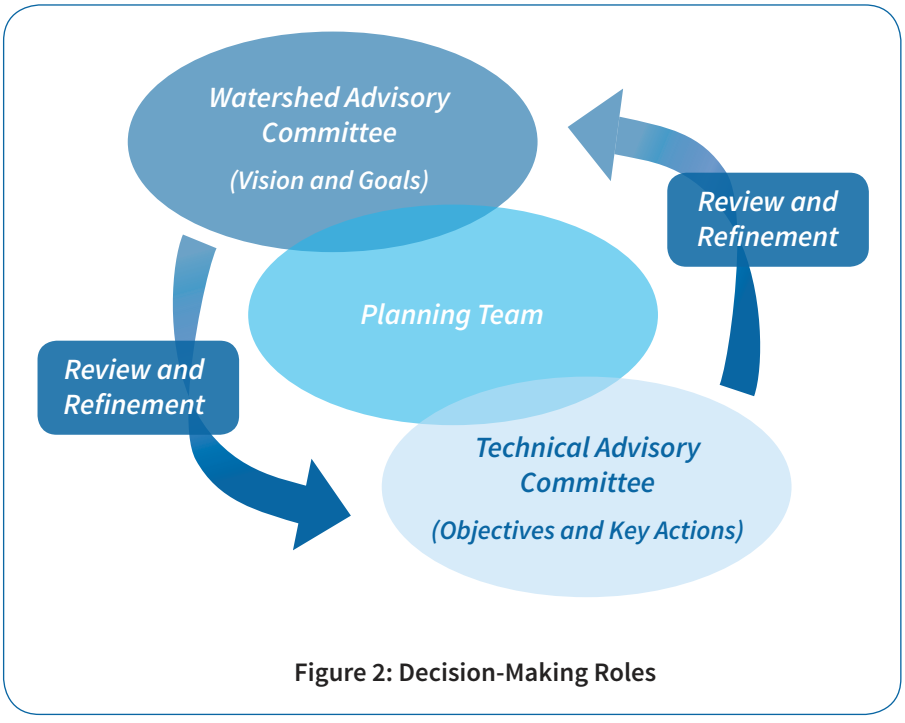


Figure 2: Decision-Making Roles

Core Elements of the Plan

Vision: *describes the desired future state of the Watershed*

Goals: *specific qualitative statements that collectively achieve the vision*

Objectives: *quantitative, specific, measureable statements that describe a specific state*

Key Actions: *defined and quantifiable actions, which, if carried out, will change current conditions to meet the state defined by the objective*

The watershed and aquifer planning program is designed to have non-profit, community-based watershed stewardship groups lead implementation of the plans; experience has demonstrated that clearly defining the role of the watershed stewardship group within the Plan is beneficial. To support this, each key action was developed with the watershed stewardship group as the lead, although certain key actions explicitly describe partnerships with additional organizations. This approach differed from previous watershed plans where agencies other than the watershed stewardship group were indicated as the lead. Instances in some of these previous watershed plans assigned key actions to government or non-government agencies that conflicted with core mandates, or were constrained by legal precedence, and rendered them unachievable. The key actions in the Plan are more focused and achievable as the implementation of each key action will be led at the local level.

With the vision and goals established, the Planning Team shifted focus to the engagement of specific TAC members to undertake the development of objectives and key actions that would achieve the goals and ultimately the vision. The Planning Team and members of the TAC worked collaboratively between June and December 2013 to draft these objectives and key actions.

As the objectives and key actions were drafted, the Planning Team hosted three WAC meetings between October 2013 and January 2014 to enable WAC members to review and refine these core elements. The complete draft Plan was developed and circulated for review between January and April 2014. A final WAC meeting was held in June 2014 to review and adopt the complete draft Plan. This meeting marked the completion of the planning process.

4. Planning Themes

The planning themes assist in setting the context for the Plan's vision, goals, objectives and key actions.

4.1. State of the Watershed Report

The 2010 State of the Watershed Report (Report) is a benchmark for assessing watershed health in Saskatchewan. The reporting process is based on a stress-condition-response model, and uses indicator-based assessments to rate watershed health, environmental stressors and management responses. This model explicitly recognizes relationships between the health of the watershed (condition), human impacts on the ecosystem (stressors), and the associated management activities (responses) adopted to mitigate the stresses and improve the health of the watershed.

The Report assessed the health of each of Saskatchewan's watersheds based on ecosystem services, ecosystem function and the watershed's resistance and resilience to change. A watershed is rated

- Healthy: If the watershed has no apparent change in function or services provided by water and the system is both resistant and resilient to change.
- Stressed: If the watershed has no degradation in function and/or services it provides, but it has lost resistance and resilience to change.
- Impacted: If the watershed has a change and/or degradation in function and/or services.

According to the Report, the condition of the Old Wives Lake Watershed was classified as stressed since three of the four conditions were rated as stressed (see Table 1). A stressed classification means that although the Watershed has no degradation in function or the services it provides, it has lost resistance and resilience to change.

Table 1: Old Wives Lake Watershed – State of the Watershed Condition Indicators[3]

Condition Indicator	Indicator Description	Healthy	Stressed	Impacted	Condition
Surface Water Quality	The Water Quality Indicator is an assessment of the chemical, biological and physical constituents within the water.	80 to 100	45 to 79	< 45	N/A*
Groundwater Quality	The Groundwater Quality indicator measures the percentage of groundwater wells that exceed human-influenced Maximum Acceptable Concentrations.	0%	> 0% to ≤ 50%	> 50%	Stressed
Aquatic Benthic Macro-invertebrates	The Aquatic Benthic Macroinvertebrates Indicator assesses the health of aquatic benthic macroinvertebrates in Saskatchewan.	≥ 90%	11% to 89%	≤ 10%	Healthy
Riparian Health	The Riparian Health Indicator measures the ability of a riparian area to perform the essential functions of trapping sediment, filtering runoff, stabilizing streambanks, recharging groundwater and providing wildlife habitat.	80% to 100%	60% to 79%	< 60%	Stressed
Riparian Buffer	Riparian Buffer is the per cent of permanent cover within a 40-metre strip of the adjacent waterway.	75% to 100%	25% to 74%	< 25%	
Rangeland Health	The Rangeland Health Indicator measures the ability of a rangeland to perform the essential functions of reducing soil erosion, increasing water infiltration, and reducing runoff.	75% to 100%	50% to 74%	< 50%	Stressed
Environmental Acid Deposition	This indicator measures the exceedance of critical load of atmospheric sulphur and nitrogen deposition.	≤ 0 eq/ha/yr	> 0 eq/ha/yr		N/A*
		Health Grade			Stressed

*Data for the Surface Water Quality and Environmental Acid Deposition condition indicators are unavailable for the Watershed.

Of the 29 Saskatchewan watersheds, six were classified as healthy, 19 were classified as stressed, including the Old Wives Lake Watershed, and four were classified as impacted.

Stressor indicators assess issues related to human population, water use, agriculture, and industry, and 22 of these stressor indicators have been developed to assess the potential stress of human activities on Saskatchewan watersheds. Since more than five of the 22 stressor indicators were classified as high intensity, the Watershed was determined to have a high intensity rating.

Response indicators include conservation efforts, education, stewardship, and planning and policy activities. These indicators were classified as either present or absent. According to the 2010 Report, the Watershed was determined to have a high response rating since more than 75 per cent of the response indicators were active or present in the Watershed in 2010.

4.2. Watershed Characterization

The Watershed Characterization theme provided an overview of the following biophysical and socio-economic characteristics: geology, topography, ecodistricts, climate, watercourses and water bodies, soils, land cover, fish and wildlife, human demographics, public infrastructure, agriculture, industry, land tenure, and recreation. A number of these characteristics are discussed below; others are discussed in subsequent sections of the Plan.

Ecodistricts

Ecological boundaries are categorized hierarchically across Canada at varying scales. Ecodistricts are reflections of local biophysical influences such as climate, soil, relief, and water availability, which result in distinctive vegetation. There are five primary ecodistricts located within the Watershed: the Wood Mountain Plateau, the Swift Current Plateau, the Dirt Hills, the Wood River Plain, and the Chaplin Plain. The following descriptions were sourced from *The Ecoregions of Saskatchewan*.[4]

The Wood Mountain Plateau forms the southern portion of the Watershed and is characterized by the presence of numerous creeks and gullies with brown loam soils occurring on the plateaus and slopes and regosolic soils in the gullied areas. Elevations in this ecodistrict range from 850 to 1,000 metres above sea level.

Wood Mountain Plateau south of Cadillac

The Swift Current Creek Plateau establishes the west and northwest boundary of the Watershed and is characterized by brown loam soils and glacial till. Plateau elevations range from 880 to 975, down to 750 metres above sea level on the plains.

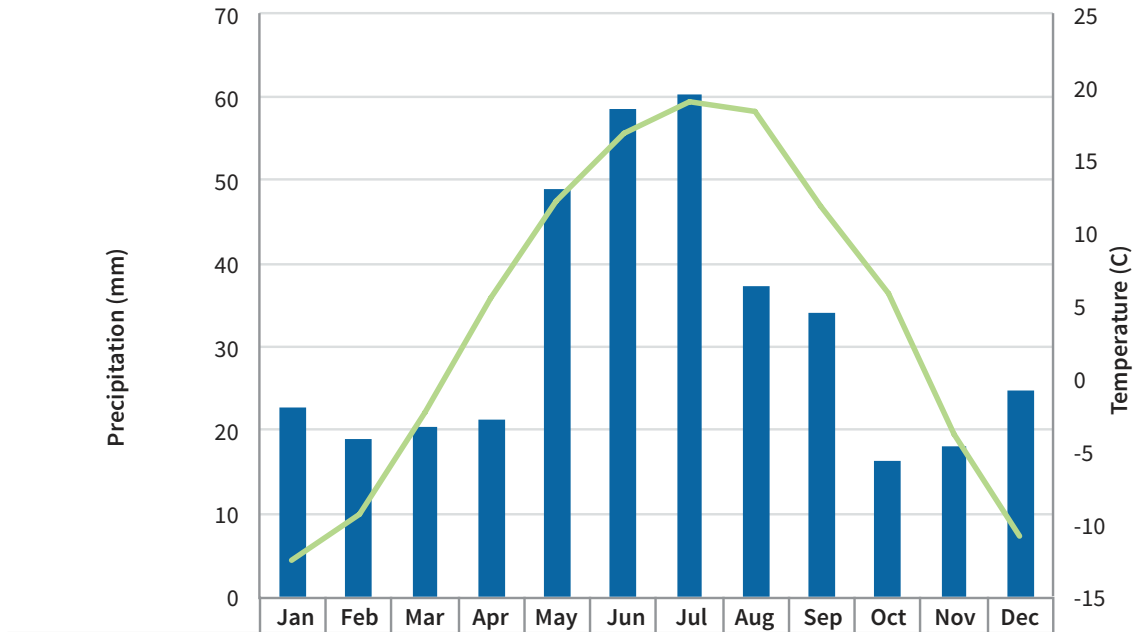
The Dirt Hills forms the northeast portion of the Watershed and is a hilly, hummocky morainal landscape characterized by dark brown loam soils and elevations that range from 600 to 820 metres above sea level.

The Wood River Plain is located in the interior of the Watershed and is characterized by brown loamy soils with localized clay deposits and elevations which range from 850 to 730 metres above sea level in the south, while flattening out to 640 metres in the northeast.

Lastly, the Chaplin Plain intersects the Wood River Plain and the Dirt Hills ecodistricts. Elevations here range from 770 metres above sea level in the uplands down to 640 around Chaplin and Old Wives Lake. This ecodistrict is dominated by brown loam soils while sandy and gravelly brown soils are present in the hummocky portions of the landscape.

Climate

The Watershed has a semi-arid climate characterized by wide variations in temperature and a mean annual precipitation of approximately 380 mm per year, characterized by snowfall between November and March, followed by periodic rainfalls between April and October. The climate normals for Gravelbourg are provided in Figure 3.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (mm)	22.8	19	20.3	21.2	48.9	58.5	60.4	37.4	34.2	16.4	18.2	24.8
Temperature (C)	-12.5	-9.3	-2.3	5.5	12.1	16.8	19	18.3	11.8	5.9	-3.8	-10.8

Figure 3: Gravelbourg Climate Normals (1971–2000)[5]

Land Cover

Inventorying land cover provides insight into the spatial extent of land use and human activities that may influence water quality and quantity. Land cover information was interpreted from 2006 satellite imagery captured during the months of May, July, and September. The categories, percentages of cover, and descriptions are included in Table 2 and Figure 4.

Table 2: Land Cover

Category	Percentage	Description
Annual Cropland	58.10	Summerfallow can account for an estimated 6.5 per cent to 18 per cent of land cover.
Native Pasture	26.24	Native and seeded grazing land but not riparian areas. Some shrub land may be included.
Tame Pasture and Hayfields	10.01	Native and seeded grazing land. Hayfields include land used for cut forage. Some shrub land may be included.
Water and Riparian Areas	5.13	Permanent water bodies, and saturated landscapes with wetland vegetation species. The wetland classification also includes riparian areas.
Urban and Barren	0.42	Populated areas, badlands, and salt and mud flats.

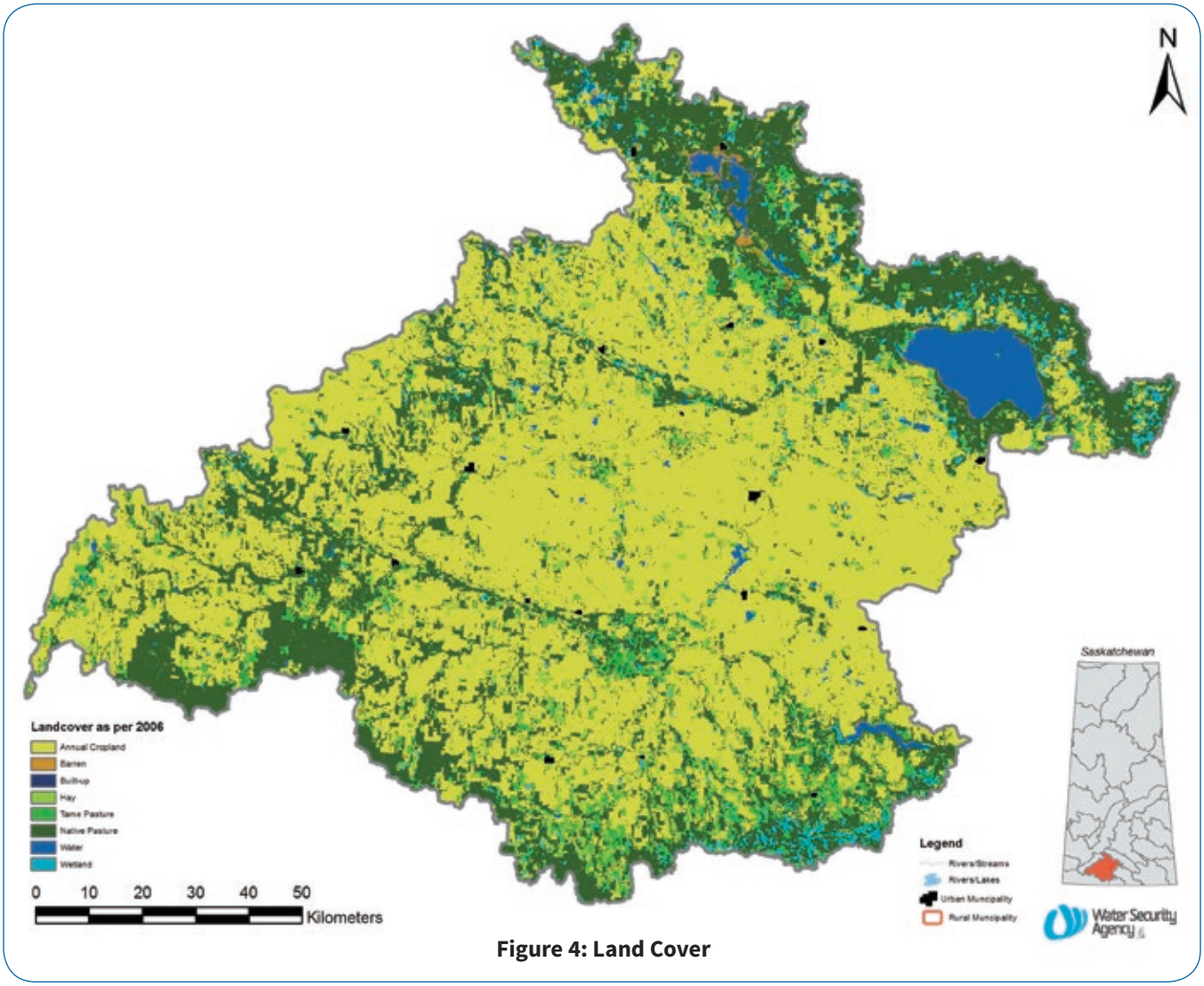


Figure 4: Land Cover

Demographics

Municipal population trends provide valuable information for future planning purposes. Data was collected for 32 rural municipalities, 17 urban municipalities, and one First Nation. Data was also collected for 12 additional urban municipalities that have dissolved into their respective rural municipalities. In order to calculate the total estimated population for the Watershed, a population density calculation (persons per square kilometre) was utilized for rural municipalities. Based on census data, the total population was estimated to be 10,665 in 2001, 9,478 in 2006, and 9,346 in 2011. Although the total population decreased between 2001 and 2011, the rate of decline slowed from –11.13 per cent between 2001 and 2006 to –1.39 per cent between 2006 and 2011. Of the estimated 9,346 people in the Watershed, rural and urban residents are categorized at 58.13 per cent and 41.87 per cent respectively. The largest urban municipality in the Watershed is the Town of Gravelbourg with a population of 1,116 in 2011.

Gravelbourg, SK

Ponteix, SK

Municipal Drinking Water Systems

Residents of the Watershed's urban municipalities are served by 24 municipal drinking water systems, regulated by the WSA, and listed by water source in Table 3. Eighteen of the 24 municipal drinking water systems are classified as human consumptive systems. Six are classified as hygienic use systems, only licensed for non-consumptive personal hygiene uses such as bathing, not for cooking, food preparation or oral hygiene.

Table 3: Municipal Water Systems

Community	Source
Town of Gravelbourg	Surface
Town of Lafleche	Surface
Village of Limerick	Surface
Village of Mankota	Surface
Mazenod (dissolved municipality)	Surface
Palmer (dissolved municipality)	Surface
Woodrow (dissolved municipality)	Surface
Admiral (dissolved municipality)	Groundwater
Aneroid (dissolved municipality)	Groundwater
Village of Cadillac	Groundwater
Village of Ernfold	Groundwater
Ferland (dissolved municipality)	Groundwater
Village of Kincaid	Groundwater
Organized Hamlet of McCord	Groundwater
Meyronne (dissolved municipality)	Groundwater
Town of Mossbank	Groundwater
Town of Ponteix	Groundwater
Village of Shamrock	Groundwater
Coderre (dissolved municipality)	GUDI
Village of Hodgeville	GUDI
Village of Vanguard	GUDI
Village of Chaplin	Suspect – GUDI
Courval (dissolved municipality)	Suspect – GUDI
Pambrun (dissolved municipality)	Suspect – GUDI

In Saskatchewan, water beneath the surface of the ground can be considered **Groundwater Under the Direct Influence of Surface Water (GUDI)** if that water exhibits

- A significant occurrence of insects or other macro-organisms, algae or large-diameter pathogens, including *Giardia lamblia* and *Cryptosporidium*; or
- A significant and relatively rapid shift in water characteristics, including turbidity, temperature, conductivity or pH factors, that closely correlate to climatological or surface water conditions.

Municipal Wastewater Systems

Most municipal wastewater treatment in the province is through the use of facultative lagoons, which take advantage of naturally occurring aerobic and anaerobic bacteria to break down organic matter in wastewater. There are a total of 21 communities in the Watershed with a central sewage lagoon facility. More than half these facilities do not discharge or they discharge into non-contributing areas. Only a small number of these facilities make intermittent releases into a receiving watercourse or water body.

Agriculture

Agriculture is the dominant land use in the Watershed. Data provided by Statistics Canada from the 2006 Agricultural Census estimates a total of 2,254 farms in the Watershed, and close to 95 per cent of the land base is dedicated to some form of agricultural production, predominately crop production, which forms a significant portion of the land use across the Watershed particularly through the interior region. Livestock production is the other main agricultural pursuit, with cattle production dominant on the more marginal soils along the southern and northwest zones of the watershed.

Cattle grazing near Vanguard

Industry

Mineral and petroleum industrial activity is quite limited in the Watershed. The only producing mine at present is the Saskatchewan Mining and Minerals Inc. sodium sulphate mine at Chaplin Lake. A large field of natural gas extends south from Swift Current with some production currently occurring in the Watershed. Oil and natural gas could potentially be discovered in other locations in the future. Sand and gravel aggregate from glacio-fluvial and postglacial fluvial deposits and crushable aggregate from the Wood Mountain and Cypress Hills formations are locally exploited for road building and construction.

Cropland near Thomson Lake

Saskatchewan Mining and Minerals Inc. operation at Chaplin Lake

Land Tenure

The majority of the land in the Watershed is privately held agricultural land. Other land tenure classifications include First Nation land, provincial community pastures, wildlife habitat protection lands, Fish and Wildlife Development Fund lands primarily surrounding Old Wives and Chaplin Lakes, provincial Crown agricultural lease land, and Agriculture and Agri-Food Canada community pastures.

4.3. Water Supply and Use

Water is a fundamental component of any sustainable community. By managing and protecting this vital resource, society benefits from such services as access to drinking water, support for agriculture and industry, and the provision of aquatic and riparian habitat for fish and wildlife and water-based recreation. The following section discusses surface and ground water availability and allocation, drought and excessive moisture, and climate change.

Surface Water

The mean annual precipitation for the Watershed is approximately 380 mm per year with snowfall accounting for roughly 30–40 per cent of total precipitation. Water supply in a given year is a reflection of spring snowmelt and spring and summer rainfall. Infiltration rates of soils in the grassland region in summer are high and this limits runoff during the summer period; therefore, the majority of runoff is generated during spring snowmelt when the infiltration capacity of frozen soils is limited. Most of the surface flows originate from the west and southern edges of the Watershed with very little runoff generated in the comparatively flat central area. **Hydrometric stations** provide flow information for watercourses in the Watershed. There are 10 active hydrometric stations in the Watershed and historic data is also available from 13 discontinued hydrometric stations, with periods of record ranging from one to 53 years. Figure 5 compares **mean annual discharge** in **cubic decametres (dam³)** for the larger streams in the Watershed.

Hydrometric Station – Wood River diversion to Chaplin Lake

A **hydrometric station** monitors and records water flow.

Mean annual discharge is the average volume of water in a year that would flow past a point.

A **cubic decametre (dam³)** is equal to 1,000 cubic metres, used to examine the amount of water that is stored or moving.

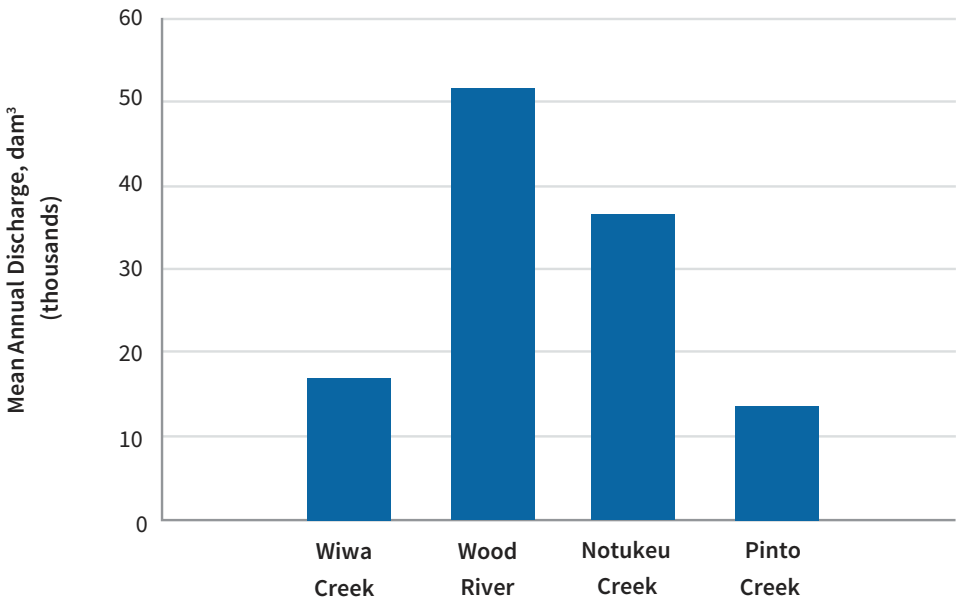


Figure 5: Mean Annual Discharge (dam³)

The mean annual discharge of the Wood River measured at a hydrometric station near Lafleche was 50,800 cubic decametres (dam^3) for the period 1944 to 2012. This volume has varied from a low of 107 dam^3 in 2008 to a high of 311,000 dam^3 in 2011. The mean monthly flow of the Wood River over the 68 years of data available is 2.45 **cubic metres per second (m^3/s)**. However, it is not uncommon for flow to be negligible or non-existent for several months each year. This pattern of extremes in flow characterizes the other watercourses in the Watershed.

Cubic metres per second (m^3/s) is a measurement of the rate at which a watercourse is flowing.

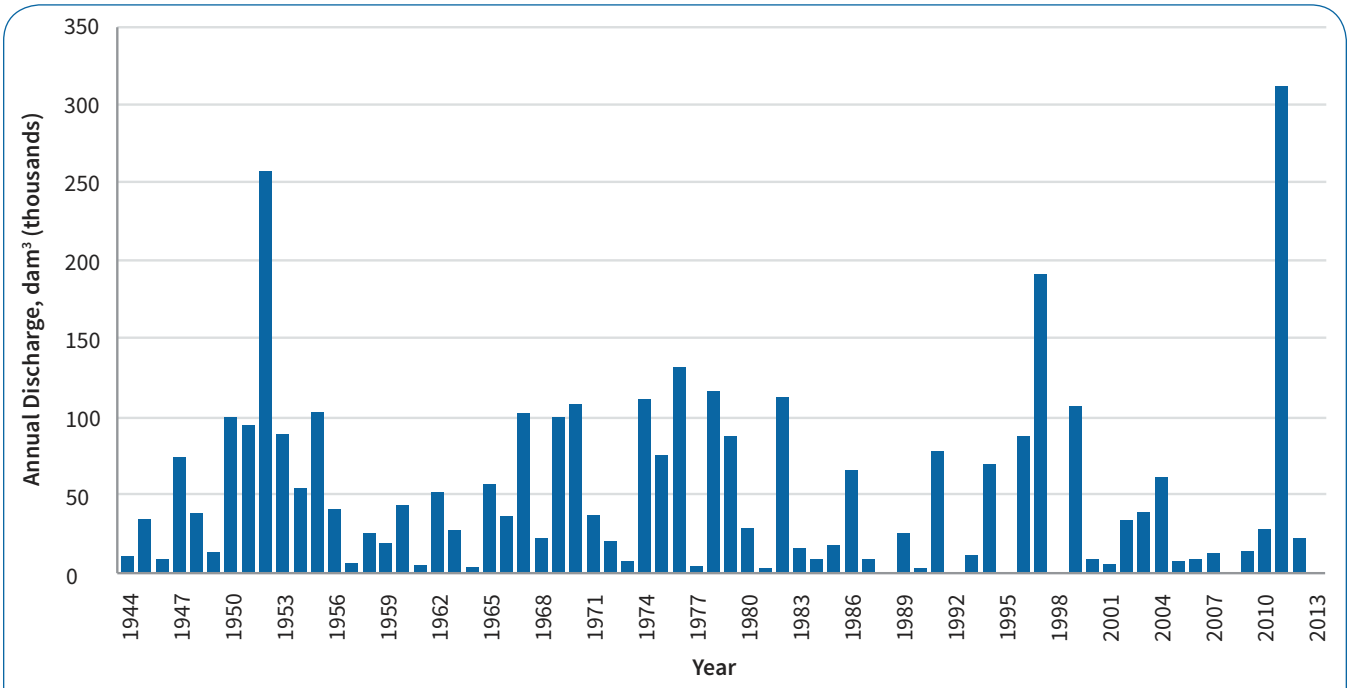


Figure 6: Wood River Annual Discharge

There are a number of natural lakes, wetlands and poorly drained lowlands within the Watershed. Old Wives Lake is the largest natural water body in the Watershed with a total lakebed area of approximately 300 km^2.[6] Since the Watershed is closed to surface water outflow, the main factors influencing water levels are inflows and evaporation from these water bodies. Although the Watershed is considered a closed system, under extreme water levels Old Wives Lake would eventually outflow to the Lake of the Rivers and Willow Bunch Lakes and then into Big Muddy Lake and the Missouri River system. Such extreme amounts of runoff would also result in huge water surface areas being exposed to evaporation. Under such conditions, evaporative losses would exceed runoff, thus making any occurrence of outflow extremely unlikely under current climatic conditions.

Russell Creek Dam

In addition to the Watershed's watercourses and natural water bodies, there are a number of man-made reservoirs. The Prairie Farm Rehabilitation Administration (PFRA), a branch of the Federal Government, was established in 1935 in response to prairie droughts, farm abandonment, and land degradation. Since that time, the PFRA designed, constructed and operated thousands of dams and canal embankments in the three Prairie Provinces. Dozens of these dams were completed in southwest Saskatchewan, providing drinking and irrigation water to its residents. Table 4 provides a list of such dams and their uses in the Watershed.

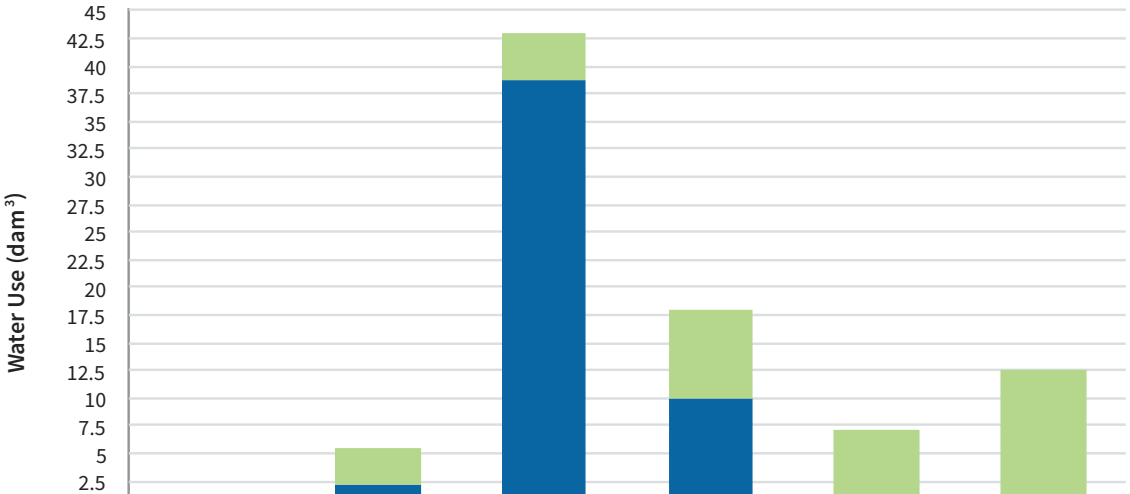
Gouverneur Dam

Table 4: Dams

Dam	Construction Date and Location	Capacity (dam³)	Uses
Admiral	Constructed in 1949 at a site on Notukeu Creek near Admiral	3,686	• Livestock
Cadillac	Constructed in 1946 at a site on Bull Creek near Cadillac	4,840	• Livestock
Gouverneur	Constructed between 1951–1952 at a site on Notukeu Creek near Ponteix	14,760	• Irrigation
Russell Creek	Constructed in 1950 on a site on Russell Creek near Vanguard	3,540	• Irrigation
Braddock	Constructed in 1951 at a site on Wiwa Creek near Braddock	1,974	• Livestock
Lafleche	Constructed between 1955–1958 at a site on Wood River approximately 10 km south of the Town of Gravelbourg	67,622	• Municipal water supply • Regional pipeline • Irrigation • Recreation
Summercove	Constructed in 1949 at a site on Wood River approximately 10 km south of the Village of Mankota	1,973	• Municipal water supply • Regional pipeline • Irrigation
Kincaid	Constructed at a site west of the Village of Kincaid	< 1,000	• Backup municipal water supply

Surface Water Allocation

Water use can be discussed in terms of offstream or consumptive water use, and instream or non-consumptive water use. Consumptive water use withdraws water from a source (i.e. drinking water, irrigation, etc.). In these instances, often a portion of the water is returned post use but the quality of the returned water may be degraded. Non-consumptive water use includes uses for fish, wildlife and recreation. In these instances, water is used but not withdrawn from a source and water quality is not typically affected. Consumptive uses are separated into municipal, domestic, irrigation, industrial, multi-purpose, and other water uses. As surface water is subject to evaporation, surface water allocations are described as the allocation, evaporative losses, and the total diversion. The total diversion is the sum of the allocation and evaporative losses. Figure 7 illustrates surface water allocation and losses in the Watershed.



	Municipal (18)	Domestic (1,267)	Irrigation (859)	Industrial (10)	Multi-Purpose (14)	Other (37)
Losses	148	3,435	4,157	7,901	7,077	12,621
Allocation	922	2,081	38,804	9,972	85	29

Figure 7: Surface Water Allocation (dam³)

There are 18 municipal surface water allocations serving as both primary and backup water sources, with the Town of Gravelbourg and the Town of Lafleche collectively accounting for 70 per cent of the total allocation. The average allocation for the 1,267 domestic licences is 1.64 dam^3; however, since not all domestic uses require a licence, these numbers do not account for all such uses. A licence is not required for domestic water use for any person who owns or occupies land which adjoins a body of surface water, providing the water is used for domestic or livestock purposes on the land, no works are constructed to impound or divert water, and the use is less than 5 dam^3.

Irrigation is the largest user of water by volume in the Watershed.

The average allocation for an irrigation licence is 45 dam^3, with nine per cent of all irrigation allocations exceeding 100 dam^3. Irrigation allocations can be grouped by type. The majority of the 859 irrigation licences are back flood or back flood drainage projects, with 648 licences totalling 21,459 dam^3. These projects only use water when it is available and typically do not compete with other uses in shortages. Sprinkler irrigation projects account for 185 licences and have a total allocation of 14,115 dam^3. The remaining 26 projects, totalling 3,230 dam^3, are border-dyke, contour dyke and gated-pipe irrigation projects. Approximately four and a half per cent of the total irrigation licences and three per cent of the total irrigation allocation have been cancelled. An additional approximate four per cent of the total irrigation licences and five per cent of the total irrigation allocation are pending cancellation, which means they will likely be cancelled. An allocation may be cancelled at the initiative of a client or the WSA. Incompatible soils and poor water quality, mainly highly saline surface water, has limited local irrigation operation and development potential in the Watershed.

Industrial water use typically involves facilities that require a significant quantity of water. There are a total of 10 industrial surface water licences within the Watershed with a total allocation of 9,972 dam^3. Two of the industrial licences are held by intensive livestock operations and two others are held by a railway. Six additional licences are held by Saskatchewan Mining and Minerals Inc., which operates the sodium sulphate plant at Chaplin Lake. The sodium sulphate is utilized by over 80 customers in detergents, pulp and paper, glass, textiles, starch, carpet deodorizers and livestock mineral feed.[7] The plant has been in operation since 1948, when it first opened as a Saskatchewan Crown corporation.[8] Today the plant operates as a private enterprise. A channel between the Wood River and Chaplin Lake is controlled in order to divert water to Chaplin Lake for salt production and waterfowl habitat. A water supply agreement was signed between Saskatchewan Mining and Minerals Inc. and Ducks Unlimited Canada (DUC) in 1985. Saskatchewan Mining and Minerals Inc. holds the water rights licence on Chaplin Creek and is entitled to the use of the first 7,400 dam^3 of diverted water. Saskatchewan Mining and Minerals Inc. will store water in Chaplin Marsh for use in the mine reservoirs. DUC operates the Wood River Diversion/Chaplin Creek/Chaplin Marsh/Chaplin Lake projects in conjunction with Saskatchewan Mining and Minerals Inc.

Saskatchewan Mining and Minerals Inc. was the largest industrial water user at the time of publication.

Saskatchewan Mining and Minerals Inc. operation

Multi-purpose water licences are generally associated with the reservoirs in the Watershed. There are a total of 14 multi-purpose projects with a total allocation of 27 dam^3, total losses of 6,967 dam^3, and a total diversion of 6,994 dam^3. Other-water-use licences relate to projects that create and/or preserve wildlife habitat: DUC holds the majority of the 37 licences. These multi-purpose and other-water-use licences do not compete with the other water uses as they are largely evaporative losses.

Groundwater

Groundwater is the water that occurs beneath the ground surface in the cracks and void spaces in soil, sand, and rock. The area where water completely fills the pore spaces is called the saturated zone and the top of the saturated zone is the water table. Aquifers are formations from which water can be removed economically. Aquifers can be overlain or underlain by confining layers (aquitards), which are soil and rock formations like clays and silts that permit slower movement of groundwater. There are two types of aquifers, confined and unconfined. A confined aquifer means the aquifer is bounded at the top and bottom by an aquitard and an unconfined aquifer means the aquifer is bounded by an aquitard at the bottom and the water table at the top (see figure 8).

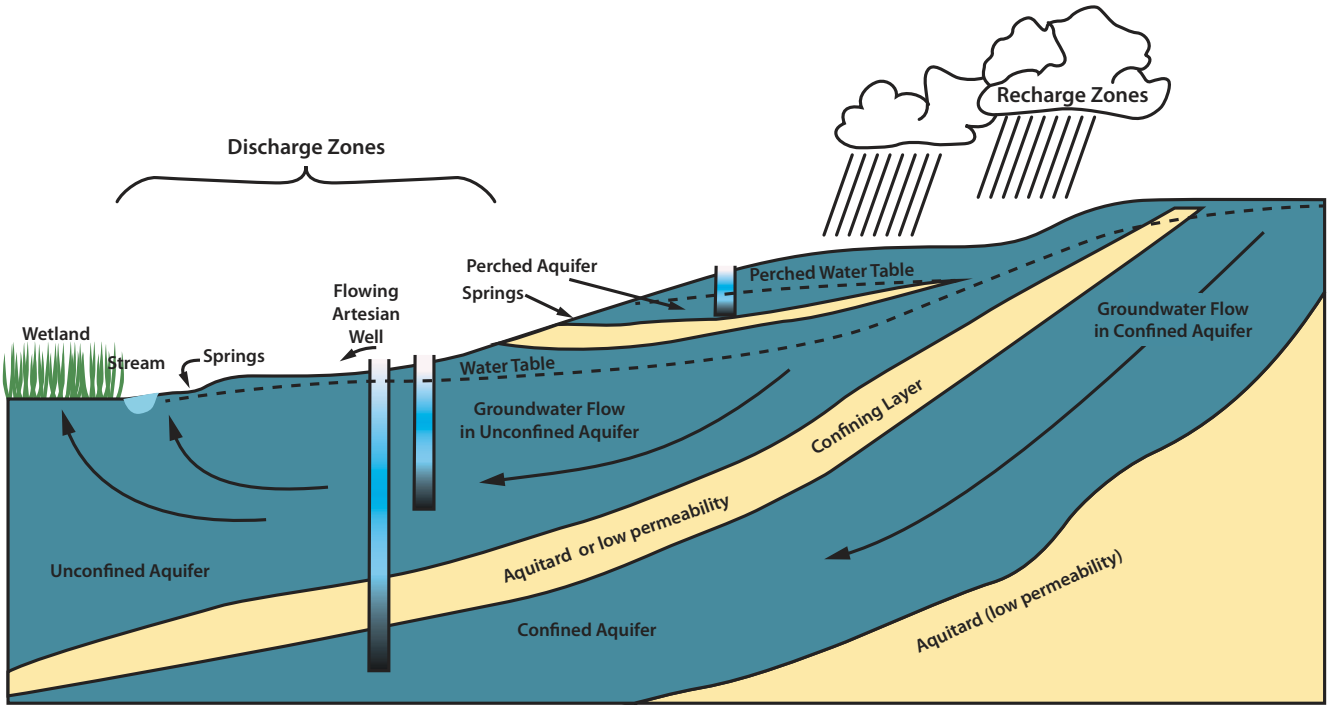


Figure 8: Aquifers and Aquitards[9]

Geologic units may be broadly divided into bedrock and glacial drift, which can be differentiated based on their characteristics and geologic history. Bedrock describes rocks occurring below the base of the glacial deposits. Glacial drift refers to those sediments between the top of the bedrock and the present ground surface. The major bedrock aquifers in the Watershed include the Judith River Formation, Bearpaw sands and the Eastend–Wood Mountain Formations. These formations tend to be found at depths greater than 100 metres and typically do not fluctuate significantly with short-term variations in surface moisture conditions. The major glacial drift aquifers in the Watershed include the Empress Group, the Sutherland Group, and the Saskatoon Group Formations. These formations tend to be subject to rapid lateral and vertical changes in extent, thickness and distribution but are the most common groundwater source in Saskatchewan. Figure 9 provides a cross-section of the regional geology in the Watershed.

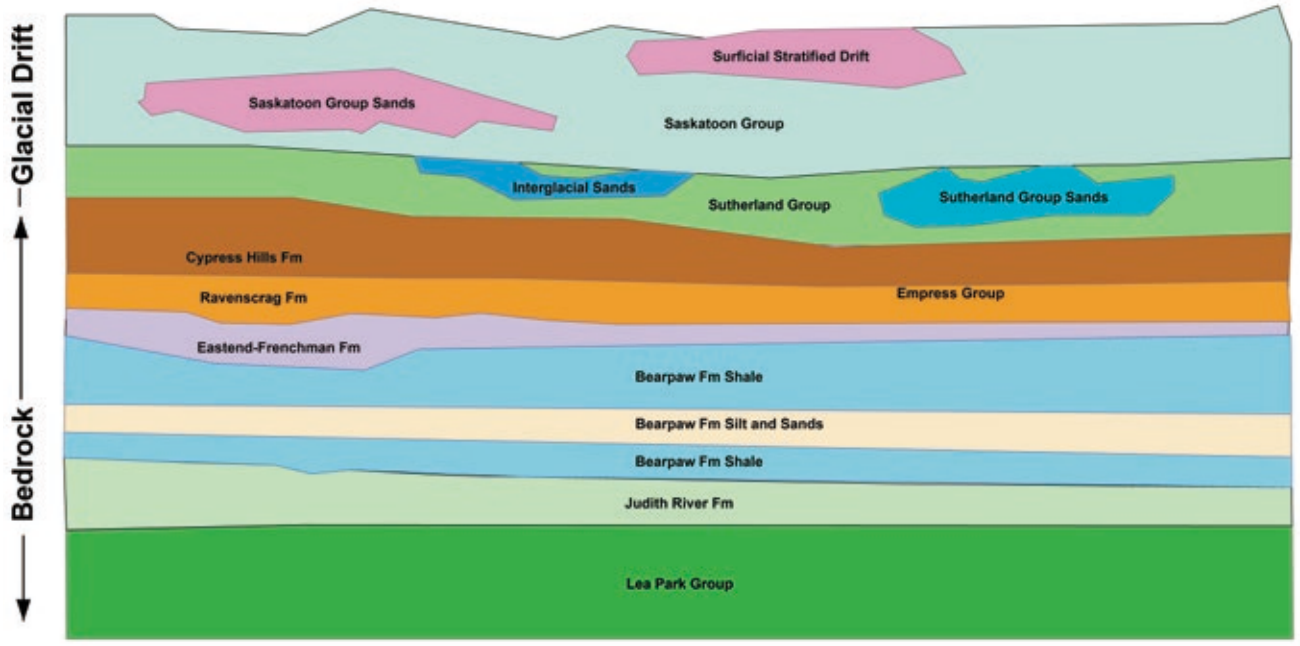


Figure 9: Regional Geology Cross-Section in the Old Wives Lake Watershed

Bedrock Aquifers

In general, sediments of the Judith River Formation are light gray, fine-grained sandstones and siltstones and coal. The saturated sands in the Judith River Formation are referred to as the Judith River aquifer system. Typically, the depth to the top of the formation ranges from 230 to 600 metres below ground surface. Locally, it may occur much shallower, particularly in valleys. The Judith River aquifer is recharged by precipitation and surface water where it is encountered near the ground surface. Where the aquifer is not near the ground surface, recharge is mainly by downward flow through the overlying Bearpaw Formation aquitard.

The Bearpaw sediments are of marine origin and consist predominantly of dark-coloured marine shales with interbedded silts and sands. The interbedded silts and sands form thin, but relatively continuous sand members of the Bearpaw Formation. These sand members form potential aquifers suitable for domestic users. The names of the Bearpaw sand members are, in ascending order, the Outlook Member, Matador Member, Demaine Member, Ardkenneth Member and the Cruikshank Member. These sand members are separated from each other by marine silt and clays aquitards and are considered as separate aquifers.

The Eastend, Whitemud, Battle, Frenchman, Ravenscrag, Cypress Hills, and Wood Mountain aquifers have been grouped together and are referred to as the Eastend–Wood Mountain aquifer. The aquifer system consists of sands, silts, clays and coal. Lignite-coal deposits are found in the Ravenscrag Formation. These aquifers occur around the Village of Wood Mountain and at the western portion of the Watershed. The aquifer is typically overlain by thin drift deposits, but may be exposed at the ground surface in low-lying areas such as valleys. The saturated sands and gravels of the Eastend–Wood Mountain aquifers are important for domestic and industrial uses. Recharge to the aquifer occurs where it is unconfined and overlain by a thin layer of drift or exposed at the surface. The aquifer discharges into the regional valleys.

Quaternary Aquifers

Quaternary aquifers are the most common groundwater source in Saskatchewan, but tend to be subject to rapid lateral and vertical changes in extent, thickness, and distribution, and are much more variable than the bedrock aquifers. The glacial drift has been geologically classified into geologic groups. In ascending order, these are referred to as the Empress Group, the Sutherland Group, and the Saskatoon Group. Aquifers occurring within each group tend to vary greatly in size, in some cases being adequate only for limited domestic use, while in other cases being able to provide sufficient supplies for large-scale industrial and municipal use.

Sediments occurring between the bedrock surface and the glacial drift are referred to as the Empress Group. Where sand and gravel components of these deposits are saturated, they form the Empress Group aquifers, which are often broad and laterally extensive. The Empress Group deposits also commonly form what are known as buried valley aquifers in Saskatchewan, formed by deposition of sand and gravel at the base of ancient river valleys that were eroded into the pre-glacial land surface. The Empress Group consists of pre- and post-glacial stratified sand, gravel, silt, and clay, and are highly permeable and may extend hundreds of kilometres. In general, these aquifers are long and narrow, similar to a modern valley, but due to repeated glacial activity they have been deeply buried and there is no surface expression of these ancient river valleys. The Empress Group aquifers occur in the central portion of Watershed. The Gravelbourg and Swift Current Valley aquifers are the largest buried valley aquifers in the study area. Generally speaking, the depth to the Gravelbourg aquifer is approximately 30 to 60 metres below ground surface and is 0 to 27 metres thick. The Swift Current Valley aquifer is typically 0 to 45 metres thick and potentially occurs at 30 to 75 metres below ground surface; however, test drilling is required to confirm the depth and thickness of these aquifers.

The Sutherland and Saskatoon Groups occur above the Empress Group. Both groups consist mainly of till, but they also contain interbedded sand and gravel within the till. The saturated sand and gravel form potential aquifers. The thickness, depth and extent of these aquifers are extremely variable. The spatial extent and distribution of the Sutherland Group aquifers are variable and discontinuous. These aquifers are very localized, occurring in the area northwest of the Village of Shamrock and east of the Dissolved Municipality of Coderre.

The Saskatoon Group aquifers occur above the Sutherland Group aquifers and have variable thicknesses. The Saskatoon Group aquifers include the deposits of the present-day surface and the upper most groundwater zone, and are referred to as the Surficial Drift aquifers. Although these aquifers are discontinuous throughout the Watershed, they may serve as an important source of water to local users. Aquifer yield is quite variable depending on the extent, thickness and saturation of the sand deposits. Wells completed within this zone are generally large-diameter bored wells. Recharge mainly originates from precipitation and spring runoff infiltrating into the water table. The general groundwater flow direction is likely controlled by the local topography. In general, these aquifers are typically more vulnerable to drought and contamination than the deeper aquifers.

Groundwater Allocation

Groundwater use is confined to consumptive uses. These uses are separated into municipal, domestic, industrial and multi-purpose allocations in Figure 10.

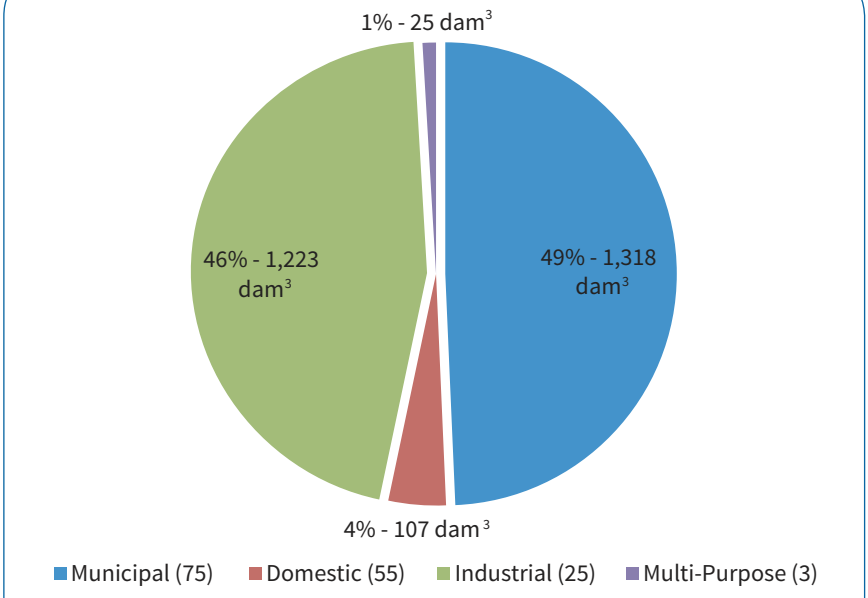


Figure 10: Groundwater Allocation (dam³)

Municipal groundwater allocations include municipal drinking water systems, municipal hygenic systems and rural municipal tankload facilities. Domestic use includes water use from those households that employ private water supplies including farmsteads and households located in smaller communities not served by a municipal water system. The average allocation for each licence is 1.9 dam³; however, the majority of domestic water use does not require a licence and is therefore not measured in this section. Domestic groundwater use only requires a licence when a well is connected to water conveyance works which cross road allowances, property or quarter section lines, or the allocation is greater than 5 dam³.

The average industrial allocation is approximately 49 dam³. Within the Watershed, 13 of the 25 licences are held by intensive livestock operations, five licences are held by four mining and oil and gas corporations and one licence is held by a bottled water company: six licences have been cancelled, including three intensive livestock operations, one mining corporation, one railroad and one agricultural operation. There are also three multi-purpose licences with a total allocation of 25 dam³ held by two Hutterite colonies.

State of the Watershed Report Stressor Indicators

It is very difficult to determine an accurate water-supply/water-use relationship for the Watershed; however, three stressor indicators from the 2010 State of the Watershed Report provide insight into the status of both surface and ground water supply and use. The stressor indicators and their ratings are described in Table 5.

The Relationship between Water Supply and Water Use

Water supply is the actual quantity of water (both surface and ground water) available within a defined region. Water use is the human requirements for water within a defined region. Water use cannot exceed water supply.

Table 5: Old Wives Lake Watershed – State of the Watershed Stressor Indicators[10]

Stressor Indicator	Indicator Description	Rating	Rating Description
Surface Water Quantity	Based on the average annual recorded flow as a percentage of natural flow	High Intensity	The average annual recorded flow volume accounts for less than 70 per cent of the natural flow volume.
Surface Water Allocation	Based on a surface water allocation of annual diversion to estimated median flow in the absence of any human modification	High Intensity	Surface water allocation and losses are greater than 40 per cent of the natural flow.
Groundwater Use	Based on the density of groundwater wells and allocation	Moderate Intensity	There are between 0.16 and 0.37 wells per square kilometre and less than 367,154 litres per km^2.

Drought, Excessive Moisture and Climate Change

The availability of water is greatly influenced by drought, excessive moisture and climate change. Drought is often referred to as one of the most complex, but least understood of all natural hazards and the impacts are apparent on water scarcity, habitat loss and agricultural failures. Conversely, too much water can be just as damaging to water supplies, infrastructure, agriculture and ecosystems.

Climate Change Impacts

The 2010 State of the Watershed Report indicates that groundwater and surface water use is moderate to high intensity within the Watershed. Compounding this pressure on available water supplies, climate variability, especially in the form of drought, has proven to be a significant challenge facing watershed residents. This challenge may be magnified in the future given the climate change scenarios.

Concerns over climate change largely stem from change occurring at a rate at which humans and ecosystems cannot adapt. Temperature observations across the globe, as well as information from proxy records and climate models, confirm global temperatures are rising and will likely continue to rise over the next century. Climate change scenarios compiled by the Prairie Adaptation Research Collaborative suggest with confidence a warmer climate for the province, with warming being more pronounced in fall and winter.[11] There is less agreement with respect to future precipitation trends but the median ranges suggest increased precipitation in fall and winter and decreased precipitation in summer. Increased precipitation will likely be offset by increased evaporative demand due to warming, producing a general drying trend for the Prairies. Although a shift to warmer wetter winters and drier summers poses risks, possibly the most significant risk is from variability in extreme climatic events such as drought and excessive moisture events.

Efficient use of Water

If water demand increases, so will the pressure on water supplies, which in many years are only marginally sufficient for current requirements. The supply shortages of today are anticipated to become an even greater problem in the future; therefore, efforts should be applied to build greater resiliency by managing demand and maximizing water efficiency.

It is evident that this Watershed does not benefit from a water surplus, yet demand is, for the most part, met by available ground and surface water supplies. However, a sufficient reserve to buffer the effects of drought events does not exist. The period of record for which hydrometric data is available show that there are years when little or no runoff occurs in parts of the Watershed. In these situations, water supply problems become extremely critical, particularly for those users who depend exclusively on surface water supplies.

4.4. Water Quality and Source Water Protection

Water quality management is important for social, economic and environmental sustainability. Poor water quality has implications for human use and degraded water quality will result in changes to the ecology of lakes and rivers. Natural factors, including geology, climate and topography, and human factors, including point source like wastewater discharges and non-point source pollution like agricultural runoff, influence and determine water quality.

Surface and ground water quality are generally different. Surface water typically has lower mineral concentrations than groundwater, but is more readily exposed to bacteria, nutrients and other compounds on the landscape. Surface water in southern Saskatchewan is typically nutrient rich as a result of the region's nutrient rich soils. This results in abundant growth of algae and aquatic plants.

Groundwater in Saskatchewan tends to be more mineralized than surface water. The major ions present include sodium, potassium, calcium, magnesium, bicarbonate, carbonate, chloride and sulphate. The quantity of dissolved minerals and the type of ions dissolved in a groundwater source are primarily dependent on the type of rock and soil that the water comes into contact with as it infiltrates and moves through the ground. Groundwater quality in Saskatchewan is quite variable, but in general, deep aquifers tend to have higher total dissolved solids levels than shallow aquifers. Shallow aquifers are more susceptible to contamination from local land use activities and are more vulnerable to nitrate and microbial contamination.

Surface Water Quality

There are no systematic, long-term, water-quality monitoring stations in the Watershed. Available data come from specific short-term studies, projects and monitoring programs; however, these activities do provide the necessary data to understand basic water quality characteristics within the Watershed. Surface water quality in the Watershed is defined by variable and often high salinity, high nutrient concentrations and high turbidity in streams during periods of high flow. These conditions set limits on the use of surface water for various purposes, such as livestock watering and irrigation.

Nutrient Concentrations and Water Quality

High nutrient concentrations result in the ongoing potential for high rates of aquatic plant growth and formation of algal blooms, notably summer and autumn blooms of blue-green algae.

Nutrients and Eutophication

A water quality study was undertaken by Holm (2004) between 2002 and 2004 on the Wood River to quantify the levels of nutrients in the Wood River, identify the major sources of nutrients and examine the impacts of these nutrients on water quality.[12]

Five sampling sites (see Table 6) were selected to better understand changes along the river and to evaluate specific adjacent land use activities. Although the sites are described in Table 6, there was no discussion of specific sampling locations.

Table 6: Sampling Sites[13]

Site Name	Description
Site 1 – Shamrock Park	Regional park agricultural activity
Site 2 – Cattle	Downstream from a ranch where cattle have access to the river
Site 3 – Gravelbourg	Downstream of release point for sewage lagoon
Site 4 – Cropland	Intensive agriculture annual crop to water's edge
Site 5 – Thomson Lake	Intensive agriculture and regional park

Sampling was conducted from 2002 to 2003, seven times between May and September at three-week intervals in 2002 (both before and after the Town of Gravelbourg spring lagoon release), and once a month between May and September in 2003; however, because of an unscheduled lagoon release in March 2003 the researcher was not was not able to collect a pre-release sample.

During periods when there were no lagoon releases, total dissolved nitrogen varied between approximately 0.8 mg/L to just under 2.0 mg/L and total ammonia concentrations varied between approximately 0.05 mg/L to just under 0.25 mg/L. In 2002, measured total dissolved nitrogen at the Gravelbourg site increased during the lagoon release from around 0.92 mg/L to almost 9.2 mg/L and total ammonia increased from 0.035 mg/L to 7.02 mg/L.

Phosphorus concentrations, during periods when there were no lagoon releases, ranged between approximately 0.2 mg/L up to 1.0 mg/L. Similar to nitrogen, phosphorus concentrations increased substantially after the effluent release at the Gravelbourg site from approximately 0.3 mg/L to 1.2 mg/L.

More recent data collected by the WSA on the Wood River at sites upstream and downstream of the Gravelbourg sewage lagoon, during 2011 and 2012 spring and fall releases, demonstrate little variability in total nitrogen, total ammonia and total phosphorus (see Table 7). This data was collected as part of the evolving wastewater regulations. The WSA is assisting Saskatchewan communities to set site-specific Effluent Discharge Objectives, which are required by 2017. Data at these two sites will be collected until 2014. As evident in Table 7, concentrations can vary within and between years due to a number of factors, including dilution.

Table 7: Nutrient Concentrations Upstream and Downstream of the Gravelbourg Sewage Lagoon

Year	Season	Parameter	Upstream (mg/L)	Downstream (mg/L)
2011	Spring	Total Nitrogen	N/A	0.8
		Total Ammonia	N/A	0.07
		Total Phosphorus	0.34	0.39
2011	Fall	Total Nitrogen	1	1.2
		Total Ammonia	0.02	0.02
		Total Phosphorus	0.43	0.33
2012	Spring	Total Nitrogen	1.1	1.2
		Total Ammonia	N/A	N/A
		Total Phosphorus	0.31	0.16
2012	Fall	Total Nitrogen	1.6	2.3
		Total Ammonia	N/A	N/A
		Total Phosphorus	0.32	0.31

Salinity

Salinity of lakes and rivers is frequently measured using the concentration of total dissolved solids (TDS). The most common source of dissolved solids in water is from the weathering of sedimentary rocks and the erosion of the earth's surface. SaskWater Corporation states in a 1994 report that, in terms of the uses requiring less saline water, water quality within the Wood River during spring runoff is generally good quality; however, wet periods raise the water table and induce saline groundwater flows which impact the quality of water in the river.[14] The report also indicates

Surface Water Quality Objectives for Agricultural Uses

Saskatchewan's Surface Water Quality Objectives establishes recommended TDS concentration limits for agricultural uses. Concentrations above these objectives are not recommended for such uses.

- *Irrigation: between 500–3,500 mg/L*
- *Livestock: maximum of 3,000 mg/L*

that many of the reservoirs are generally of very good quality (in terms of salinity) as they support irrigation and stocked recreational fisheries; however, these water bodies can also be impacted by the inflow of poor quality groundwater.[15] Stream monitoring of the Wood River (near Lafleche) and McDonald Creek (near McCord) between 2008 and 2012 found TDS was variable, frequently varying by several 1,000 mg/L within a summer. Generally, streams become more saline as the summer progresses; however, inflows from large rainfall events cause decreases in the salinity. Salinity during spring melt is dependent on runoff volume and can be dramatically different over years. TDS data on various watercourses and water bodies are provided in Table 8.

Table 8: Total Dissolved Solids Data in the Old Wives Lake Watershed

Watercourse/ water body	Sampling Timeframe	Average TDS* (mg/L)	Range of Findings from Studies TDS (mg/L)		Source
			Low	High	
Wood River (location not defined)	N/A	741	N/A		SaskWater Corporation (1994)
Wood River upstream of McDonald Creek	1991–2001	2,000	399	2,550	Bradshaw and McIver (2001)[16]
Wood River	2002–2003	N/A	300	2,500	Holm (2004)
Wood River	2008–2012		472	8,490	WSA
Wood River (near Lafleche)	1967	327	N/A		Rutherford (1970)[17]
McDonald Creek	1991–2000	3,875	345	7,949	Bradshaw and McIver (2001)
McDonald Creek	2008–2012		650	12,100	WSA
Six Mile Creek	1987–2001	1,380	179	2,221	Bradshaw and McIver (2001)
Notukeu Creek (near Gravelbourg)	1967	404	N/A		Rutherford (1970)
Notukeu Creek (near Vanguard)	1967	434	N/A		Rutherford (1970)
Thomson Reservoir (SE06-9-5-W3)	1989–2001	1,540	300	2,509	Bradshaw and McIver (2001)
Thomson Reservoir (SW10-9-5-W3)	1988–2001	830	262	1,280	Bradshaw and McIver (2001)
Thomson Reservoir (NW36-9-5-W3)	1985–2001	640	151	2,163	Bradshaw and McIver (2001)
Thomson Reservoir (near dam site)	1967	390	N/A		Rutherford (1970)
Summercove Reservoir	1985–2001	800	474	1,216	Bradshaw and McIver (2001)
Russell Creek Reservoir	N/A	309	N/A		SaskWater Corporation (1994)
Gouverneur Reservoir	N/A	703	N/A		SaskWater Corporation (1994)
Admiral Reservoir	N/A	436	N/A		SaskWater Corporation (1994)
Coderre Weir	1990–2001	1,060	172	1,800	Bradshaw and McIver (2001)
Old Wives Lake	1967	17,095	N/A		Rutherford (1970)
Old Wives Lake	1919	N/A	95,340**		SaskWater Corporation (1994)
Chaplin Lake	1919	N/A	2,958**		SaskWater Corporation (1994)

* TDS considerations are highly variable and relate to flow. The TDS averages, with the exclusion of Rutherford (1970), are not flow-weighted averages and should be treated with caution.

** Only one value was provided by SaskWater Corporation (1994). It is not intended to be representative of the lake.

2010 State of the Watershed Report

The 2010 State of the Watershed Report aquatic benthic macroinvertebrates condition indicator also provides insight into surface water quality of the Wood River and Notukeu Creek. Aquatic benthic macroinvertebrates are the organisms living in a water body, including insects such as midges and mayflies. These aquatic organisms are used as an indicator because they are sensitive to the chemical and physical conditions in the habitats in which they reside. Examining organisms collected from a water body can indicate the quality of surface water.

The aquatic benthic macroinvertebrates condition indicator for the sampling locations on the Wood River and Notukeu Creek were classified as Healthy. This means the site condition is typical of best available reference sites; has ≥ 90 per cent chance of being in reference condition.

Groundwater Quality

The quality of groundwater is also influenced by a range of natural processes and human activities. Groundwater quality in aquifers that have little connection with the surface typically reflect the natural condition; however, wells themselves can pose contamination risks to groundwater as they can be a conduit between surface activities and the aquifer. Groundwater that is connected with the surface reflects natural conditions, but may also reflect human influences. Generally, deeper aquifers tend to be highly mineralized, while shallow aquifers may yield better quality water, but may be more vulnerable to contamination. As with surface water, human groundwater use may be limited by salinity levels. Groundwater quality is highly variable and cannot be extrapolated reliably over a regional scale. As a result, the availability of groundwater quality data in the Watershed is limited to discussion of TDS.

Saskatchewan's Drinking Water Quality Standards and Objectives

TDS is an aesthetic objective. Concentrations above 1,500 mg/L are not typically viable drinking water sources. Aesthetic objectives do not cause adverse health effects but may impair the taste, smell, or colour of the water.

Bedrock Aquifers

In general, water from the Judith River Aquifer is considered to be of relatively poor quality due to its high mineral content. The water quality is variable and is dependent on the geologic structure and local recharge but tends to be soft with a high concentration of sodium chloride. The water is a sodium bicarbonate/chloride type with TDS levels ranging from 1,300 to 8,000 mg/L, but typically lower than 2,500 mg/L.

Water from sand members within the Bearpaw Formation is generally considered to be poor quality due to high TDS. The TDS levels in water from these sand members range from 660 to 10,330 mg/L with an average of 3,560 mg/L. The TDS level in water from the Wood Mountain area ranges from 320 to 1,700 mg/L.

The general water quality from the Eastend–Whitemud, Frenchman and Ravenscrag Formations is calcium, magnesium sulphate/bicarbonate type water with reported TDS concentrations between 500 to over 2,500 mg/L. Water from the Cypress and Wood Mountain Formations is generally good quality water with TDS levels ranging from 200 to 800 mg/L.

Quaternary Aquifers

Water from the Gravelbourg Valley Aquifer is typically highly mineralized with a TDS level up to 5,000 mg/L. Water quality in the Swift Current Valley Aquifer is typically sodium-sulphate type water with a reported TDS concentration of 2,200 to 2,850 mg/L. Intertill and surficial aquifers generally provide good quality water with TDS levels ranging from 300 to 1,200 mg/L.

2010 State of the Watershed Report

The 2010 State of the Watershed Report groundwater quality condition indicator provides a general overview of groundwater source quality. The Groundwater Quality Condition Indicator assessed water quality results from 181 private wells within the Watershed between 1996 and April 2009.

The results identified 60 per cent of the wells exceeded at least one of the **Maximum Acceptable Concentrations**. Given these results, the indicator classified groundwater quality as stressed.

Maximum Acceptable Concentrations are established Guidelines for Canadian Drinking Water Quality for substances that can adversely affect human health.

Risks to Private Drinking Water Systems

Proper testing, treatment and well maintenance is recommended on all private water wells used for potable sources to reduce human health risks.

Multi-Barrier Approach and Source Water Protection

The quality and safety of drinking water is an important public health issue. The threats to human health from drinking water range from microbiological organisms to heavy metals. There is also a range of drinking water systems (i.e. municipal, semi-public and private) and a range of sources (i.e. surface/ground water and GUDI), and each invokes specific management considerations.

A study of Canadian drinking water systems found that small drinking water systems serving populations under 5,000 people, like those within the Watershed, face greater challenges in providing safe drinking water because they often lack the funding to build, operate and maintain the necessary infrastructure.[18]

The multi-barrier approach provides opportunities to address many of these challenges. The Canadian Council of Ministers of the Environment define the multi-barrier approach as "an integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from source to tap in order to reduce risks to public health."[19]

Source Water Protection (SWP)

Source water quality within the Watershed is influenced by a range of natural and human influences that limit what can be done from a water quality perspective; however, SWP activities should always attempt to limit point and non-point sources of pollution as a precautionary approach.

Benefits from the multi-barrier approach can include better public health protection, a reduction in health-care costs and drinking water treatment costs, and an indirect increase in environmental protection. The major elements of the multi-barrier approach are

1. Source water protection;
2. Drinking water treatment;
3. The drinking water distribution system; and
4. Monitoring.

Lakes, rivers and aquifers used as drinking water sources are commonly referred to as source waters. Source water protection (SWP), therefore is a coordinated effort among multiple partners to protect source waters from contamination in order to ensure the safety of drinking water.

Summercove Reservoir

Community-Based Source Water Protection Pilot Projects

SWP is a core component of the watershed planning process. To focus the planning efforts, the Planning Team initiated two community-based source water protection planning exercises. The Planning Team partnered with the OWWA in the development and delivery of two community-based source water protection planning pilot projects to build capacity in the OWWA toward the development of additional SWP plans in the Watershed.

Process

The Planning Team adopted a five-stage SWP planning model provided by Dr. Robert Patrick, Associate Professor at the University of Saskatchewan, Department of Geography and Planning, displayed in Figure 11, which includes development of a steering committee, conducting of a source water assessment, development of land management actions, and implementation and subsequent review of the plan.

Stage 1: Steering Committee

The formation of a steering committee is the first step in the development of any SWP plan as members of the steering committee guide the entire SWP planning process. Members of the steering committee should typically include a mix of local representatives and water management experts.

Stage 2: Source Water Assessment

The source water assessment involves the collection of background information on the water sources, the delineation of the source water assessment area, an inventory of land use, an identification of potential contamination events and an assessment of the risks to the drinking water source(s) from the identified potential contamination events.

Stage 3: Land Management Actions

Information gathered during Stage 2 facilitates the development of land management actions that seek to mitigate or manage risks to the drinking water source(s) from the identified potential contamination events. The completion of this stage marks the completion of the development of the SWP plan document.

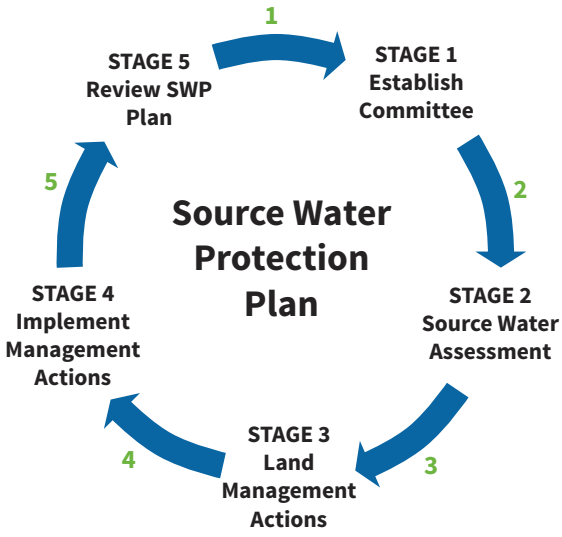


Figure 11: Five-Stage SWP Planning Model

Stage 4: Implementation

Once the plan has been developed the focus shifts to the implementation of the land management actions. Implementation typically occurs over a period of five years.

Stage 5: Review of SWP Plan

A SWP plan is a document that should be reviewed on a regular basis. Following the five-year implementation period, if not earlier, members of the steering committee should undertake a review of the SWP plan and its results.

Background and Community Selection

Two communities were selected for these pilot projects and these selections were based on consultations with WSA staff and community involvement in the development of the Plan. It was decided to conduct a SWP planning process for one surface water municipal drinking water system (Mankota) and one GUDI municipal drinking water system (Vanguard).

The Village of Mankota was selected as the community to conduct a SWP planning process for a surface water municipal drinking water system due to the manageable size of the surface water source and the Village of Vanguard was recommended by WSA drinking water experts as an appropriate community to conduct a SWP planning process for a GUDI municipal drinking water system. Representatives of both communities were also very active in the development of the Plan so this was a logical fit.

Village of Mankota

The Village of Mankota is located in the southern portion of the Watershed, approximately 55 kilometres north of Grasslands National Park. According to the 2011 Census, the total population of the village is 211. The village receives its raw water from Summercove Reservoir, constructed in 1949 at a site on the Wood River approximately 10 kilometres south of the village. The dam is owned by the WSA and includes an 8.5 m high earthfill embankment with a capacity of 1,973 dam^3, with the last major rehabilitation occurring in 1965.

Village of Vanguard

The Village of Vanguard is located in the west central portion of the Watershed, approximately 60 kilometres west of Gravelbourg. According to the 2011 Census, the total population of the village is 152. The village receives its raw water from a single groundwater well located on NW 9-11-10 W3 approximately one kilometre west of the village. According to the Village of Vanguard Waterworks System Assessment (August 2011), the well was constructed in partnership with the PFRA in 1983.

The well was constructed to an overall depth of approximately 11.5 metres of 200 mm diameter well casing. The wellhead is enclosed in an approximate 1.75 metre well pit. A dugout was constructed west of the well by the PFRA to artificially recharge the well with surface water by pumping. A berm was also constructed around the dugout and well enclosing an approximate two-acre area and the village constructed a fence along the top of the berm.

Planning Process

Each SWP plan was developed during a series of two workshops held in July 2013 and November 2013 in Mankota, and July 2013 and January 2014 in Vanguard. Membership for each steering committee was confirmed prior to the first set of workshops. The first workshop allowed the steering committee members to conduct the source water assessment (Stage 2) and initiate the development of land management actions (Stage 3).

At the completion of the first workshop, a number of draft land management actions were developed and additional land management actions were developed between Workshop #1 and #2 by the Planning Team with technical input from WSA drinking water staff. The second workshop allowed steering committee members to review and finalize the land management actions, identify agencies to implement the actions, identify potential funding sources, and establish a timeline for each action. The second workshop marked the completion of Stage 3, the development of the SWP plan.

In support of the two SWP plans, the WSA partnered with both communities to collect raw water quality data for each drinking water source for a period of one year. The water treatment plant operator for each community collected samples while the WSA provided data interpretation and funding for the lab analysis.

Actions in the Village of Mankota SWP Plan

There were a total of 16 land management actions adopted in the SWP plan for the Village of Mankota. One of the top priority actions was continued raw water quality monitoring, supported by a cost-sharing partnership between the village and surrounding rural municipalities. Other notable actions included encouraging adoption of agricultural beneficial management practices (BMPs) upstream of Summercove reservoir and enhancing awareness around fuel and chemical management around the reservoir.

Actions in the Village of Vanguard SWP Plan

There were a total of 14 land management actions adopted in the SWP plan for the Village of Vanguard. Steering committee members noted a lack of raw water quality data as an issue, and established actions to continue monitoring raw water quality through a partnership with the village and the surrounding rural municipality. Other noteworthy actions included undertaking an investigation into using municipal zoning bylaws to protect source water, maintaining or upgrading infrastructure around the well, and the decommissioning of nearby abandoned groundwater wells.

Plan Implementation and Review

The land management actions listed in each of the SWP plans identify government and non-government agencies and organizations to lead the implementation of each action, and potential funding sources and cost estimates were identified where possible. A proposed completion timeline was also identified for the majority of the actions, with more to be added as additional information becomes available.

The development of a SWP plan and the implementation of its actions is not a replacement for regular maintenance or upgrades to a drinking water treatment facility, but rather one of many barriers in the multi-barrier approach to reduce risks to public health. The application of SWP, through pilot projects, forms a foundation for action to mitigate or manage risks to two drinking water sources; however, the success of these SWP plans is ultimately dependent on the development of partnerships and continued support at the local level required in implementation.

4.5. Ecosystem Services

An ecosystem is a community of living organisms and their physical environment interacting and functioning together as a system. Healthy ecosystems provide a wide range of services that benefit humans, the management of which is critical to watershed health.

Watershed ecosystems can be described as upland, riparian or aquatic ecosystems. Ecosystem services can be categorized under four categories: provisioning, regulating, cultural and supporting.[20] Provisioning services are classified as products obtained from ecosystems. Regulating services are classified as benefits obtained from the regulation of ecosystem processes. Cultural services are classified as nonmaterial benefits obtained from ecosystems. Supporting services are classified as services necessary for the production of all other ecosystem services (see Table 9).

Table 9: Ecosystem Services Categories[21]

Provisioning Services	Regulating Services	Cultural Services
• Food • Fresh water* • Fuel • Wood and fibre	• Climate regulation • Erosion control • Water purification • Water regulation	• Aesthetic • Educational • Cultural heritage • Recreation
Supporting Services		
• Soil formation • Nutrient cycling • Primary production		

*Although the provision of fresh water is critical, it is more so related to the hydrologic cycle than watershed management.

Regulating (water regulation, water purification and erosion control) and cultural ecosystem services (aesthetic considerations and the provision of recreation) are the most relevant to the management of water.

Under the regulating services category, upland and riparian ecosystems provide a wide range of benefits to watershed residents. Upland ecosystems can capture and slow the release of water as well as reduce soil erosion and sedimentation in watercourses and water bodies. Riparian ecosystems are defined as transitional areas that exist between the aquatic ecosystem (the river or stream) and the surrounding upland ecosystem. There are two types of riparian ecosystems, **lotic** and **lentic**; however, the services they provide are similar, including protection and maintenance of banks, trapping of sediment, filtering and buffering of water, reducing and dissipating the velocity of streams or runoff, slowing flood water and assisting in recharging aquifers.

In 2001, the Wood River Riparian Project was initiated as a component of Saskatchewan's Important Bird Area Program for the Old Wives and Chaplin Lakes. Lotic health assessments were conducted on each quarter section along the Wood River. The results of the study are provided in Table 10.

Table 10: Summary of Average Health of the Riparian Area per Rural Municipality[22]

Rural Municipality	Average Health Rating	Quarter Sections Evaluated
Waverly No. 44	76%	9
Mankota No. 45	88%	9
Wood River No. 74	84%	30
Gravelbourg No. 104	66%	18
Rogers No. 133	75%	22
Shamrock No. 134	73%	10
Overall	77%	98

Lotic riparian areas occur along a body of flowing water

Lentic riparian areas occur alongside a standing or still body of water

Old Wives Lake

The study concluded that the majority of riparian areas along the Wood River were classified as functioning at risk, but with problems. The study noted that with slight management adjustments, many sites could significantly improve in score.

The 2010 State of the Watershed Report riparian health condition indicator also rated riparian health (both lotic and lentic) as stressed based on 243 riparian health assessments. A stressed rating is characterized as functioning at risk, which means the riparian area performs many functions, but signs of degradation are visible.

The aesthetic and recreation benefits under the cultural services category typically relate to aquatic ecosystems. Aquatic ecosystems provide watershed residents with drinking water and support economic activities, and also provide recreation and aesthetic benefits such as opportunities for fishing, boating, hunting, camping, and birding.

The presence and abundance of fish is a good indicator of aquatic health. Many of the fish populations within the Watershed are restricted to riverine habitats since many of the larger water bodies such as Old Wives Lake and Chaplin Lake are naturally saline. The saline water bodies can support certain fish species including fathead minnows and brook stickleback but cannot consistently support game fish. The Wood River is known to support a variety of native fish species including northern pike, walleye, yellow perch and several species of non-game fish. Russell Creek, a tributary to Notukeu Creek, has historically been stocked with brook trout. Other water bodies such as Thomson Lake, Gouverneur Reservoir and Braddock Reservoir are stocked with walleye or are known to support northern pike and perch.

In terms of birding, Old Wives and Chaplin Lake are sites of international significance as they are listed as Important Bird Areas, sites recognized for the conservation of birds and biodiversity. One-day survey result estimates demonstrate the significance of these areas as 64,000 shorebirds have been recorded at Old Wives Lake[23] and 60,000 to 73,000 at Chaplin Lake.[24]

A number of direct and indirect drivers of change—from natural factors, such as drought or flood events, or human activities, such as land use change or agricultural inputs—can have an impact on Watershed ecosystems. Stewardship activities play an important role in managing the impacts from these drivers by enhancing ecosystem resiliency. Agencies such as Ducks Unlimited Canada, the Frenchman–Wood River Weed Management Area, Nature Conservancy of Canada, the OWWA and the Saskatchewan Wildlife Federation are actively implementing programs to restore or maintain healthy aquatic and riparian ecosystems. Opportunities exist through the implementation of the Plan to further the work of these organizations and ultimately maintain or improve the functioning of these ecosystems.

5. Vision for the Watershed

The watershed vision was developed by the members of the WAC utilizing a set of principles that all participants agreed on. The vision served to guide the development of the Plan and will guide plan implementation.

Vision

Sufficient water quality and adequate water supplies that meet the current and future community, economic and ecosystem needs in the Old Wives Lake Watershed

Planning Principles

WAC members agreed that the watershed plan should consider drinking water and agricultural needs as priority water uses as well as other water uses including recreational, industrial, environmental and aesthetic and the water supply needs for future economic opportunities.

WAC members also agreed that the watershed plan should

- Address the needs and requirements of all stakeholders;
- Ensure costs of implementation are distributed among stakeholders and beneficiaries;
- Ensure all stakeholders have input and consensus is reached; and
- Promote a stewardship, educational, and common sense approach to enhance water use efficiency and protect water resources for future generations.

Russell Creek

Notukeu Creek

6. Watershed Plan Goals, Objectives and Key Actions

The Plan is comprised of six goals, 16 objectives and 34 key actions, which are the direct result of a co-operative and collaborative partnership between local stakeholders and government and non-government agencies staff.

Goal 1 **Safe drinking water is available to watershed residents in a sustainable manner**

Goal 2 **Thomson Lake is a source of quality water for watershed residents and provides recreational opportunities**

Goal 3 **Riparian and aquatic ecosystem services provided by the Wood River, Notukeu Creek, Wiwa Creek and their tributaries are enhanced**

Goal 4 **Habitat diversity to maintain or increase migratory bird and species at risk populations**

Goal 5 **Water and watershed infrastructure is managed proactively to address drought and excessive moisture events**

Goal 6 **Water use is efficient and fair and considers all stakeholders and their needs, including domestic, agricultural and industrial, and future economic development**

6.1. Safe Drinking Water

Goal 1: Safe drinking water is available to watershed residents in a sustainable manner

Safe and reliable drinking water is one of the most critical needs in any society. Drinking water systems in Saskatchewan are grouped into three categories: municipal, semi-public and private. Municipal systems rely on either surface or ground water sources, while semi-public and private systems typically rely solely on groundwater sources.

There are 18 municipal drinking water systems designed for human consumptive use in the Watershed. Six of these systems rely on surface water sources, seven rely on groundwater sources and five rely on GUDI or suspect GUDI water sources. Of the estimated 9,346 watershed residents, 1,850 rely on municipal surface water systems, 1,180 rely on groundwater systems, 570 rely on GUDI or suspect GUDI systems and approximately 5,750 residents rely on semi-public or private drinking water systems.

Municipal drinking water systems are regulated systems that are accessible to the public and deliver more than 18 cubic metres of water per day.

Semi-public drinking water systems are regulated systems that are accessible to the public but deliver less than 18 cubic metres of water per day.

Private drinking water systems are unregulated systems intended for private use.

Members of the WAC identified the protection of human health and the financial sustainability of drinking water systems as primary interests shaping the development of the safe drinking water goal. The following objectives and key actions were developed by drinking water experts, community planners and the Planning Team, to protect human health through undertaking community-based SWP, managing community development and reducing potential health risk exposures associated with the consumption of groundwater from private water wells.

Objective 1

Community-based source water protection plans are developed and implemented for municipalities with a municipal drinking water system.

Key Action 1
Develop community-based source water protection plans for municipalities by partnering with and utilizing a planning process provided by the WSA.

Key Action 2
Support the implementation of actions identified in the community-based source water protection plans.

SWP is the first barrier in the multi-barrier approach and an essential component of any strategy to prevent or reduce contamination risks in a drinking water system. Community-based source water protection plans were developed for two communities in the Watershed, focused on identifying and subsequently mitigating potential risks to a municipal drinking water system. The intent of Objective 1 is to further advance community-based source water protection in the Watershed through the development of additional SWP plans.

Objective 2

All 16 urban municipalities and all 27 rural municipalities with more than two per cent of their administrative area within the Watershed have policies within their official community plan and zoning bylaw that conform with the Statements of Provincial Interest on the following issues:

- Source Water Protection;
- Shore Land and Water Bodies;
- Biodiversity and Natural Ecosystems; and
- Public Safety.

Key Action 3
Encourage municipalities to adopt new official community plans and zoning bylaws or undertake amendments to their official community plans and zoning bylaws. Communicate the benefits to municipalities of having policies in place that protect source water.

The Planning and Development Act, 2007 enables urban and rural municipalities to adopt an official community plan, essential to managing community growth and development by providing a means to control development and effectively manage land use, coordinate development, separate incompatible land uses and prevent development from locating on hazard lands. In order to fully realize the benefits of an official community plan, a municipality needs to adopt a zoning bylaw, the primary legal and administrative means of implementing an official community plan. The intent of Objective 2 is to encourage municipalities to develop or amend official community plans and zoning bylaws as a means to manage community growth and development in a manner consistent with the vision and goals of the Plan. A summary of the urban and rural municipalities with official community plans and zoning bylaws is provided in Table 11.

Table 11: Municipalities with Official Community Plans and Zoning Bylaw

Type of Municipality	Official Community Plan	Zoning Bylaw
Urban (16)	0	4
Rural (27)*	14	20

* Rural municipalities with less than two per cent of their administrative area within the Old Wives Lake Watershed were excluded.

Objective 3

Facilitate the distribution of educational materials provided by appropriate government ministries and agencies, and encourage the use of beneficial management practices (BMPs) within the Watershed to protect private drinking water sources from contamination and decrease potential health risk exposures associated with the consumption of groundwater from private water wells.

Key Action 4
Increase awareness and education of the human health risks associated with consumption of groundwater exceeding current drinking water standards and objectives (*Saskatchewan Drinking Water Quality Standards and Objectives 2006; Guidelines for Canadian Drinking Water Quality 2012*) through the distribution of information provided by appropriate government ministries and agencies to private well owners.

Key Action 5
Encourage and promote good well-water quality maintenance and monitoring through the practice of routine water quality testing, water level monitoring and shock chlorination of private drinking water wells according to the resources or information provided by the appropriate government ministries and agencies.

Key Action 6
Refer individuals who consume water from private wells to their local Saskatchewan Health Region or to information provided online by the appropriate ministries and agencies if they require guidance on treatment methods.

Key Action 7
Distribute accurate and appropriate educational information to private well owners on well and land-use management best practices, including wellhead integrity and well decommissioning.

The majority of Watershed residents, an estimated 5,750, rely on semi-public or private drinking water systems. Semi-public systems, while accessible to the public, typically do not serve daily needs as they include individual businesses and campgrounds. Private drinking systems, which are almost entirely groundwater systems, are heavily relied upon to meet daily drinking water needs on farms and acreages and in small communities without a central water system. WSA drinking water experts note that the potential health risk exposures associated with the consumption of groundwater from private water wells are generally consistent across municipal Saskatchewan and that the most effective approach to reducing these risks is to encourage proper testing, treatment and well maintenance on private water wells used for potable sources. Therefore, the intent of the third objective is to attempt to reduce these health risks through a number of communication initiatives to promote good well management.

Private wells

6.2. Water Quality and Riparian and Aquatic Ecosystem Health

Goal 2: Thomson Lake is a source of quality water for watershed residents and provides recreational opportunities

Thomson Lake was formed by the construction of the Lafleche Dam during 1955–1958 at a site on the Wood River approximately 10 kilometres south of the Town of Gravelbourg. Thomson Lake hosts two cottage developments, supports activities such as fishing and boating, supplies water for irrigation, and most notably, supplies raw water for the Town of Gravelbourg, the Town of Lafleche and four rural water pipelines. This is a highly valued water source and therefore drew significant attention from the WAC members throughout the development of the Plan. The Thomson Lake water quality goal reflects interests to use the best available methods to understand and manage water quality in Thomson Lake in order to reduce drinking water treatment inputs for the Towns of Gravelbourg and Lafleche and to sustain the various recreational and agricultural uses.

Lafleche Dam

Development at Thomson Lake Regional Park

Objective 4

Develop a water quality strategy for Thomson Lake.

Key Action 8
Engage the appropriate technical experts to assess what changes in source water quality are required to reduce treatment inputs.

Key Action 9
Undertake a water quality study of Thomson Lake to understand the current state of water quality and inflow water quality to evaluate viable management options.

In a 2006 report, SaskWater, the crown corporation which owns and operates the Gravelbourg water treatment plant, noted that Thomson Lake is a challenge to manage as it is nutrient rich, experiences algal blooms and is low in dissolved oxygen and high in ammonia and organic matter.[25] More recently, water quality sampling and analysis undertaken by the WSA indicates that the Wood River is frequently high in dissolved inorganic nitrogen. These characteristics are not entirely unique to this Watershed since nutrient concentrations in water bodies across southern Saskatchewan tend to be high, are highly variable within and among years and can be related to high **background concentrations**.[26] Further complicating the issue, the contribution of nutrients in surface water from anthropogenic non-point source pollution is not well understood in southern Saskatchewan as a result of these high background concentrations.

A **background concentration** is a concentration of a substance in a particular environment that is indicative of minimal influence by anthropogenic sources.

Objective 4 was developed by the WSA water quality experts and Planning Team to begin to address these challenges through the development and execution of a water quality study for Thomson Lake. The implementation of this objective establishes a foundation to guide the management of Thomson Lake; however, it is not intended to achieve Goal 2 alone. Strategies to minimize anthropogenic impacts on highly valued riparian and aquatic ecosystems, including Thomson Lake are identified in the objectives and key actions under Goal 3.

Goal 3: Riparian and aquatic ecosystem services provided by the Wood River, Notukeu Creek, Wiwa Creek and their tributaries are enhanced

Watershed ecosystems provide a wide range of aquatic ecosystem services, including benefits such as fishing, boating, hunting, camping and birding; riparian ecosystem benefits that include the protection and maintenance of stream banks, trapping of sediment, filtering and buffering water, reducing and dissipating the velocity of streams or runoff, slowing flood water and assisting in recharging aquifers; and upland ecosystems benefits such as capturing and slowing the release of water and reducing soil erosion and sediment deposition in watercourses and water bodies.

Throughout the planning process, members of the WAC expressed interests in enhancing the ecosystem services provided by the watercourses, identifying and understanding both anthropogenic and natural factors influencing water quality and monitoring changes in water quality over time. These interests are reflected in the riparian and aquatic ecosystem goal and the resulting objectives and key actions seek to characterize water quality in highly valued watercourses and improve the health of riparian and aquatic ecosystems by reducing anthropogenic impacts. Objectives 5 through 8, and the related key actions are designed to support the achievement of the riparian and aquatic ecosystem goal by characterizing water quality in highly valued watercourses and improving the health of riparian and aquatic ecosystems by reducing anthropogenic impacts.

Thomson Lake

Objective 5

Characterize the quality of water within the Wood River, Notukeu Creek, Wiwa Creek or other tributaries.

Key Action 10
Assess activities within the Watershed and identify areas that may be impacting water quality.

Key Action 11
Develop and implement a water quality sampling program with guidance from appropriate technical experts to characterize water quality and identify potential water quality concerns in those areas identified in Key Action 10.

The intent of Objective 5 is to characterize the quality of water in select watercourses; however, as previously noted there are no systematic long-term water quality monitoring stations in the Watershed. To maximize the cost-effectiveness of a water quality monitoring program, Objective 5 key actions seek to assess activities in the Watershed and identify those that may be impacting water quality, and to develop and deliver a water quality monitoring program to study the potential impact of these activities. The results of this water quality monitoring program will serve to advance the understanding of water quality in the Watershed and support future decision-making by providing a scientific basis to target future activities.

Objective 6

Aquatic ecosystems within the Watershed are enhanced to support fish populations and aquatic organisms within the natural limits of a drought-prone ecosystem.

Key Action 12
Develop a strategy to identify important fish habitat and barriers to fish migration (i.e. road crossings, weirs, etc.) and work with landowners, municipalities and partners to improve fish habitat throughout the Watershed.

Key Action 13
Develop educational initiatives intended to provide watershed residents and municipalities with information on regulatory requirements when working in or near water and on the importance of aquatic habitat.

The intent of Objective 6 is to enhance the health of aquatic ecosystems, defined as ecosystems where human activities have not impaired the system's natural function or altered the species composition.[27] Indicators are used to provide insight into the condition of a system, and the presence and abundance of fish is a good indicator of aquatic health. Barriers to fish migration such as low level crossings and weirs and activities such as the physical destruction of habitat can impact the presence and abundance of fish. These anthropogenic impacts can be sufficiently mitigated through the identification of important fish habitat, improvements in fish passage and through communicating to watershed residents the requirements when working in or near water.

Objective 7

The impact of cropping and livestock operations and invasive species on the health of lotic riparian areas along the Wood River, Notukeu Creek, Wiwa Creek and their tributaries is reduced.

Key Action 14
Develop a lotic riparian health monitoring program to evaluate the impact of Key Actions 15 and 16 on lotic riparian health along those reaches targeted by programming.

Key Action 15
Deliver available programming to encourage the adoption of agricultural BMPs in those lotic riparian areas along the Wood River, Notukeu Creek, Wiwa Creek and their tributaries impacted by annual cropping and livestock operations.

Key Action 16
Work with land managers, local weed management areas and other partners to manage high-risk invasive species in aquatic and lotic riparian areas along the Wood River, Notukeu Creek, Wiwa Creek and their tributaries. Management strategies may include education and awareness, early detection, rapid response and monitoring.

Objective 8

The impacts on aquatic ecosystems from upland ecosystems (including cropland and perennial forage) within the Watershed's **effective drainage area** are reduced.

The **effective drainage area** is the drainage area expected to contribute runoff to a watercourse or water body under average runoff conditions.

Key Action 17
Deliver educational information and available programming to encourage the adoption of agricultural BMPs on cropland to reduce erosion and salinity and nutrient and sediment loading in the aquatic system.

Key Action 18
Deliver educational information on pasture management and available programming to encourage the adoption of agricultural BMPs to promote healthy hydrologic function.

Key Action 19
In support of Objective 2, encourage municipalities to adopt new official community plans and zoning bylaws or undertake amendments to their official community plans and zoning bylaws. Communicate the benefits to municipalities of having policies in place that protect and manage riparian and aquatic ecosystems.

The health of an aquatic ecosystem is also dependent on the function of riparian and upland ecosystems. Objectives 7 and 8 seek to enhance the health and function of these ecosystems to fully realize the benefits they provide. According to the 2010 State of the Watershed Report, riparian health and rangeland health in the Watershed were categorized as stressed. Agricultural operations can have an impact on the health and function of riparian and upland ecosystems; however, these impacts can be mitigated through the delivery of educational information to the agricultural community and the implementation of agricultural BMPs. Agricultural BMPs such as converting highly erodible soils from annual grain production to permanent cover, re-vegetating riparian areas, improving manure storage and improving grazing management can reduce erosion and improve the quality of agricultural runoff, thus improving the health and function of riparian and upland ecosystems.

Wood River

Notukeu Creek

Russell Creek

6.3. Habitat Diversity

Goal 4: Habitat diversity to maintain or increase migratory bird and species at risk populations

The presence and abundance of migratory birds and wildlife species at risk that rely on riparian and aquatic habitats is another indicator of ecosystem health. The Watershed's diverse aquatic systems include both fresh and extremely saline water bodies that provide important habitat for migratory birds such as waterfowl and critical habitat for species at risk like the piping plover.[28]

During the planning process, WAC members expressed interest in recognizing important habitat such as Old Wives Lake and Chaplin Lake and identifying areas where habitat should be either maintained or restored to support migratory bird and species at risk populations. The objectives and key actions developed under this goal seek to support the maintenance or restoration of wetland habitat, support the recovery strategies for species at risk that rely on aquatic and riparian habitats and increase watershed resident awareness of the threats to migratory bird and species at risk populations.

The following objectives and key actions were developed by the Planning Team and avian ecologists to support the achievement of the Plan's habitat maintenance and restoration goals as well as achievement of provincial, national and international goals and objectives for migratory birds and species at risk populations.

Old Wives Lake – Migratory Bird Sanctuary

Piping Plover Photo courtesy Corie White

Objective 9

Support the achievement of the Saskatchewan multi-year Prairie Habitat Joint Venture (PHJV) habitat objectives for the Coteau Central target landscape.

Key Action 20

Work with landowners to undertake projects to retain or restore wetland habitat for migratory birds. Report on habitat projects delivered within the Watershed to the provincial North American Waterfowl Management Plan (NAWMP) Coordinator on an annual basis.

The North American Waterfowl Management Plan (NAWMP) is the major driver of wetland habitat protection and restoration in the Canadian Prairies. A portion of one NAWMP target landscape, the Coteau Central Target Landscape, occurs within the Watershed, where it provides important habitat breeding for blue-winged teal, mallard, gadwall, and northern shoveller, with portions supporting 23 or more duck pairs per square kilometre, and for pintails, supporting approximately four to five duck pairs per square kilometre in some areas. The intent of Objectives 9 and 11 are to support the achievement of the wetland habitat objectives for this target landscape.

North American Waterfowl Management Plan (NAWMP)

The NAWMP is implemented through Joint Ventures, which are partnerships that focus on areas or species of concern identified in the NAWMP. The Prairie Habitat Joint Venture (PHJV) leads the delivery of the NAWMP on the prairies by developing and delivering multi-year provincial implementation plans. Each plan contains multi-year wetland and upland restoration habitat objectives.

Objective 10

Support the achievement of the Recovery Goals outlined in the Recovery Strategies and Action Plans for those species at risk located within the Watershed.

Key Action 21
Work with landowners to undertake projects to maintain, retain or restore habitat for species at risk that rely on aquatic and riparian habitats. Develop a monitoring program to evaluate the results of the established habitat projects.

Objective 11

Increase watershed resident awareness of the threats to migratory birds and species at risk.

Key Action 22
Distribute educational information to watershed residents on the importance of migratory bird and species at risk habit, project opportunities and habitat management success stories.

It is widely accepted that the single greatest factor responsible for the endangerment of species is habitat loss and degradation.[29] The Government of Canada has developed a three-part strategy to protect species at risk, which includes the **Species at Risk Act** (SARA), the Accord for the Protection of Species at Risk and the Habitat Stewardship Program for Species at Risk. Each component plays an important role in the management and protection of species at risk. Of particular interest is the requirement under the SARA that a Recovery Strategy and Action Plan be developed once a species is listed as **endangered**, **threatened** or **extirpated**.

Endangered species means a wildlife species that is facing imminent extirpation or extinction.

Threatened species means a wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

Extirpated species means a wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.

A Recovery Strategy is a planning document that outlines the short-term objectives and long-term goals for protecting and recovering a species at risk. This strategy includes a description of the species and its needs; identification of threats to survival; identification of critical habitat; the setting of goals, objectives and approaches for recovery; the identification of information gaps; and the determination of timeframes for action.[30] The Action Plan provides a summary of the specific projects and activities required to meet the recovery goals and objectives. This includes the identification of critical habitat, proposed measures for protecting critical habitat, steps for implementing the Recovery Strategy and an evaluation of the Action Plan's social and economic costs.

Typical recovery actions necessary to protect species at risk such as the Piping Plover include protecting nesting areas through improved grazing management and exclusion fencing. The Watershed supports significant habitat for Piping Plovers. The Missouri Coteau region, including Chaplin Lake and Old Wives Lake, can support up to 46 per cent of the Saskatchewan piping plover population; Chaplin Lake alone can support up to 25 per cent of the Saskatchewan population and 3.5 per cent of the continental population. The intent of Objectives 10 and 11 are to support the achievement of the Recovery Goals for species at risk by implementing projects that maintain, retain or restore important habitat.

6.4. Drought and Excessive Moisture Preparedness

Goal 5: Water and watershed infrastructure is managed proactively to address drought and excessive moisture events

Extreme climatic events, specifically drought and excessive moisture events, are two of the most expensive natural disasters that occur in Canada. The drought between 2001 and 2002 resulted in an estimated drop in gross domestic product of $5.8 billion nation-wide,[31] while the more recent 2013 flood in Alberta resulted in the loss of four lives and an estimated cost of $6 billion.[32] Although it is impossible to avoid all impacts from these natural disasters extreme event preparedness can assist in reducing these impacts.

Throughout the planning process, WAC members identified the maintenance of watershed infrastructure as a means of both water storage and community flood protection, increased awareness of drought adaptation measures and enhanced flood preparedness measures including flood mapping as measures to prepare for extreme events, as important interests that are reflected in Goal 5 and the resulting objectives and key actions. The observed climate record indicates that extreme climatic variability is a natural feature of the prairie climate; however, paleoclimate research and climate projections suggest that the frequency and intensity of these events may be magnified in the future.[33] The Planning Team, in collaboration with climatologists, water resource managers and emergency response experts, designed these objectives and key actions to support the achievement of Goal 5, and address the challenges associated with the anticipated increasing frequency and intensity of extreme climatic events.

Village of Vanguard July 2000 Extreme Rainstorm Event

On July 3, 2000, a storm cell centred near the Village of Vanguard deposited approximately 375 mm of rain in an eight-hour period; an amount equal to the average annual precipitation for the Watershed. This unprecedented storm event resulted in significant damage to roads, railroads and farm buildings. Flooding also resulted in the contamination of both municipal and private water supplies.

Highway 58 near Gravelbourg, spring 2011

Objective 12

Watershed residents and municipalities undertake activities to prepare for a multi-year, hydrological drought of equal severity to the drought experienced in 1988.

Key Action 23
Encourage urban municipalities to develop a water use strategy to manage hydrological drought. This could include encouraging relevant municipalities to develop a backup water supply strategy.

Key Action 24
Communicate opportunities to rural municipalities and agricultural producers to enhance the capacity of their non-potable water supply.

Key Action 25
Communicate opportunities to crop and livestock producers for activities they can undertake to enhance drought resilience.

Key Action 26
Facilitate input from watershed residents into the development of a provincial drought response plan.

The intent of Objective 12 is to enhance drought preparedness by undertaking activities to prepare for a multi-year hydrological drought. Hydrological drought occurs when low precipitation results in low water levels in lakes, rivers, reservoirs and aquifers. Preparedness activities include encouraging municipalities to develop a water use strategy to manage water shortages, to develop new non-potable water supplies, to encourage agricultural producers to adopt drought preparedness activities and to support the development of a provincial drought response plan.

Objective 13

Watershed residents and municipalities undertake activities to prepare for a 1:500-year flood event.

Key Action 27
Assist the WSA in the identification of urban municipalities at flood risk and support the development of 1:500-year flood elevation maps for those vulnerable municipalities.

Key Action 28
In support of Objective 2, encourage municipalities to adopt new official community plans and zoning bylaws or undertake amendments to their official community plans and zoning bylaws. Communicate the benefits to municipalities of having policies in place that manage flood risks.

Key Action 29
Encourage urban municipalities to review and update emergency response plans to ensure there are strategies in place to manage excessive moisture events.

The intent of Objective 13 is to advance flood preparedness by undertaking activities to prepare for a 1:500-year flood event. A 1:500-year flood event has a 1 in 500 (or 0.2 per cent) chance of occurring in any given year and the associated flood elevation is the area that would be flooded. This flood elevation has been adopted into provincial regulations as the safe building elevation standard. These regulations also require flood proofing of new buildings and additions to buildings located in the **flood fringe** to an elevation 0.5 metres above the 1:500-year flood elevation of any watercourse or water body. Flood preparedness activities include identifying municipalities at flood risk, developing flood maps for vulnerable municipalities, encouraging municipalities to adopt new or to amend existing official community plans and zoning bylaws to better manage development, and encouraging urban municipalities to review and update emergency flood response plans.

The **flood fringe** is the portion of the flood plain where the waters in the 1:500-year flood are projected to be less than a depth of one metre or a velocity of one metre per second.

6.5. Sustainable Water Use

Goal 6: Water use is efficient and fair and considers all stakeholders and their needs, including domestic, agricultural and industrial, and future economic development

Water is fundamental to every aspect of life. It is a finite resource that must be utilized efficiently and equitably across a diverse group of stakeholders. Interests related to the prudent use of water to protect water supplies for future generations, the fair utilization of water use between multiple users, enhanced water demand management through enhanced water conservation and the proactive management of groundwater resources for future economic development opportunities are reflected in the sustainable water use goal.

The following objectives and key actions are designed to support the achievement of Goal 6, by seeking to encourage local input into water management and policy decisions, promote the efficient use of water and advance the understanding of groundwater.

Objective 14

Local and provincial water management and policy decisions effectively engage watershed residents.

Key Action 30
Facilitate input from watershed residents into water management and policy decisions.

Water governance, "the decision-making process through which water is managed," is a research topic that has garnered significant attention as effective water governance is a fundamental component of sound water management.[34] Jurisdictions across Canada have begun to shift away from traditional, top-down governance structures to more collaborative and stakeholder-based structures to facilitate more comprehensive and effective water management regimes while also addressing the desire for increased local input into water management decisions.[35] Within Saskatchewan, the creation of the 25-Year Saskatchewan Water Security Plan, the WSA, the development of the Old Wives Lake Watershed Plan and the formalization of the OWWA are all significant advancements that support the broader shift in water governance. The intent of Objective 14 is to build on the momentum generated by these initiatives by ensuring watershed residents continue to be effectively engaged in water management and policy decisions.

Objective 15

The five-year average of per capita water use for each urban municipality between 2014 and 2019 will be lower than the five-year average of per capita water use between 2007 and 2011, as reported in the WSA Community Water Use Records.

Key Action 31
Develop a strategy to inform watershed residents of the importance and economic benefits of water conservation. Include a specific youth engagement component as part of the strategy.

Key Action 32
Encourage watershed residents to adopt water conservation activities and technologies.

The intent of Objective 15 is to reduce per capita water use. Canada is one of the highest domestic water users with the average person using 329 litres per day, while countries such as France use less than half this amount.[36] Reducing water consumption provides a wide range of economic benefits, including lower utility bills for individuals and municipal cost savings through reduced treatment costs, reduced energy consumption associated with water treatment and distribution and lifespan extensions for municipal infrastructure.[37]

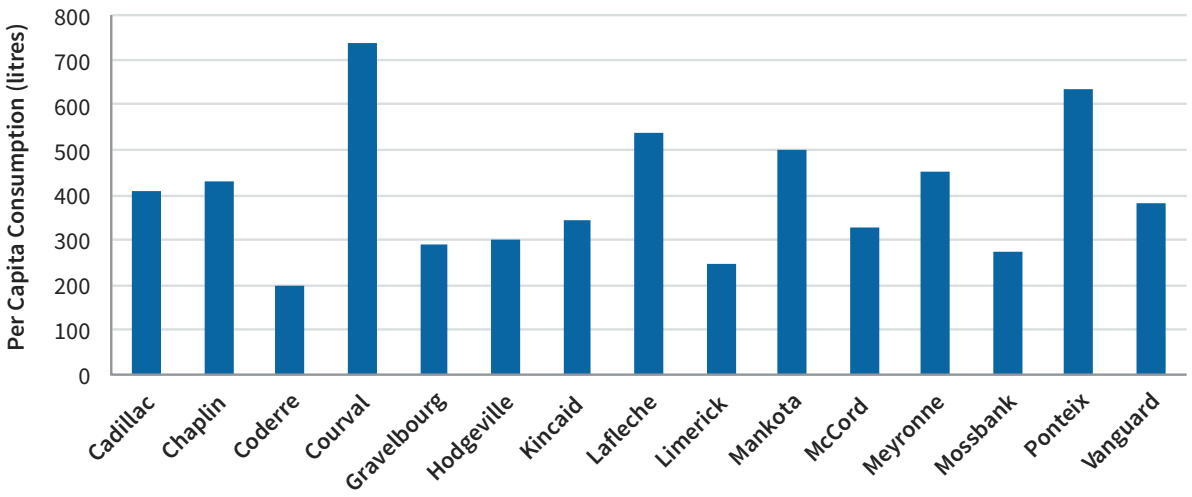


Figure 12: Five-Year Water Use Average (2007–2011)

Figure 12 provides average per capita water use data for some communities within the Watershed. Average per capita water use for many Watershed communities exceeds the Canadian average; therefore, creating opportunities to enhance water use efficiency using activities and technologies such as flow control devices, xeriscaping, pricing policies and education.

Objective 16.

Support the understanding of local hydrogeological conditions and groundwater quality.

Key Action 33
Encourage watershed residents to have registered well drillers run geophysical logs (E-logs) when developing new wells.

Key Action 34
Encourage watershed residents to conduct water quality tests for their drinking water wells and submit the general chemical analysis results to the WSA with a signed waiver allowing the WSA to use the information in future documents.

Quantifying groundwater supply is a difficult and resource-intensive undertaking. Development of known aquifers is limited and therefore, exact information on recharge rates, sustainable yield and extent, is rarely available. Much of the groundwater supply information that is available originates from pump tests undertaken during specific well development projects that typically serve as municipal or domestic water supplies for individuals or communities. The data acquired from the testing programs completed for these wells are site and purpose specific and cannot be relied upon to provide a measure of sustainable, aquifer-wide water yields. Objective 16 seeks to advance the collection of information on geologic formations and water quality data during the development of new wells through the completion of geophysical logs and the promotion of well water quality sampling.

7. Plan Implementation

The publication of the Old Wives Lake Watershed Plan is a significant achievement. This document represents the collective efforts of local volunteer stakeholders who formed the WAC, and government and non-government staff who formed the TAC and the Planning Team.

The Plan, through its objectives and key actions, establishes strategies to address key issues related to safe drinking water, ecosystem health, extreme-climate-event preparedness and the sustainable use of water. These strategies primarily seek to address known water-related issues but also promote the collection of data to fill knowledge gaps to support future decision-making processes.

The OWWA is the locally based watershed stewardship group that will lead the implementation of this plan. The OWWA joins the 10 other watershed stewardship groups formerly established in the province. These groups receive funding from the WSA to support annual operation and are encouraged to seek additional funding and technical support to deliver the key actions in their respective watershed plans. This additional funding and technical support is typically derived through partnerships with local stakeholders such as industry and government and non-government agencies, some of which were established during the planning process. The strength of these partnerships is a critical determining factor in the successful implementation of a watershed plan.

Since the implementation of the Plan will occur over a number of years, the development of a multi-year organizational strategic plan is essential. This strategic plan should address the organization's governance structure, human resources, financial management, and core messaging, and should also identify implementation strategies for the key actions found within the Plan, to allow OWWA board members and staff to prioritize actions and create annual budgets and work plans.

As with all planning processes, the success of the plan is not realized until the actions identified within that plan are implemented. The efforts of the OWWA and its partners to implement this watershed plan will address key water-related issues, work toward reducing identified knowledge gaps and form the foundation for local water governance, the impact of which will yield benefits to the residents of the Old Wives Lake Watershed for years to come.

Wood Mountain Plateau looking north

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Photos courtesy Old Wives Watershed Association

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Appendix A: List of Participants

Watershed Advisory Committee Members

Last Name	First Name	Organization
Bourgeois	Andrea	RM of Gravelbourg No. 104
Bowler	Dan	Old Wives Watershed Association
Clark	Gordon	Old Wives Watershed Association
Croisitiere	Chris	Wood River Utilities Board
Dumonceau	Rita	RM of Auvergne No. 76 and Ponteix Irrigation District
Dyck	George	Village of Hodgeville
Gaucher	Frank	Village of Coderre
Gillespie	Doug	Saskatchewan Cattleman's Association
Harrow	Gavin	Thomson Lake Regional Park
Hawkins	Sam	Town of Gravelbourg
Heinricks	Stewart	RM of Shamrock No. 134
Hicks	Russ	Notukeu Wildlife Federation
Hicks	Barry	RM of Lake Johnston No. 102
Hornung	Jeff	Village of Vanguard
Hughes	Steve	RM of Chaplin No. 164
Kruger	Gordon	RM of Glen McPherson No. 46
Krushelniski	Sandra	Village of Vanguard
Levac	Roland	RM of Gravelbourg No. 104 and Old Wives Watershed Association
MacKenzie	Julie	Old Wives Watershed Association
Martin	Grant	Village of Mankota
Millar	Clem	Chaplin Nature Centre
Monvoisin	Jean-Paul	Old Wives Watershed Association
Mowchenko	Joel	Provincial Council of Agriculture Development and Diversification ADD Boards for Saskatchewan Inc.
Murray	Gord	Town of Gravelbourg
Nagel	Richard	RM of Sutton No. 103
Ostrander	Doug	RM of Whiska Creek No. 106 and Old Wives Watershed Association
Ostrander	Terry	Saskatchewan Stock Growers Association
Roeher	Ed	Flowing Well Conservation Area Authority
Sauder	Collin	RM of Lawtonia No. 135
Schenher	Brent	Thomson Lake Regional Park
Squires	Allison	Old Wives Watershed Association and Wood Mountain Regional Park
Szigety	Melvin	Village of Mankota
Targerson	Greg	RM of Coulee No. 136
Trembley	Don	RM of Hillsborough No.132 and RM of Rodgers No. 133
Weiss	Art	RM of Sutton No. 103
Weiss	Carl	Town of Mossbank
Williamson	Kelly	Old Wives Watershed Association

Technical Advisory Committee Members

Last Name	First Name	Organization
Anaka	Rik	Nature Conservancy of Canada
Assie	Scott	Ministry of Government Relations
Billigetu	Bill	Ministry of Agriculture
Bonneau	Andre	Ministry of Agriculture
Brunet	Nathalie	Water Security Agency
Davies	Stephen	Environment Canada – Canadian Wildlife Service
Garner	Megan	Water Security Agency
Hovdebo	Jeff	Fisheries and Oceans Canada
Lennox	Trevor	Ministry of Agriculture
Matichuk	Adam	Saskatchewan Wildlife Federation
Nazar	Daryl	Ducks Unlimited Canada
Neuert	Kelly	Water Security Agency
Philipation	Travis	Five Hills Health Region
Rogers	Murray	Ministry of Economy
Ursu	Dave	Agriculture and Agri-Food Canada
Williams	Alan	Ministry of Government Relations
Wilson	Ben	Fisheries and Oceans Canada
Wingert	Kevin	Water Security Agency

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