



# Review of Water Monitoring in the SEAWA Watershed

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South Saskatchewan River Sub-basin

Prepared for:  
SEAWA - South East Alberta Watershed Alliance

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## 1.0 INTRODUCTION

The South East Alberta Watershed Alliance ([SEAWA](#)) is working in partnership with governments, industry and local stakeholders to develop and implement an Integrated Watershed Management Plan (IWMP) for South East Alberta. Reliable monitoring of the quantity and quality of streams, rivers, lakes and groundwater is a vital first step in understanding the resource, and is critical for establishing water management objectives. As part of the IWMP process, this summary report will provide a review of current water monitoring activities in the SEAWA Watershed and will identify information gaps and future opportunities to support development of a Long Term Water Monitoring strategy in the watershed.

## 2.0 BACKGROUND

Water monitoring has been recognized by both the Governments of Canada and Alberta as a critical step in understanding and dealing with issues that threaten the future of sustainable development in Alberta. The Alberta Government announced the following in a news release on March 13, 2012. “Our goal is to build a world-class, science-based monitoring system,” said Diana McQueen, Minister of Environment and Water. “This team of scientific, regulatory and academic experts will review governance and funding options and provide recommendations to the government so that we continue making progress.” ([ESRD, 2012](#))

While this action was in response to oil sands development in Northern Alberta’s Athabasca River Basin, the South Saskatchewan River Basin also faces significant challenges related to development. Alberta census data show that in the past decade 392,000 people have settled in the South Saskatchewan River Basin, an increase of 31 percent over 2001. ([Alberta Department of Municipal Affairs](#)) As of 2012, this brings the total basin population to 1.64 million, creating significant pressure on the quantity and quality of water available to downstream users. Add to this the ongoing efforts to increase irrigated areas upstream ([SMRID, 2011](#)), and monitoring becomes even more crucial to ensure a reliable water supply is maintained in the lower reach of the South Saskatchewan River in Alberta.

In 2009, SEAWA was asked to provide priorities for the South Saskatchewan Regional Plan (SSRP). The three priorities are:

- High water quality standards
- Sustainable water quantity allocation
- Incentives for low impact development

All of these objectives rely on adequate monitoring to provide high quality data to be used in making water management decisions and for tracking changes on the landscape.

Since that time, SEAWA and ESRD have been working in partnership to develop an Integrated Watershed Management Plan (IWMP) for the South Saskatchewan River sub-basin. Key to the future progress of the IWMP is a complete understanding of monitoring partners, their programs, data sources and information gaps that are relevant to the watershed. ([SEAWA - IWMP, 2013](#))

In November of 2012, SEAWA assembled many of the regional monitoring partners at a planning workshop at Dinosaur Park where they provided details on their monitoring efforts. The workshop information has been compiled and included in Appendix A.

This report will build on that work and provide a comprehensive summary of partners, programs, data sources and gaps to assist in the development of a Long Term Monitoring Strategy for SEAWA.

## 3.0 HYDROLOGY

### 3.1 SEAWA – SOUTH SASKATCHEWAN RIVER (SSR) SUB-BASIN

The SEAWA Watershed is a sub-basin to the larger South Saskatchewan River basin. It begins at the confluence of the Bow and Oldman Rivers where they combine to form the main stem of the South Saskatchewan River. (Figure 1)

SEAWA has designated 6 smaller sub-watersheds which are:

- Seven Persons Creek
- Pakowki Lake
- Many Island Lake
- South Saskatchewan River - West
- South Saskatchewan River –Central
- South Saskatchewan River - East

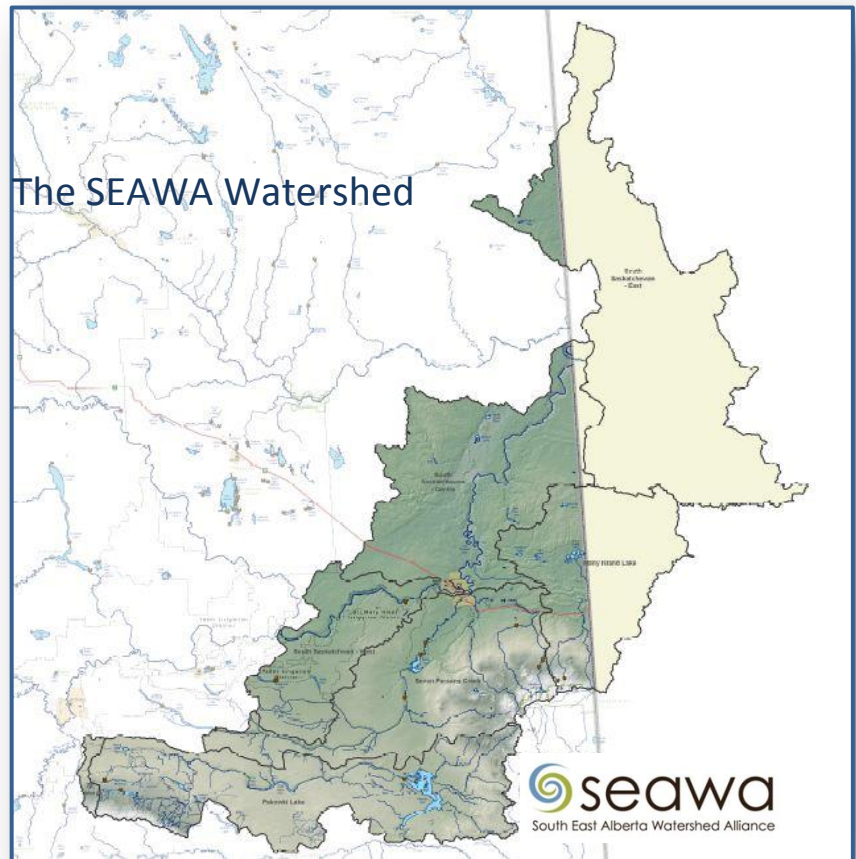


Figure 1

([SEAWA, 2011](#))

Spring snowmelt from local fields, farmland, pastures, road ditches, and city streets recharge the river flows. The runoff creates a silt-laden slurry that stands as testament to the skill of our water treatment experts who continue to provide clean, safe drinking water to our communities. Later in the year snowmelt from the mountains begins to appear and will often crest in Medicine Hat around the first week in June. At the same time, Southern Alberta will receive much of the rainfall it gets for the year.

The combination of snowmelt and rainfall often raises concern about flooding. Depending on the mountain snowpack, the Irrigation Districts may wait until the crest has passed and then begin diversion into their works to replenish the reservoirs. These diversions will continue through the summer into the fall often depending on the nature of the spring and summer rains.

However, the spring rains are not guaranteed and mountain snowpack can be quite variable. In the south county, drought is never far from people's mind. If it stays dry into the summer, diversions get used to the fullest, and everyone is affected as river levels drop and calls for conservation abound.

### **3.2 TRIBUTARIES**

There are several named creeks that originate from the north slope of the Cypress Hills and contribute to the South Saskatchewan River. They include the Seven Persons, Ross, Bullshead, Gros-Ventre and Piegan Creeks. Vegetative cover in these sub-watersheds is a mixture of cropped and stubble fields, forage production, native grass and forest lands. Median annual runoff from the north slope of Cypress Hills is some of the highest on the Prairies at approximately 30 - 50 dam<sup>3</sup> /km<sup>2</sup>. ([Bell & Cole, 2013](#)) The steeply sloping topography can generate significant erosive forces during runoff events as evidenced in the flood of 2010. ([Pentland, Abrahamson, & Wiens, 2011](#))

There are three sub-watersheds that contribute directly to the river. The most significant is the SEAWA West sub-watershed which includes the main stem of the river between the Great Forks and the City of Medicine Hat. The hydrology in the upland area of this sub-watershed is dominated by irrigation structures and controls, operated by the St. Mary River Irrigation District (SMRID). The irrigation district uses the natural drainage courses to provide outlets for their supply ditches and, as such, they provide an important resource as they contribute the return flow directly to the river. This reach of the river includes the City of Medicine Hat. ([State of the Watershed, 2010](#))

### **3.3 NON-CONTRIBUTING OR CONFINED BASINS**

Pakowki and Many Island Lakes are both non-contributing basins in that neither of them contributes flow to the South Saskatchewan River. They comprise a significant area and are very much an entity in themselves. Both of the basins have, in the past, seen significant development of private irrigation schemes that rely solely on runoff from the local watershed. Due to the recent wet springs, the trend is toward increasing water levels in both Pakowki Lake and Many Island Lakes.

### **3.4 GROUNDWATER**

Groundwater is an important water source for rural residents and communities in the watershed. These groundwater resources offer an enticing alternative to supplement surface water supplies but are poorly understood by comparison. Regional aquifers include those in the Oldman (Belly River); Milk River Sandstone and Medicine Hat Valley as well as numerous smaller infill and surficial formations. ([Davison, Dubord, & HCL, 2011](#))

## 4.0 REVIEW OF MONITORING PROGRAMS IN THE SOUTH SASKATCHEWAN RIVER SUB-BASIN (SEAWA WATERSHED)

### What is monitoring?

- Monitoring: A scientifically-designed system of long-term, standardized measurements, systematic observations, evaluation and reporting.
- Surveillance: A focused, short-term study to assess and report on a priority issue or specific threat.
- Research: Systematic, science-based study used to establish facts and reach conclusions.

([Environment Canada, 2010](#))

### HYDROMETRIC MONITORING

Hydrometric monitoring refers to the collection of water flow data from rivers and streams and static observations of lake levels. Data are collected in support of water management, water supply, river ice break up and flood forecasting. Response to high water and other water-related emergency events are also part of this program. The collection of hydrometric data is critical to the understanding of the availability, variability and distribution of our water resources. The hydrometric network blanketing Alberta provides data essential to informed decision-making for purposes such as flood risk, water supply/approvals, International Joint Commission and trans-boundary agreements, State of the Environment reporting and cumulative effects management. It is also the basis for a historical long-term data archive used for modeling and other activities by a multitude of users. Emergency collection of critical data during high water events help in the protection of communities at risk. ([Hills, 2012](#))

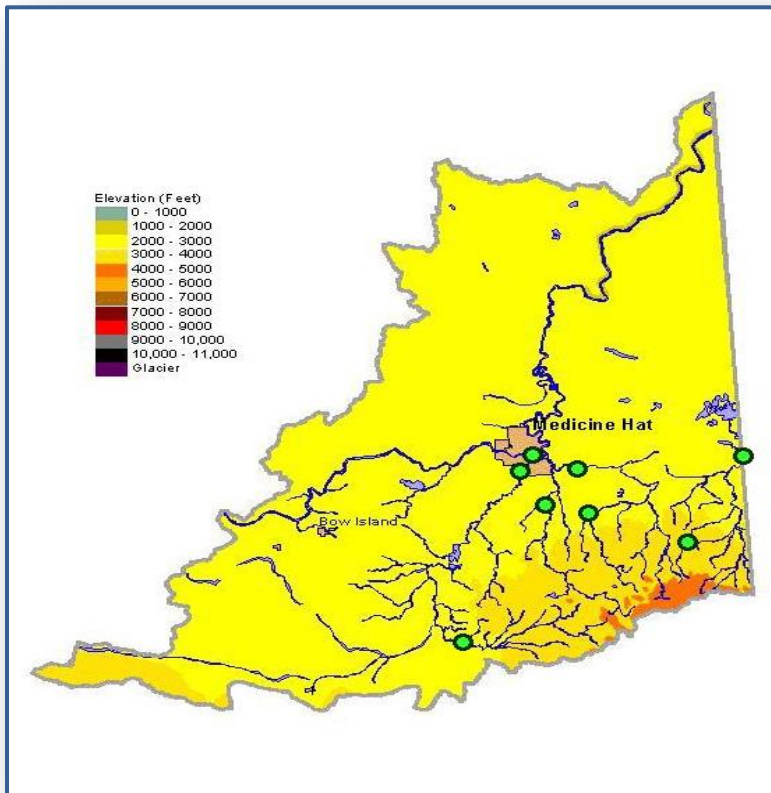
#### 4.1 ALBERTA ENVIRONMENT AND SUSTAINABLE RESOURCE DEVELOPMENT (ESRD)

The Alberta River Basins website ([ESRD, 2013](#)) provides maps, tables, charts and raw data for numerous monitoring sources across the province. The web-page for the South Saskatchewan River sub-basin currently includes:

- River Flow and Levels
- Lake and Reservoir Levels
- Meteorological and Precipitation Data
- Water Quality Data
- Water Management and Operations Reports

The Water Survey of Canada (WSC) is the national authority responsible for the collection, interpretation and dissemination of standardized water resource data and information in Canada. In partnership with the provinces, territories and other agencies, the WSC operates over 2,500 active hydrometric gauges across the country. Environment Canada operates approximately 400 stations in the province of Alberta on behalf of ESRD, as a result of a long-standing, co-management agreement between the two organizations established in 1975. Site specific descriptions including UTM co-ordinates and related hydrologic data are compiled in a spreadsheet attached as Appendix B. ([Hills, 2012](#))

Using a sophisticated telecommunications system, water level and stream-flow conditions are reported within hours of their measurement. The data are transmitted by satellite or by land-line directly from the gauging station to regional data centres. Data transfer between the regional data centres and the website occurs on a scheduled basis every hour. ([Water Survey of Canada](#)) While measurements are somewhat delayed, for simplicity, this report will refer to these as real-time measurements.



*Real-Time Hydrometric Stations in the South Saskatchewan River Sub-Basin*

*River and Stream Flows* ([ESRD, 2013](#))

Note: Manyberries Creek station data is accessed from the Milk River Basin web-page.

Figure 2

In SEAWA, there are 43 hydrometric stations of which 9 provide real-time hydrometric data. There are 8 stations on the tributaries and 1 station at Medicine Hat on the South Saskatchewan River. Flow measurements at this station began in 1908, the year the Finlay Bridge was constructed. There are 103 years of historical flow record at this location and it continues to provide real time data from this site.



Tributary flow data are taken from various real-time stations in the sub-watersheds located on:

- Box Elder Creek at Hargraves Ranch;
- McAlpine Creek (East Fork) near Elkwater
- Gros Ventre Creek near Dunmore
- Bullshead Creek at Black and White Trail
- Ross Creek at Hwy 41
- Seven Persons Creek at Medicine Hat
- Peigan Creek near Pakowki Road
- Manyberries Creek at Brodin's Farm

(See Figure 2)

### Lake Level Stations

The collection of lake level data is critical to the understanding of the availability, variability and distribution of our water resources. The lake level network in Alberta is the basis for a historical long-term data archive. Data are used for modeling, water licensing and establishing minimum levels for water withdrawals. ESRD currently measures levels on approximately 180 lakes and reservoirs. ([ESRD Oldman River Operations Team](#))

In SEAWA, there are 6 non real-time Lake Level Stations. These are:

- Crow Indian Lake
- Pakowki Lake
- Rush Lakes North and South
- Tyrell Lake
- Yellow Lake

There are 12 real-time lakes and reservoirs reporting to Alberta Environment.

- Bullshead Lake
- Mackay Lake
- McAlpine Lake
- Cypress View Lake
- Elkwater Lake
- Spruce Coulee Lake
- Reesor Lake
- Sauder Reservoir
- Murray Lake
- Forty Mile Reservoir
- Grassy Lake
- Chin Reservoir

The lake level data reports are used in support of structure operations, licensing, water supply, irrigation, drought planning, water quality indicators, recreation, climate change initiatives and regional planning.

### Snowpack Measurements

Real-time mountain snow accumulation is monitored using snow pillow surveys in the upper reaches of the tributaries to the Oldman and Bow Rivers. These data are critical for predicting river flows and available water for river diversion modelling for the upcoming irrigation season. In the SEAWA Watershed there are 6 Plains snow course survey sites operated by ESRD in years of significant snowpack. They are located on the north slopes of the Cypress Hills in the upper reaches of the Gros Ventre, Mitchell and Ross Creeks and are used to forecast potential flood conditions and to prepare water supply predictions.

## **SURFACE WATER QUALITY MONITORING**

There is no single or simple measure of water quality. Depending on the need, water may be tested for a few characteristics or numerous natural substances and contaminants. Analysis may be done by collecting a representative water sample from a waterbody and sending it to a laboratory or it may be analyzed immediately using hand-held electronic meters or kits.

Water quality sampling provides a snapshot in time but over many cycles it can be used to characterize the nature of the waterbody and provide what is known as *baseline data*. Interpretation of this data is used to identify issues or concerns and provides background for planning actions intended to mitigate problems. Water quality is impacted by natural processes as well as anthropogenic (man-made) influences or inputs. It may be from a one-time or recurring point source of contamination, or it may be an event based input caused by rainfall or snowmelt. The inputs are interlinked with ongoing land-use and as well as new development, both urban and rural.

Real-time reporting of certain water quality is possible using technology similar to that used to report Water Survey of Canada flow data. For example, the U.S. Geological Survey (USGS) maintains instruments that continuously record physical and chemical characteristics of the water including turbidity, pH, specific conductance, temperature, dissolved oxygen, and percent dissolved-oxygen saturation. Supporting data such as air temperature and barometric pressure are also available at some sites. This data is compiled and subsequently posted on the USGS website as provisional data pending validation. ([US Geological Survey](#))

In the SEAWA sub-basin, monitoring will be useful as a planning tool to assess the environment, understand risks, suggest a course of action, and monitor trends. It is important to fully understand and define the objectives of any water quality monitoring program before data collection begins. An excellent resource with information for designing water quality monitoring projects can be found on the AARD website. ([Introductory Guide to Surface Water Quality Monitoring in Agriculture, 2006](#))

### The Alberta River Water Quality Index

This index was developed as a way to summarize physical, chemical and biological data into a simple descriptor of water quality. It provides a snapshot of annual water quality conditions in major rivers of the province. Only data collected as part of the province's Long-term River Network are used to calculate Index values. They are calculated annually to inform Albertans about how well anthropogenic effects are managed. The Index is based on the average of four sub-indices using these four variable groups:

- Metals (up to 22 variables measured quarterly);
- Nutrients (6 variables measured monthly);
- Bacteria (2 variables measured monthly); and
- Pesticides (17 variables measured 4 times during open-water season).

A complete list of parameters can be found on the Alberta ESRD website. ([Alberta River Water Quality Index](#))

In February 2010, Alberta ESRD released the draft version of "The Water Quality Management Framework (WQMF) for the South Saskatchewan Regional Plan". For SEAWA, this framework establishes reach-specific thresholds for water quality in two main-stem river reaches for the South Saskatchewan River. SEAWA has identified Water Quality Triggers and Limits and has summarized them in the SEAWA – State of Watershed Report. ([SEAWA, 2010](#))

#### The Long Term River Network (LTRN)

The LTRN consists of 29 sites located on large provincial rivers, often above and below major population and activity centres. The network has been in operation since the late 1970's and has evolved over time. It provides a reliable long-term data set that is useful in understanding the dynamics of aquatic ecosystems and human impacts and provides input data for predictive water quality modelling. The provincial database is accessible to the public from the ESRD website. ([Long Term River Network](#))

There is one LTRN site on the South Saskatchewan River at Medicine Hat. There are also LTRN sites upstream of the confluence; on the Oldman River at Highway 36 Bridge and on the Bow River at the Ronalane Bridge on Highway 524.

In the spring of 2012 sampling began at a site on the South Saskatchewan River immediately downstream of the City of Medicine Hat to evaluate the impacts of the city activities. At this time, the site is not considered part of the LTRN. Over time, as more data is collected and trends are identified, SEAWA may want to consider providing rationale to support the inclusion of this site in the LTRN. Sampling will continue in 2013.

There has never been a Synoptic Survey completed for the lower reach of the South Saskatchewan River. A synoptic survey is one in which water samples are collected according to river travel time, so the same portion of water is sampled as it flows down river. This allows researchers to assess the source and relative load of contaminants entering the river. Synoptic surveys in the basin have been conducted on the Bow River in 1995-1996 ([Sosiak, 1994-1995](#)) and the Oldman River in 1998, 2000 and 2005. ([Saffran, 2005](#)). For the first time ever, a basin wide synoptic survey is planned for August 2013. It will include the Bow, Oldman, Red Deer and South Saskatchewan Rivers.

#### Tributary Water Quality

In 2011, monthly sampling was begun on Seven Persons Creek and Ross Creek at locations near their mouths in the City of Medicine Hat. These sites are sampled year-round, for a wide range of water quality variables including instantaneous field measurements (pH, temperature, dissolved oxygen, conductivity), major ions, suspended and dissolved solids. Dissolved and total metals and ultra trace total mercury are sampled 6 times a year. Pesticides will be sampled from May to August. Sampling will continue in 2013/2014. After validation the data will be posted to the ESRD Inventory of Sampling Locations and Water Quality Data ([ESRD Water Quality Data](#)). Requests for additional data can be made to ESRD. Future monitoring work on the tributaries may include a synoptic survey of important indicator parameters or implementing an event-based sampling program.

Since 1992, Cows and Fish -The Alberta Riparian Management Society has been promoting improvements in grazing and management of riparian areas with the goal of enhancing landscape health and productivity. Their hands-on approach uses riparian health assessments as a powerful tool to demonstrate and educate the public on the benefits of healthy riparian area function. In SEAWA, there are 32 sites identified of which, 21 are located in the Seven Persons Creek sub-basin ([Riemersma & Andrews, 2007](#)). There is 1 assessment which was commissioned by SEAWA. Future work for SEAWA may include hiring Cows and Fish staff to develop a more complete data-set of those assessments to better characterize current riparian conditions in the tributaries.

#### Water Quality Monitoring in Lake and Reservoirs

In 2011, ESRD sampled Rattlesnake (Sauder) Reservoir and in the following year sampling was moved to Murray Lake. Sampling was conducted 3 to 5 times during the open water season, involving the collection of a composite epilithic sample from about 10 places in the lake. Data are mainly collected on major ions and nutrients, with a focus on assessment of trophic status. A temperature / dissolved oxygen profile is usually also done in the waterbody near its deepest point. Sampling is expected to continue in 2013 at Forty Mile Reservoir.

### **GROUNDWATER MONITORING**

#### Groundwater Levels

The Groundwater Observation Well Network (GOWN) is an ESRD owned network of groundwater monitoring wells located in various aquifers throughout the province. Most of these wells are fitted with specialized electronic equipment that continually record groundwater levels. Regional employees from ESRD maintain the wells, take manual readings, down-load the loggers and validate the data. Management staff review the data coming in from the regions, update the provincial database and post data to the internet.

There are currently 7 GOWN wells with level and quality in SEAWA boundaries:

- Forty Mile Coulee 86-1
- Pakowki 85-1
- Ross Creek 2286E and 2288E
- Elkwater 2294E
- Foremost Farm 954
- Cypress 85-1.

Details on each of the wells and views of the historical levels can be viewed from ESRD's website.

[\(GOWN - Groundwater Observation Well Network\)](#)

The Alberta Water Well Information Database contains 500,000 water well drilling reports. The reports may include site specific information on lithology, well construction, groundwater quality, groundwater elevation and pump test results. Baseline water well test reports have recently been added to the database. It is unknown how many records pertain to the SEAWA Watershed. ([ESRD - Waterwell Information Database](#))

#### Groundwater Quality

Groundwater quality monitoring by AENV was initiated in the 1980s and has continued intermittently until the mid-1990s. Sampling recommenced in 2006 with 30-40 wells sampled annually across the province and 165 wells were sampled over a 5 year period. The wells are to be sampled every 5 years to

monitor long-term trends. There are another 6 GOWN wells sampled for quality within the SEAWA boundary.

- Hilda East
- Hilda West
- Many Island Lake North
- Many Island Lake South
- Medicine Hat North
- Suffield 85-1

Variables include major ions, metals, hydrocarbons, nutrients, pesticides, bacteria and gas compounds. Data can be requested from ESRD.

ESRD also has sporadic data collected from regulated municipal groundwater supply wells within the area. The majority of these data are held by the respective municipality. Additional water quality data may be associated with Well Driller Reports and archived in the Water Well Information Database.

## 4.2 IRRIGATION DISTRICTS

### Flow Monitoring in Irrigation Districts

The St. Mary River Irrigation District (SMRID) provides water in two separate blocks within the SEAWA Watershed. The Central block consists of the Grassy Lake, Burdett, and Bow Island areas, with an assessed irrigable area of 62,090 ha. The Eastern Block includes the Medicine Hat and Seven Persons areas with an assessed area of 27,573 ha. ([SMRID Annual Report, 2011](#)) In addition, the Ross Creek Irrigation District (RCID) diverts out of Gros Ventre Creek into Cavan Lake. The RCID provides irrigation water to 446 ha.

The Irrigation Districts carefully monitor water use and delivery through their system. In order to increase delivery efficiency the districts are using Supervisory Control and Data Acquisition (SCADA) systems. With SCADA, they are able to remotely regulate flow across the entire network of infrastructure. Diversion into and return flow out of the irrigation works is carefully monitored and reported to ESRD. These return flow data are accounted in annual water budget calculations.

### Water Quality in Irrigation Districts

Alberta Agriculture and Rural Development (AARD) – Irrigation and Farm Water Division, is conducting a multi-year study from 2011-2015 to assess the water quality of the 11 Irrigation Districts in the South Saskatchewan River Basin in Alberta. This project re-visits sites established from two previous years of Irrigation water quality sampling in 2006-2007. ([AARD- Irrigation Full Report, 2012](#))

Approximately 90 sites within Alberta's 13 irrigation districts are sampled. The sites include source water diversion locations, sites within the delivery system, return flow sites as well as river sites upstream and downstream of irrigation outfalls. Samples are collected four times per year during the irrigation season (June to September) and analyzed for more than 155 parameters including:

- Nutrients
- Salinity
- Biological
- Metals
- Pesticides

## St. Mary River Irrigation District



*Irrigation Water Quality  
Project Monitoring Sites in  
the SEAWA Watershed  
2011-2015*  
([Alberta ARD-Irrigation Branch,  
2011](#))

Figure 3

In 2013, sampling will continue at 12 irrigation sites located in the SEAWA Watershed (see Figure 3). They include 2 Primary sites where water enters the irrigation district; 4 secondary sites where canals branch off within a district for on-farm water supply; 5 return flow sites where water exits the irrigation infrastructure; and one site on the South Saskatchewan River. Early results are summarized in the 2011 Progress Report. ([Alberta ARD-Irrigation Branch, 2012](#)) The RCID would benefit if Cavan Lake were included in this monitoring program.

### 4.3 PRAIRIE PROVINCES WATER BOARD

To ensure water resources are shared fairly, the Provinces of Alberta, Saskatchewan, and Manitoba and the Government of Canada created the Prairie Provinces Water Board in 1948. In 1969, the four governments entered into the Master Agreement on Apportionment (MAA), the purpose of which is to apportion or share water equitably between the Prairie Provinces and to protect interprovincial surface water quality and groundwater aquifers.

Environment Canada conducts monitoring at 12 PPWB Apportionment sites across the Prairie Provinces, the minimum required under the MMA. However, the current apportionment computations use data from 85 hydrometric stations that are operated by different agencies. There are 40 such hydrometric sites within the South Saskatchewan River Basin in Alberta (including Bow, Red Deer and Oldman

Rivers). In the SEAWA Watershed the PPWB operates one site located at Highway 41 at the Sandy Point Bridge. Data on both flow and quality are acquired at the site. The data are summarized and evaluated in Prairie Provinces Water Board Annual Reports available on the website. Specific raw data may be available upon request. ([PPWB Annual Reports](#))

#### **4.4 CITY OF MEDICINE HAT**

##### **Regional Drinking Water**

The South Saskatchewan River is the source of raw water for the City of Medicine Hat. Water quality in the river fluctuates on a seasonal basis, normally resulting in water quality variables in the following ranges:

Turbidity	1 to 3,000 NTU
pH	7.6 to 8.8
Total Hardness	130 to 270 mg/l (7.6 to 15.8 grains)
Alkalinity	120 to 240 mg/l
Temperature	2 to 32 Celsius

[\(City of Medicine Hat, 2013\)](#)

The water treatment plant has recently expanded and is now able to meet the water demand for 75,000 customers. The City provides drinking water to the Village of Dunmore and the Hamlet of Seven Persons and numerous farms along the way. Basic raw water parameters are monitored on a regular basis.

As a drinking water supply, the City of Medicine Hat has a vested interest in maintaining a high quality water source, and in keeping the river flow volumes high enough to minimize the impact of unwanted substances in the water. A complete understanding of the In Stream Flow Needs (ISFN) becomes even more critical in times of drought or when the City starts to consider an approach to take in adapting to changing climatic conditions. Common adaptation options for the water resources sector all represent ‘no-regrets’ adaptation options, meaning that their implementation would lead to benefits irrespective of the effects of climate change.

These include:

- Water conservation measures;
- Improved planning and preparedness for droughts and severe floods;
- Improved water quality protection from cultural, industrial and human wastes;
- Enhanced monitoring efforts; and
- Improved procedures for equitable allocation of water

[\(Sanford & et.al., 2011\)](#)

##### **Trace Organics Research Project**

In 2010, Medicine Hat College student Morgan Basiuk researched and reported on the issues surrounding pharmaceuticals in water. A draft project report posted on the SEAWA website. ([Basiuk, 2010](#))

Subsequently, in 2012, Rachel Brown joined Morgan Basiuk and a project was undertaken related to



these and other trace organic compounds in water. Co-sponsored by SEAWA, the Alberta Association of Colleges and Technical Institutes (AACTI), the City of Medicine Hat, Hyperion Research Ltd. and a private donation, the objective was to evaluate a methodology for the determination of several chemicals in water samples using Enzyme-Linked Immunosorbent Assay (ELISA) kits. The chemicals in question were linked to pharmaceuticals, personal care products, industrial chemicals and other known endocrine disruptors.

In 2012, samples were evaluated from Seven Persons Creek, Ross Creek, the South Saskatchewan River, waste-water treatment plant (influent and effluent), tap water, and de-ionized water using the ELISA kits. Compounds of interest have been compared to previous research and full reports were created on alkylphenols, sulfamethazine, sulfamethoxazole, glyphosates, benzo(a)pyrene) and triclosan. Partial reports were created on estrogens, ethinylestradiol, testosterone, avermectins, 2,4-D, microcystins and carbamates. With funding, future work will continue in 2013 with samples from the sites evaluated with standard Mass Spectrometry/Gas Chromatography to further validate the ELISA method.

#### **4.5 MUNICIPAL WATER QUALITY MONITORING**

Various acts and codes of practice, administered by ESRD, necessitate a substantial and wide range of monitoring activities including those required by approvals and licensing. In all cases, operations of the water systems are guided by an Approval to Operate issued by ESRD for that specific source and associated works. ([ESRD-Approval Viewer](#))

##### **Water Supply**

There are numerous water sources and treatment systems operated by the municipalities. In addition to the City of Medicine Hat, raw water quality is monitored by the towns, villages and hamlets in Cypress County and the County of Forty Mile.

- **Surface water sources** serve the City of Medicine Hat; Towns of Redcliff and Bow Island; Hamlets of Walsh and Seven Persons.
- **Groundwater sources** serve the Town of Foremost; Villages of Elkwater, Empress and Manyberries; Hamlets of Irvine, Schuler, Hilda, Nemiskam and Etzikom.

Raw water sampling requirements vary, depending on the source but generally require analysis of turbidity on a daily basis and *Escherichia coli* on a weekly basis or more frequently where the source is considered vulnerable. Operation of the waterworks system is carried out by a qualified Water Treatment and Distribution System Operator. The approval also specifies the monitoring, reporting and potential remedial action that may be required by the approval holder as a condition to operate the water supply system. In most cases, the requirements are based on [Canadian Drinking Water Quality Guidelines](#).

##### **Wastewater Treatment**

All municipal treatment systems, whether a village lagoon or the City of Medicine Hat wastewater treatment plant, are subject to terms and conditions specified in their specific Approval to Operate issued by ESRD. The City of Medicine Hat wastewater stream is evaluated throughout the treatment



process which includes solid separation, microbial phosphorus removal and UV disinfection. The majority of the final effluent is discharged into the South Saskatchewan River by means of a submerged diffuser system. Other municipal wastewater systems are subject to ESRD operational requirements that regulate their release into the environment. The fate of these wastewater releases from other municipal or industrial treatment systems may not be well documented and need further evaluation in the future.

In 2012, a preliminary survey of the South Saskatchewan River from the Highway 879 Bridge to 2.5 kilometers downstream of Medicine Hat, identified 29 locations of potential point source outfalls. ([Hilden, 2012](#)) The sites are a combination of treated wastewater and untreated storm-water outfalls. This information will prove useful in planning a synoptic survey of river water quality.

#### **4.6 INDUSTRIAL WATER USERS**

The amount of water that is allocated to be diverted for industrial use is specified on the water licence granted and administered by ESRD. The amount of water actually used is reported annually to ESRD. If there is a waste flow from the industrial process it will be subject to approval with treatment and monitoring requirements specified on the ESRD Approval document. Although waste outfall locations are identified in ESRD documentation, future work may be required to evaluate and map the actual outfall locations. ([ESRD - Licence Viewer](#))

Oil and gas operations typically access water through a Temporary Diversion Licence issued by ESRD that regulates the quantity of water that may be diverted for each specific case. Conditions of each licence describe the volume and rate of withdrawal taking into consideration the activity, when the water is required and where withdrawal is coming from. Where possible, saline groundwater is pumped from below the Base of Groundwater Protection and after use in the drilling process, the water is usually returned to the same or deeper formation. The quantity of water used is documented and reported to ERCB. Return flow to surface water is negligible.

Oil and gas development is regulated by ERCB under the following regulations:

- Directive 056: Energy Development and Applications Schedules
- Directive 050: Drilling Waste Management ([ERCB](#))

During pipeline installation, every effort is made to manage the development. Some impact to surface water may be involved in routine tasks such as horizontal directional drilling, the open cut of seasonally inundated drainages, and discharge of hydrostatic test water (used to pressure test pipelines). These risks are primarily associated with inadequate erosion and sediment control measures near drainages.

Drilling fluid, made up inert polymers, clay and water, may pose a siltation risk to surface water from improper onsite disposal of drill fluid, activities such as land-spreading on an area with gradient, or sump containment that is overwhelmed. These construction-related impacts on the watercourse or wetland are effectively mitigated with proper attention to industry recognized best management practices and risk management. ERCB monitors these projects and holds the data or reports, although they may also

be held by the operator. Certain data may be available upon specific request.

#### **4.7 AGRICULTURAL WATER USERS**

Aside from irrigation, water allocated for agriculture is primarily for stock watering use. Depending on the management practice, livestock operations may have a variety of impacts on surface water sources. Of primary concern are elevated nutrient and bacterial contaminants from manure management practices.

It is important to establish a baseline level of these contaminants to set achievable targets and to track progress on improving management practices in the watershed. ([A Primer on Water Quality: Agricultural Contaminants, 2002](#))

## **5.0 DISCUSSION**

### **5.1 GAPS and RECOMMENDATIONS**

**Baseline data is not adequate to enable the development of Water Quality objectives and indicators for the tributaries.**

- Recent sampling by ESRD on the tributaries should continue.
- The monitoring program should be expanded to include event based sampling.
- Consider evaluating Total Phosphorus loading.
- Consider having Cows and Fish compile assessment results for the tributaries.

**The monitoring site on the river downstream of Medicine Hat is not considered part of the LTRN.**

- Evaluate the need for an additional LTRN site downstream of Medicine Hat.

**Trace Organic results need to be evaluated to select a suite of key analytes as potential indicators, and to better understand their seasonal variation.**

- Continued support of the validation project to target a predictable suite of analytes and plan for tech transfer of ELISA testing to the City.
- Conduct an analysis of results related to seasonal variation and eventually trends.

**There is a shortage of information on the water quality needs or objectives for stakeholders such as industry, oil and gas sector, greenhouse operators, rural raw water pipelines, City of Medicine Hat Parks department, on-farm water and others.**

- This will form part of the discussion SEAWA will take to stakeholders related to engagement on the IWMP.

**There is a lack of information on the location and quality associated with wastewater outfalls, municipal waste treatment systems, storm drains and natural drainage courses.**

- Research and document outfalls and associated operating requirements from ESRD.

- Research and report on the correlation and consequence of return flow from Calgary WWTP into the Bow River compared to Lethbridge WWTP into the Oldman River.

**Water quality data on the river are not collected in real-time. Real-time water quality data would enable a comparative analysis of the seasonal relationship between river flow and water quality.**

- Install a data sonde upstream of the City.
- Plan to conduct the comparative analysis of the City's In Stream Flow Needs in the future.

**Water quality data sets may need to be more accessible**

- It would be useful for SEAWA to develop a further compilation of data types, sources, providers and contacts to be posted to their website.
- This may also include important data sets that might serve to advance future SoW work.

## **5.2 ENGAGEMENT OPPORTUNITIES**

Monitoring may provide opportunities for engagement. Rural residents take pride in their stewardship role and understand the value of maintaining the land and water for future generations. Discussions can take place around the issues and improve linkages with key rural stakeholders.

The urban message should describe the importance of the river and promote stewardship as a way of life in Medicine Hat. SEAWA can help show the way by continuing to celebrate the river and act as a conduit for discussion while providing key resources for education and outreach. For example, SEAWA and partners may consider supplying simple water quality testing kits to allow residents, both rural and urban, to participate in a Citizen Science type of monitoring project.

Engagement activities in 2013/2014 related to monitoring will include :

- Hosting an additional workshop to build on the successful water monitoring workshop held in October 11, 2012;
- Collaborating with provincial water monitoring agencies (development of targets, management implications, monitoring and data acquisition);
- Engaging rural municipality decision-makers (including Irrigation Districts);
- Engaging rural water users through discussion of needs, interests, and issues to encourage Beneficial Management Practices and related monitoring; and
- Engaging urban leaders and Watershed Stewardship Groups to determine needs regarding urban water quality.

## **5.3 LONG TERM MONITORING STRATEGY**

Monitoring-related planning, data collection and analysis will be key activities this coming year as directed in the IWMP Terms of Reference. As a result, a monitoring strategy will be developed to define the purpose and scope of monitoring, provide direction for future monitoring throughout the watershed, and clarify roles and responsibilities for key stakeholders. ([Introductory Guide to Surface](#)

The Monitoring Plan will include the:

- Identification and prioritization of data gaps in SEAWA's six sub-watersheds;
- Identification of water quality issues relating to tributaries, and relevant indicators to be monitored; and
- Methodology for the collection of qualitative information regarding tributaries from rural residents and land owners.

The IWMP workplan has identified opportunities to advance the development of a monitoring plan mainly through the involvement of the SEAWA Technical Committee (TC). In response to engagement activities, the TC will provide input into data gap discussion and issue identification. With this in hand, the TC would direct the development of the long-term monitoring strategy with the goal of having a draft strategy to present to the board by the end of 2013. ([SEAWA - IWMP, 2013](#))

## 6.0 CONCLUSION

In the SEAWA Watershed, Alberta Environment and Sustainable Resource Development (AESRD) in partnership with Water Survey of Canada (WSC) are monitoring stream flow and water levels and posting the real-time data, along with a large selection of other related data, on their respective web-sites.

ESRD conducts water quality monitoring in conjunction with the Long Term River Network, 2 recently established sites on the tributaries, and the Groundwater Observation Well Network. Other water quality monitoring includes work in the Irrigation Districts by Alberta Agriculture and Rural Development (AARD); river sampling done by the Prairie Provinces Water Board; operational monitoring by the City of Medicine Hat water and wastewater treatment plants; monitoring for research into trace organic compounds and; monitoring related to various regulatory needs in municipal and industrial operations. Some raw data are archived on the AESRD website but much is held by other agencies and referenced in various reports.

Since the 1990's and the upgrades to Calgary and Lethbridge treatment facilities, raw water quality in the river has markedly improved. However, there are still challenges on the horizon. Nutrient runoff from snowmelt and flood events can be very significant. Information on the tributaries is lacking and the impact of outfalls into the main-stem river is unknown as are issues related to trace organic contaminants. Underpinning all this is the need to understand the long term security of the South Saskatchewan River as a water supply in light of in-stream flow needs. Thoughtful, well-planned monitoring programs can help us identify and prioritize issues, engage the residents of the watershed, suggest solutions and track changes as the basis for a logical way forward.

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