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# Water Use Data Sources for Western Canada

*Identify and catalog water use data sources in Western Canada*



Ponderosa Environmental and Water  
Resources Inc.

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Submitted by: Curtis Ferguson, P.Eng, MSc  
Owner Ponderosa Environmental and Water Resources Inc.  
PO Box 27026 RPO Grosvenor Park  
Saskatoon, SK S7H 5N9

Submitted to: Lorie Frei  
Petroleum Technology Alliance Canada  
Suite 400, Chevron Plaza  
500 – Fifth Avenue S.W.  
Calgary, AB T2P 3L5

## Executive Summary

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This report has been prepared for the Petroleum Technology Alliance of Canada (PTAC) to research available sources of water use data in Western Canada. Funding was received through the Alberta Upstream Petroleum Research Fund.

The goal of this research is to develop an understanding of the water use data available from public and regulatory domains. In general, regulatory jurisdictions in western Canada have a consistent approach for managing water resources although there are significant differences in the policies, guidelines, and systems utilized for authorizing and tracking water used for upstream oil and gas development.

The Canadian Association of Petroleum Producers (CAPP) published an annual progress report as part of the Responsible Canadian Energy (RCE) program in 2013 and 2014 summarizing data collected in 2012 and 2013, respectively. The RCE program is designed to track the social and environmental performance of the upstream oil and gas industry in Canada. The publication includes several facts and statistics related to social performance, health and safety, air, water, and land. GEOWA has collected and processed water use data for CAPP dating back to 2009 in order to monitor trends in water use for the upstream oil and gas industry. In 2016 CAPP's Board of Governors determined that member data collection is not a priority and all elements of the RCE program are currently on hold. In 2014 and 2015 water use data was collected but annual RCE reports were not issued. In an effort to streamline reporting efficiently and improve data capture and quality, CAPP continues to pursue centralization of water data from public and regulatory sources. This report is intended to review existing data sources and processes used by GEOWA and document descriptive information about the data. A secondary objective includes identifying new data sources, documenting the similarities and difference between datasets, and scanning for missing water use information.

The deliverables include a water data catalog providing the available sources of water use data or other data in the absence of water use data. In order to provide context, this report includes water volumes used in western Canada in 2014.

Important findings from this report include:

- 1) There are 9 unique data sources currently used by GEOWA
- 2) A significant portion of water use data for upstream oil and gas is available through volume reporting systems based on oil and gas production regulations requiring measurement of fluids produced and injected. The Petrinex volume reporting system is used in Alberta and Saskatchewan.
- 3) The estimate of water used for drilling and hydraulic fracturing is considerably higher in Alberta as compared to other jurisdictions since it is based on water allocation as opposed to water use for temporary diversion licenses. The majority of this water use information exists and is reported through the drilling and completion requirements under Alberta Energy Regulator Directive 059 although it is not currently available to reconcile the artificially high water volumes.

The recommendations for water data enhancements include:

- 1) Refer to the annual CAPP statistical handbook for well counts and oil and gas production data. GEOWA's production volume data collection can be sorted by CAPP member company, which may have some utility but is not necessary for RCE reporting.
- 2) It is recommended that Alberta Environment and Parks establish a working agreement with the Alberta Energy Regulator to submit water use data through WURS from industry-supplied

electronic well completion records as per Alberta Energy Regulator Directive 059. This will enhance public transparency without additional reporting burden for CAPP members. It is anticipated that the actual water volume used for hydraulic fracturing in Alberta will be considerably less than the allocated volumes currently reported in RCE.

- 3) Perform a periodic audit of the water information gathering process to demonstrate data quality assurance and identify improvements in water use data availability as provincial systems and processes evolve.
- 4) Enhance fracfocus.ca to identify the type and source of water used for hydraulic fracturing rather than classifying all hydraulic fracturing fluid volumes as “water”.
- 5) Create a detailed data dictionary to define the numerous fields within the Alberta Environment and Parks’ relational water tracking databases, specifically WURS and EMS.

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## Introduction

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Ponderosa Environmental and Water Resources Inc. was contracted by the Petroleum Technology Alliance of Canada (PTAC) under contract 15-WIPC-o8 to identify and catalog water usage information from available regulatory and public data sources in Western Canada. This report describes the water use data available and the assumptions regarding the data sources. The report is organized by province and each section of the report.

From 2008-2014 water usage data has been provided to the Canadian Association of Petroleum Producers (CAPP) annually by Geowa Information Technologies Ltd (GEOWA) for the purpose of compiling water use information for CAPP's Responsible Canadian Energy (RCE) report. During this time period CAPP also collected member data for water, air, land, and other environmental metrics. In 2013 CAPP representatives identified several unique sources of water usage data. The precise relationship between the unique data sources was unclear, although important differences exist both within and between the water use data sets. In 2016 CAPP's Board of Governors determined that member data collection is not a priority and all elements of the RCE program are currently on hold. In 2014 and 2015 water use data was collected but annual RCE reports were not issued. The last annual RCE report was issued in 2014 summarizing data to the end of 2013. In an effort to streamline reporting efficiently and improve data capture and quality, CAPP continues to pursue centralization of water data from public and regulatory sources.

This report is intended to identify and document water use data sources currently collected by government or regulatory departments. The report will document the current water data collection process and clarify the similarities and differences among datasets and methodologies employed across western Canada. This report will assist CAPP members, government bodies, and the public to understand the important characteristics and limitations of different water data sources related to the upstream oil and gas industry in western Canada. The deliverables include a water data catalog documenting the available sources of water use and allocation data in addition to a basic description about each data source (metadata). Detailed information of each data source including the various fields and formats is not within the scope of this report.

## CAPP Energy Production Categories

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CAPP represents the upstream oil and natural gas industry, including several sub-sectors of resource development. Environmental performance metrics such as water use can vary widely depending on the hydrocarbon product (bitumen, crude oil, or natural gas) and the extraction process (mining, steam-assisted gravity drainage, hydraulic fracturing...). In order to properly monitor environmental performance, CAPP has adopted the following production categories for RCE (Table 1).

**Table 1: CAPP Energy Production Categories**

Production Category	Description
Western Canada Sedimentary Basin (WCSB)	Conventional and unconventional oil and gas development
Oil Sands In-Situ	In-situ production of heavy hydrocarbons (bitumen)
Oil Sands Mining	Mining production of heavy hydrocarbons (bitumen)

Based on this CAPP guidance GEOWA categorizes water use data associated with hydrocarbon production outlined in Table 1, respectively. In addition to water use data GEOWA collects oil and gas production data where available. The review of GEOWA’s process for collecting and compiling upstream oil and gas production data is not included in the scope of this report.

## How is Water used by the oil and gas industry?

There are several ways in which these production categories use water. Table 2 defines the ways in which water is used in the upstream oil and gas industry in western Canada.

**Table 2: Upstream Oil and Gas Water Use Categories**

Water Use Categories	Water Use Purpose
Development and Maintenance Activities	Camps
	Field offices
	Construction
	Ice Roads
	Dust control
	Hydrostatic Testing
	Seismic
	Oil Sands Exploration
Processing Activities	Mined bitumen separation
	Gas processing
	Upgrading (Heavy crude oil and diluted bitumen)
Primary Extraction	Drilling
	Hydraulic Fracturing
Enhanced Oil Recovery	Conventional Waterfloods and Cold Bitumen Polymer Flooding
	Steam-assisted Gravity Drainage (SAGD)
	Cyclic Steam Simulation (CSS)

## Water Types

In western Canada there is no standard approach to categorizing water, however most jurisdictions follow the Alberta guidance and terminology for classifying water types by quality and source. These water type definitions are subject to change.

### Surface Water

Surface water is water originating from a surface source such as a stream, river, or lake, and includes surface water runoff collected in natural and man made depressions.



## Groundwater

Groundwater is the water found underground.

### *Saline Groundwater*

Saline groundwater is defined in section 1(1)(z) of the [Alberta Water \(Ministerial\) Regulation](#) as, “water that has total dissolved solids exceeding 4,000 milligrams per litre.” Such groundwater is defined as “brackish water” in the Petrinex volume reporting system (Petrinex) and “saline groundwater” by AEP.

### *Non-saline Groundwater*

By the Alberta definition, non-saline groundwater is groundwater with a TDS concentration less than 4,000 mg/L. Non-saline groundwater is often referred to as “fresh” groundwater.

There are other water types that are currently used in the oil and gas industry however not included in the current RCE reporting. There are challenges to accurately tracking and reporting the following water types:

### Produced Water

Produced water is water that is produced as a by-product of oil and gas production. Produced water is most commonly used for enhanced oil recovery in conventional waterflood operations.

### Reused Water

When water is used and is subsequently used again for the original or new purpose by the original or a new user. An example of water reuse in the oil and gas industry is reuse of water collected during hydraulic fracturing flowback operations.

### Recycled Water

Recycled water is essentially reused water but implies a processing component where the waste water stream passes through a process and undergoes an improvement in quality prior to reuse. An example of water recycling in the oil and gas industry is the recycling of water used for steam in SAGD.

CAPP has identified that measuring and reporting reused and recycled water volumes through the RCE process could be interpreted as double counting. Currently there is no standard methodology endorsed by the regulators to account for water reused and recycled for the various production categories (Table 1).

The new British Columbia Water Sustainability Act, which came into force January 29, 2016 has a more complex definition for [deep groundwater](#) embedded in the [Water Sustainability Regulation](#), which does not require an authorization for use. This new BC legislation and regulation are an improvement over the previous BC Water Act as the previous legislation did not require groundwater use authorizations. However, the use of this definition for deep groundwater could prove challenging for industry to summarize water use by type across Western Canada.

## Definitions

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This report spans 4 provinces and one territory. Within provinces there are multiple jurisdictions involved in water management for the oil and gas industry. The list below provides some important definitions and context for oil and gas.

## Water Allocation

A water allocation is the maximum volume of water that the licensee is allowed to withdraw from the system.

## Water Use

Water use is the actual volume of water withdrawn from the system.

## Consumptive Use

The balance of water taken from a source not entirely or directly returned to the source.

## Non-consumptive Use

Use of water in which all of the water used is directly returned to the source from which it came.

For the oil and gas industry there are some instances where water is used for cooling and returned to the original source but the majority of oil and gas water use is consumptive.

## Water Use Tracking

### Federal

Under the Constitution Act (1867), the provinces are "owners" of the water resources and have wide responsibilities in their day-to-day management. The federal government has certain specific responsibilities relating to water, such as fisheries and navigation, as well as exercising certain overall responsibilities, such as the conduct of external affairs.

The Federal Government of Canada (including Environment Canada and Statistics Canada) currently does not track water use on an annual basis. Statistics Canada collects data from CAPP every 2<sup>nd</sup> year and the [Industrial Water Use](#) information is available online (Table 3).

**Table 3: Statistics Canada Physical Flow Account for Water Use (m<sup>3</sup> \*1,000)**

Sector	2009	2011	2013
Total, industries and households	38,788,670	35,517,933	37,910,769
Total, industries	35,200,016	32,011,699	34,671,607
Crop production [BS111]	1,266,057	942,159	1,069,461
Animal production [BS112]	1,100,057	866,357	937,352
Forestry and logging [BS11300]	346	463	647
<b>Oil and gas extraction [BS21100]</b>	<b>292,562</b>	<b>349,484</b>	<b>401,725</b>
Coal mining [BS21210]	20,966	33,632	91,903
Metal ore mining [BS21220]	319,054	260,066	373,172
Non-metallic mineral mining and quarrying [BS21230]	103,073	123,732	134,303
Electric power generation, transmission and distribution [BS22110]	26,213,561	23,715,875	25,635,244
Paper manufacturing [BS322]	1,678,136	1,448,139	1,537,380
Households	3,588,654	3,506,234	3,239,162

## Regulating and Licensing Water Allocation

In western Canada all provincial and territorial jurisdictions are responsible for water resource management, including administering licenses and approvals. Most regulatory jurisdictions include exemptions for which a license to withdraw water is not required. Some jurisdictions include two approval processes to facilitate both longer- and shorter-term water uses (Table 4). An example of a long-term water use would be a permanent SAGD facility requiring water for steam injection over the life of the project. An example of a short-term water use would be hydraulic fracturing where water is used one time to stimulate the reservoir and bring the well into production. Generally short-term water uses are approved for a time period no greater than 1 year and average 1-2 months for short-term water approvals in Alberta (CAPP correspondence).

**Table 4: Water License Comparison**

Jurisdiction	Regulatory Authority	Long-term approval	Short-term approval	Comment
Alberta	Alberta Energy Regulator	Water Act License	Temporary Diversion License (TDL)	No Water Act license required for saline groundwater use
British Columbia	British Columbia Oil and Gas Commission	Water Act License	Short-term Water Approval	Groundwater source wells do not require a Water Act license but regulated as BCOGC water source well.
Saskatchewan	Water Security Agency	Water Rights License	Temporary Water Rights License	Includes saline groundwater
Manitoba	Manitoba Water Stewardship	Water Rights License	Temporary Use Authorization	Includes saline groundwater
NWT	Mackenzie Valley Land and Water Board (MVLWB)	Water License	N/A	N/A

## Water Use Measurement, Reporting, and Accessibility

Each jurisdiction has a different approach to water use measurement, data collection, and data accessibility (Table 5).

**Table 5: Tracking Water Use in Western Canada**

Jurisdiction	Water Use Tracking	Publicly available	Comment
Alberta	Yes with exemptions	Upon request	Not all licenses past and present specify in the conditions that water use reporting is mandatory. For example, the majority of TDLs until early 2016 did not require water use reporting.
British Columbia	Yes with exemptions	Published quarterly and annually	Water use available for the Oil and Gas Sector through BCOGC
Saskatchewan	Yes with exemptions	Upon request	
Manitoba	Yes with exemptions	No	Saline groundwater use data for upstream oil and gas is publicly available online MB production spreadsheets.
NWT	Yes with exemptions	MVLWB online registry	Water use records can be found in online registry.

## Water Use Data Sources

In western Canada there are nine sources of water use data currently available (Table 6). Within the water use datasets there is a variety of options to sort water use data by water type, production category, and water use purpose but these options are not consistent across each jurisdiction. Not all of the water allocated to the oil and gas industry is tracked and reported as use in the categories outlined in Table 6.

**Table 6: Water Use Data Sources**

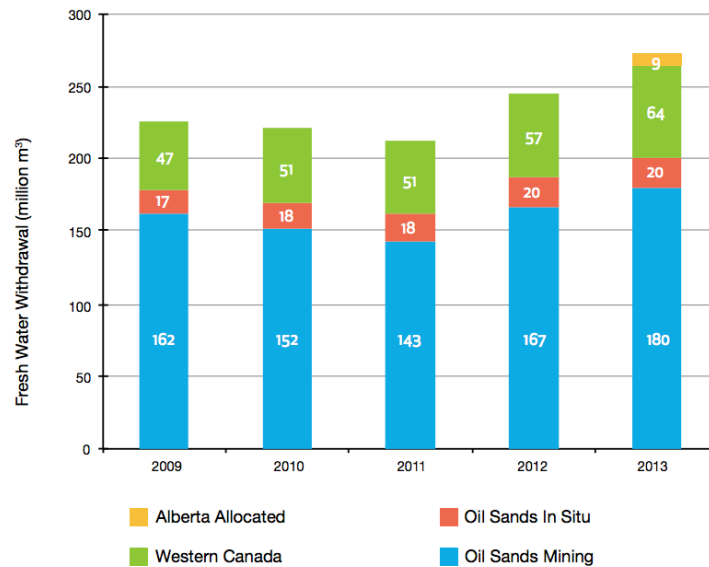
Water Use Data Source	What parties gather water usage information?	Province	Where is the water tracked?
AEP WURS	AER (AB Water Act)	AB	By source
Petrinex	AER (Directive 007) and SK Ministry of Economy (Directive R01) for volumetric production reporting	AB/SK	To and from well ID, source ID, and receiving facility ID
BC Short-term Approvals	BCOGC (BC Water Sustainability Act)	BC	By source
BC Water Licenses	BCOGC (BC Water Sustainability Act)	BC	By source
BC Water Source Wells	BCOGC (Oil and Gas Act)	BC	By source well ID
Manitoba Water Production	Manitoba Petroleum Branch for production reporting (Drilling and Production Regulations)	MB	By source well ID
WSA Water Use	Water Security Agency (Water Security Act)	SK	By source
Mackenzie Valley Online Registry	Mackenzie Valley Land and Water Board as required by permit	NWT	By source
FracFocus.ca	Upstream oil and gas regulators submit hydraulic fracturing completion information for public transparency	AB, BC, NWT	At the point of use (wellhead)

In the absence of water use data there are alternative data sources that provide an estimate of the water allocated to the oil and gas industry (Table 7). Prior to 2016, there was minimal water use reporting data associated with temporary diversion licenses in Alberta and no water use reporting data available for temporary use authorizations in Manitoba. In the absence of water use data for drilling and hydraulic fracturing, the Manitoba Petroleum Branch recommends to approximate the upstream oil and gas water use based on horizontal and vertical oil well counts (Table 7).

**Table 7: Alternative Water Data Sources**

Data Source	What parties gather information?	Type of data	Province	Comments
AEP Environmental Management System (EMS)	AER/AEP	Water allocation	AB	The majority of temporary diversion licenses do not have water use reporting requirements in WURS prior to 2016.
MB Well Count Water Estimate	None	Annual oil production well counts	MB	Assume each vertical oil well uses 500 m <sup>3</sup> and each horizontal oil well uses 1,000 m <sup>3</sup> surface water.

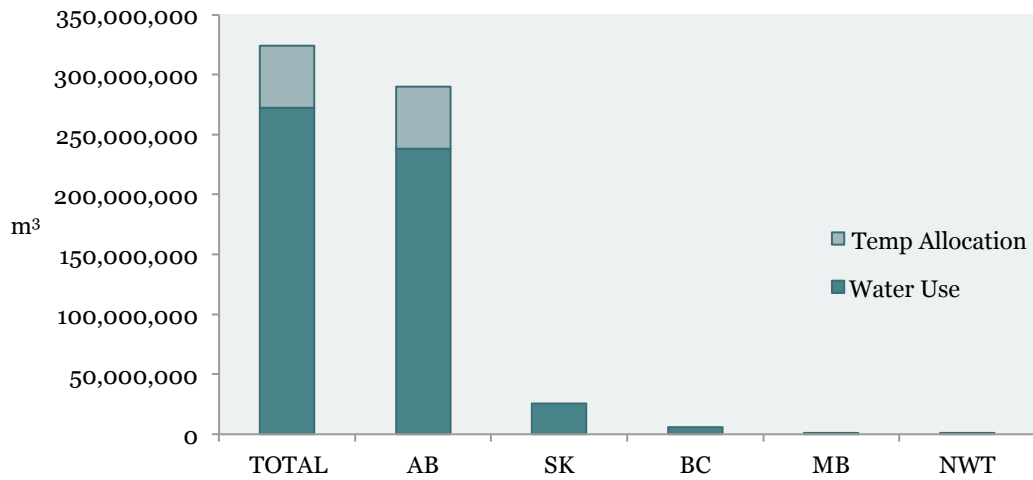
Previous RCE reports combined water use data and water allocation data. In 2013 CAPP recognized a significant increase in temporary diversion licenses in Alberta and adjusted the RCE report accordingly (Figure 1).



**Figure 1: CAPP RCE 2013 Fresh Water Withdrawal**

The gold bar denoted in Figure 1 represents 9 million m<sup>3</sup> of fresh water allocated in Alberta under temporary diversion licenses that could not be validated with water use information.

The 2014 water use volumes and temporary allocation volumes are included in this report, where applicable. In scenarios where both water allocation and water use volumes are known, the water use data source takes precedence. For cases when water use data is not available but allocation volumes are known, the default assumption is that water use is equivalent to water allocation. Figure 2 displays the total volume of water used in western Canada. Note that water volumes allocated under temporary diversion licenses (TDLs) are included in the figure and are differentiated by colour.



**Figure 2: 2014 Water Use and Temporary Allocation Summary**

In 2014 approximately 84% (~272 million m<sup>3</sup>) of oil and gas industry water use is represented through water use data (Table 6). The remaining 16% (~52 million m<sup>3</sup>) is based on alternative data sources listed in Table 7. Figure 2 includes three water types (surface water, non-saline groundwater, and saline groundwater) but does not include produced water or volumes that are recycled or reused.

Alberta accounts for 89% of the total water used for upstream oil and gas in western Canada. Saskatchewan accounts for 8% while British Columbia, Manitoba, and the Northwest Territories combined account for less than 3% of the water used in 2014 (Figure 2). Refer to the Water Use Data Catalog in Appendix A for more details.

## Alberta

In the province of Alberta there are two unique sources of water use data available in addition to the AEP Environmental Management System (EMS), which houses all of the water-related approvals.

**Table 8: Alberta Water Data Sources**

Data Source	Description	Allocation or Use	Water Types	Oil and Gas Water Uses
Water Use Reporting System (WURS)	An online database to report licensed water use covering more than 80% of the total non-saline water used in Alberta	Use	Surface water and non-saline groundwater	All
Petrinex	A production volume database for tracking produced fluids to and from wells and facilities.	Use	Surface, non-saline, and saline groundwater	Enhanced Oil Recovery
Environmental Management System (EMS)	An authorizations tracking system and database that contains information about water approvals and licences. It includes approved water volumes allocated.	Allocation	Surface water and non-saline groundwater	All

WURS and EMS are separate databases that can be linked together by a common attribute. GEOWA utilizes database functions in Microsoft Access to merge the data from the two systems into a single database.

In Alberta, a license under the Water Act (1999) or Water Resources Act (1931) is required to divert and use water from natural sources. The license may specify terms and conditions under which the water may be diverted. The conditions may include a requirement that the licensee submit water use reports to Alberta Environment and Parks (AEP). AEP developed the online Water Use Reporting System (WURS) to allow licensed water users to report their water diversions electronically. Licensees enter the data on a daily, monthly or annual basis depending on the reporting requirement of their license. Some exemptions from reporting water use through WURS to AEP include:

- The majority of temporary diversion licenses (TDLs) prior to 2016
- Groundwater licensed for household or camp use (drinking, cooking, washing, and sanitation) up to 1,250 m<sup>3</sup>/year.
- Traditional agriculture users are also exempt from reporting an additional 6,250 m<sup>3</sup>/year for raising animals and application of pesticides and herbicides to crops (Alberta Water Act, 1999).
- Saline groundwater
- Fire-fighting

Because the WURS system is still relatively a new online method of submitting water use records, there is no certainty

The Water Act, and its predecessor Water Resources Act, gives the authority over all water, saline and non-saline, to the Crown in right of Alberta. The requirement to obtain a Water Resources Act authorization to divert saline groundwater was discontinued in 1996 with the adoption of the definition of saline groundwater as water with a TDS concentration exceeding 4,000 milligrams per litre (mg/L). Authorizations previously granted under the Water Resources Act to divert saline groundwater were either cancelled or not renewed. AEP continues this approach to saline water resources under similar provisions of the Water Act, and the AER continues to track the diversion of saline groundwater through the Petrinex system.

The WURS data source is for surface and non-saline groundwater use include both long-term licenses and temporary diversion licenses (TDLs). Allocated volumes for all sectors are available through the Alberta Environment and Park’s (AEP) environmental management system (EMS) database. Each year GEOWA is provided a database file containing all reported surface water and non-saline groundwater allocations.

Within the EMS system, AEP has provided several methods to categorize water users. The first category is a sector classification (Table 9). A full list of AEP sector classifications is included in Appendix B.

Table 9: AEP Sector Classifications Relevant to Upstream Oil and Gas
Injection (Water Flood/Conventional Oil)
Oil Sands (Mining)
Oil Sands (Sagd/Css/Thermal)
Oil Sands (Cold Bitumen)
Drilling (Conventional & Vertical Fracturing)
Multi-Stage Horizontal Hydraulic Fracturing (Drilling & Completions)
Hydrostatic Testing
Oil & Gas Plant Processing/Oilsands Upgrader/Plant Utility Water
Refineries & Upgraders
Waste Disposal/Remediation

The second category is the specific activity (Table 10). A full list of AEP activities and specific activities is included in Appendix C. Note that sector classifications and specific activity are subject to change.

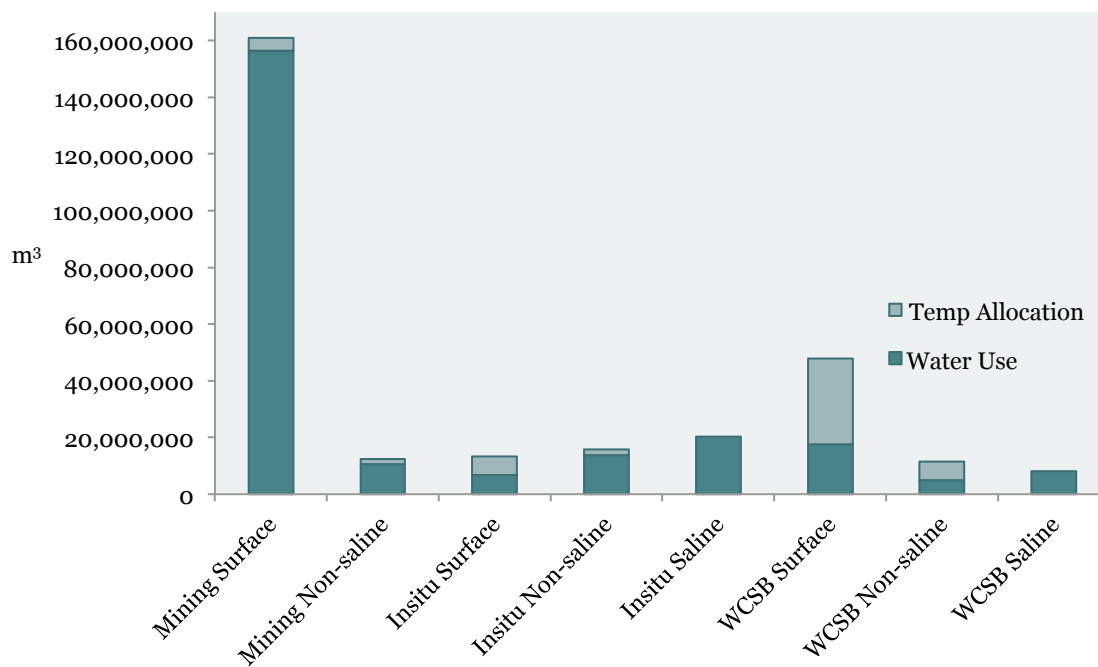
Table 10: AEP Specific Activities Relevant to Upstream Oil and Gas
Camps
Construction
Oil/Gas
Oil Sands Exploration
Hydraulic Fracturing
Shale Fracturing
Hydrostatic Testing
Oilfield Injection
SAGD
Gas/Petrochemical Plants

Petrinex monthly volume submissions are a requirement under AER Directive 007. In addition to hydrocarbon production volumes, Petrinex includes the volumes of water produced and injected. For instances when both Petrinex and WURS water use data exists, GEOWA recognizes the overlapping



datasets and defaults to the Petrinex reported volumes to avoid double counting. Based on past experience GEOWA has found Petrinex is more robust and generally considered more accurate when compared to WURS. The Petrinex system uses numerical codes to identify each water source used for oil and gas. Refer to Appendix C for a list of water sources and corresponding codes in Alberta. The limitation of using Petrinex rather than WURS is that non-injection uses such as evaporation from a storage reservoir are not included. Spot comparisons between Petrinex and WURS data suggest that the overall difference in volumes is minor overall and even on individual sources is not significant (GEOWA correspondence).

GEOWA uses the specific activities and the sector classifications to group water use and allocation into the CAPP production categories as well as by water type (Figure 3).



**Figure 3: 2014 Alberta Water Use and Temporary Allocations**

It is important to note that in 2014, within the WCSB production category there is ~30 million m<sup>3</sup> of surface water and 6.5 million m<sup>3</sup> of non-saline groundwater allocations currently with no available water use data. There is an opportunity to reconcile the water allocation volumes with water use volumes embedded in hydraulic fracturing completion reports digitally submitted to the AER. These reports are mandatory under AER Directive 59 and include a description of the source water, temporary diversion license approval number, and the volume injected down the wellbore among other requirements. Unfortunately the AER dataset was not available either publicly or upon request during the time of this report.

## British Columbia

British Columbia oil and gas production is categorized in the WCSB production category (Table 1). The main water uses include enhanced oil recovery (conventional waterflood), construction, drilling, and hydraulic fracturing (Table 2).

In British Columbia the British Columbia Oil and Gas Commission (BCOGC) is the jurisdiction managing water in the province related to upstream Oil and Gas activity. The Ministry of Forests, Lands, and Natural Resource Operations (FLNRO) manages water licenses for other users and maintains a complete list of approved water licenses and their allocated volumes across the province. Currently FLNRO does not track or compile actual water use volumes provincially. The new [Water Sustainability Act](#) came into force on January 29, 2016. Part of the new act expands on the current provisions of the original BC Water Act to provide regulatory authority for measuring, calculating and reporting on the quantity and quality of water diverted and used. The new Water Sustainability Act also includes licensing of groundwater, previously excluded under the Water Act.

The BCOGC is responsible for facilitating water management for the oil and gas industry. Unlike FNLRO, BCOGC has regulations and processes in place to track water use for oil and gas. BCOGC publishes quarterly and annual water use reports that include both water allocation and water use volumes for the oil and gas industry. Data sources include long-term license water use, short-term water use approvals, and regulated groundwater source wells. 2014 water use for upstream oil and gas in BC is included in Figure 4.

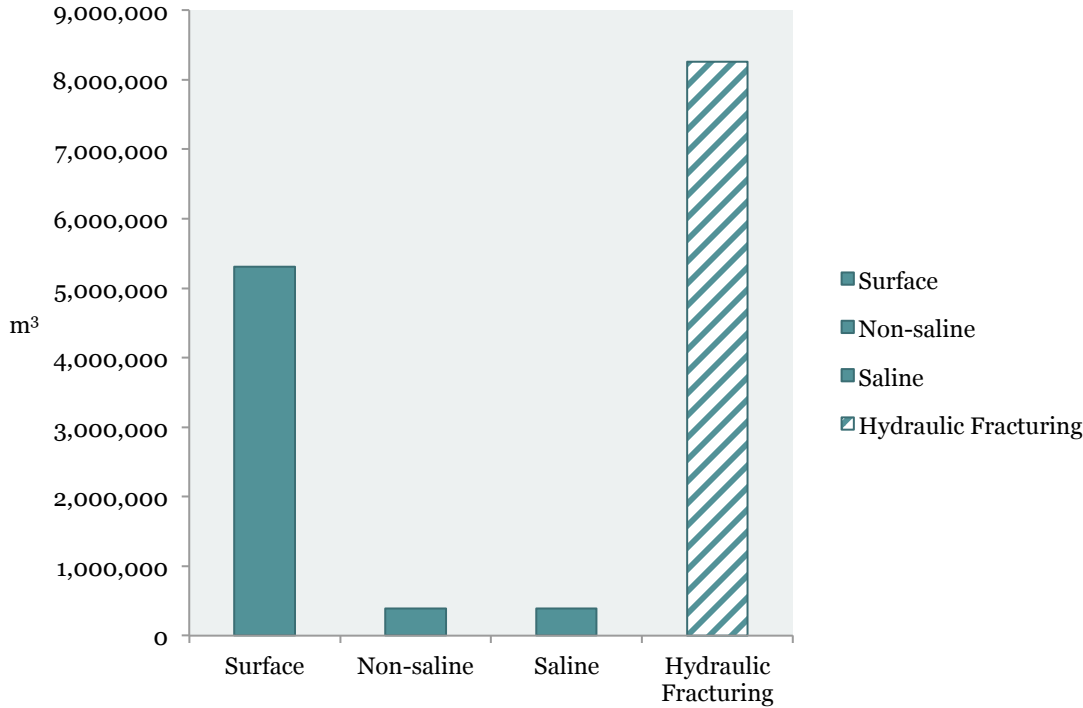


Figure 4: 2014 British Columbia Water Use

Currently GEOWA processes the raw water use files provided by BCOGC. BCOGC also produces an [Annual Water Use Report](#) that provides essentially the same water use information reviewed by the commission. The only difference is that BCOGC annual water use report also provides hydraulic fracturing water use volumes from completion data provided in Figure 4. The water volume withdrawn from water bodies in BC is less than the water volume used for hydraulic fracturing. BCOGC estimates

that 15% of the water used for hydraulic fracturing is reused water and that the remainder is privately acquired or municipal water sources which do not require a permit for withdrawal. For additional filtering of the BCOGC water use data, files can be categorized according water use purpose. Refer to the water use purpose definitions in Appendix D.

## Northwest Territories

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NWT oil and gas production falls within the WCSB production category (Table 1). The main water uses include enhanced oil recovery (conventional waterflood), construction, drilling and hydraulic fracturing (Table 2).

In the Northwest Territories there are several regulatory groups that manage water resources. Licenses for the use of water and deposit of waste in waters flowing through or overlying lands within the Mackenzie Valley are issued by the respective Land and Water Board (Board) operating under the Mackenzie Valley Resource Management Act (MVRMA, 2007). Acting under the authority of the MVRMA and the Northwest Territories Water Regulations, the Board may issue, amend, renew, suspend or cancel water licenses for undertakings in federal areas. For undertakings outside of federal areas, the Board may issue, amend, renew, suspend, or cancel water licenses under the authority of the MVRMA, NWT Waters Act, and NWT Waters Regulations.

The activities that require a water license are:

- 100 m<sup>3</sup> or more of direct water use per day;
- A municipality or camp that uses more than 50 m<sup>3</sup> of water per day;
- Construction of a structure across a water course five or more meters wide at ordinary high water mark;
- Channel and bank alterations, erosion control, diversion of water, alteration of flow or storage of water (dam or storage reservoir);
- Draining or infilling of a water course;
- Any deposit of waste (solid waste, sewage, oil drilling etc.); and
- Industrial or mining and milling activities that use more than 100 m<sup>3</sup> of water per day.

The main upstream oil and gas use in the NWT is a mature waterflood project located at Norman Wells. The water use data [2014 Annual Water Use Report](#) can be found on the MVLWB registry. The 2014 surface water use for the Norman Wells waterflood project was 973,813 m<sup>3</sup>, not including the water used for cooling and returned back to the surface water source.

The Sahtu Land and Water Board (SLWB) manages an online searchable [registry](#) including water use reports for all active water licenses in their jurisdiction. Water use volumes are embedded in annual reports submitted by industry to the SLWB. The summation of water use data is tedious as it requires manually searching the active water licenses in the registry and reviewing each annual report for water use information. Some annual reports span two year and therefore review and analysis is required to ensure accuracy. However, presently there are very few upstream oil and gas water users in the region and a list of active water licenses can be found on the [SLWB website](#).

## Manitoba

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Manitoba oil production falls within the WCSB production category (Table 1). The main water uses include enhanced oil recovery (conventional waterflood) and drilling and hydraulic fracturing (Table 2).

The Manitoba Water Stewardship (MWS) licensing and use branch processes applications requesting the allocation of surface water or groundwater for municipal, agricultural, industrial, irrigation and other purposes. All new projects require the issuance of either a Development Authorization for surface water projects or a Groundwater Exploration Permit for groundwater sourced projects in advance of such projects proceeding to construction. Water rights licenses are issued to the applicants subsequent to the satisfactory completion of a project. In addition to these instruments, water rights licensing staff also respond to requests to divert water for short-term purposes. Examples include the hydrostatic testing of petroleum products pipelines, for dust suppression purposes on road construction projects, wetting soil base for road compaction projects, etc. In such cases, a letter of authorization is normally issued rather than a formal license.

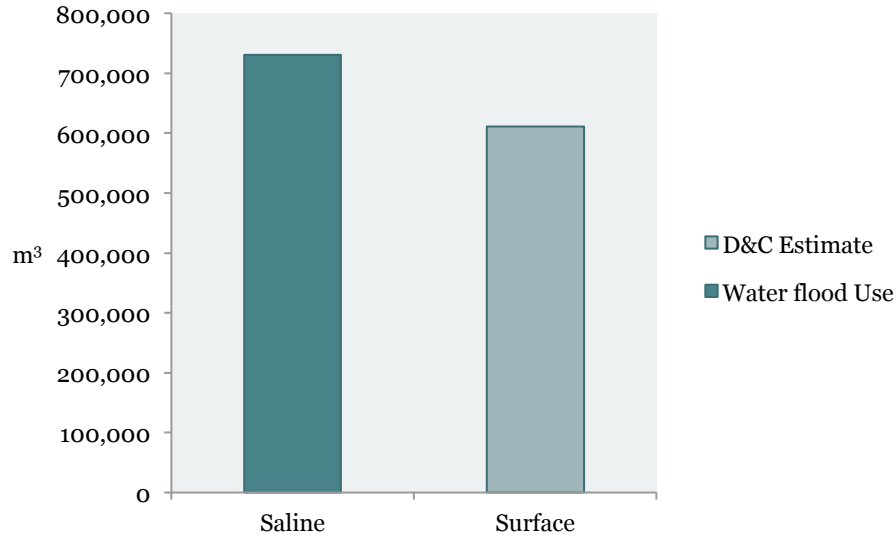
Water use reports are submitted to the MWS on an annual basis in February of the following year. MWS does not publish water use or water allocation data. Water allocation or water use information was not available on request due to the Freedom of Information and Protection of Privacy Act.

The Manitoba petroleum branch is responsible under the Drilling and Production regulations to track fluids pumped into and from wells. Completion reports submitted to the petroleum branch likely contain water use information. The petroleum branch confirmed these reports exist for each well but there is currently no digital system or database in place to upload, store, and extract the water use reports. Therefore well files would have to be reviewed manually in order to get an accurate estimate of water used for drilling and hydraulic fracturing. Given that the estimated water use for oil production in Manitoba accounts for less than 1% of the total water volume used for upstream oil and gas, the following estimates were validated with the Manitoba petroleum branch and are considered to be appropriate.

For drilling and hydraulic fracturing completions:

- 1) Assume all water use is surface water
- 2) Use the [Manitoba Petroleum Statistics](#) for annual well counts.
- 3) Estimate vertical oil wells use 500 m<sup>3</sup>
- 4) Estimate horizontal oil wells use 1,000 m<sup>3</sup> water.

For waterfloods the saline water well production volumes can be found in the annual production report spreadsheets ([Manitoba Petroleum Production Annual Reports](#))



**Figure 5: 2014 Manitoba Water Use**

## Saskatchewan

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In Saskatchewan upstream oil and gas production categories include WCSB and heavy oil produced from insitu operations (SAGD and CSS). Additionally, Saskatchewan has an upgrader facility near Lloydminster that uses water to upgrade heavy oil to synthetic crude oil. From 2009-2013 GEOWA has categorized Saskatchewan water use in the WCSB category but it is recommended to move water volumes associated with the Lloydminster upgrader and insitu production to the insitu category in order to maintain consistency with Alberta (Figure 6). Water used at upgraders in Alberta is categorized as OS insitu production (Table 1).

Similar to Alberta, Saskatchewan production volumes are captured in the Petrinex volume reporting system for surface water, non-saline and saline groundwater use. For EOR water use, Petrinex is the main source of data. For other uses including drilling and completions, the Water Security Agency provides annual water use data.

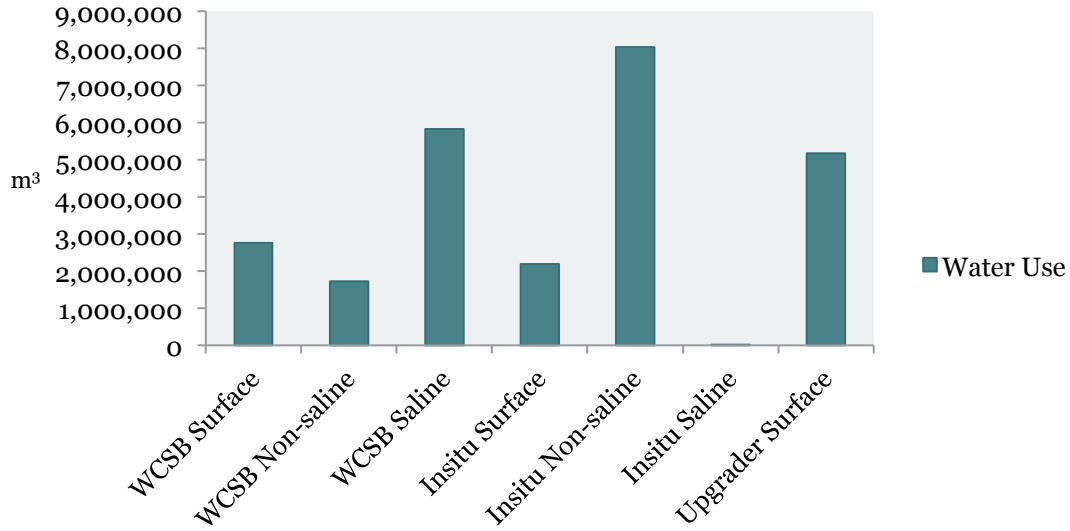


Figure 6: 2014 Saskatchewan Water Use

## FracFocus.ca

FracFocus.ca is a collaboration between provinces, territories, regulators and industry to provide Canadians with objective information on hydraulic fracturing, what legislation and regulations are in place to protect the environment including groundwater, and transparency on the ingredients that make up hydraulic fracturing fluids. The website allows individual jurisdictions to upload data around hydraulic fracturing fluids provided to them by industry. It is designed so all provinces and territories can participate with public access to data regarding the location of oil and gas activity.

Currently regulatory jurisdictions from British Columbia, Alberta, Northwest Territories, and New Brunswick provide hydraulic fracturing data to FracFocus.ca. Note that the type of water used is not available from FracFocus.ca however it does provide a volume of water use in m<sup>3</sup>.

## Conclusions and Recommendations

The goal of this research is to develop an understanding of the upstream oil and gas water use data available from publicly available and regulatory domains. In general, regulatory jurisdictions in western Canada have a consistent approach for managing the Crown’s water resources although there are significant differences in the policies, guidelines, and systems utilized for authorizing and tracking water used for upstream oil and gas development.

For the past five years, GEOWA has collected and processed water use data for CAPP in support of the RCE annual report. In 2016 CAPP’s Board of Governors determined that member data collection is not a priority and all elements of the RCE program are currently on hold. In 2014 and 2015 water use data was collected but annual RCE reports were not issued. The last annual RCE report was issued in 2014 summarizing data to the end of 2013. In an effort to streamline reporting efficiently and improve data

capture and quality, CAPP continues to pursue centralization of water data from public and regulatory sources.

This project is intended to review existing data sources and processes used by GEOWA and document descriptive information about the data. A secondary objective includes identifying new data sources, documenting the similarities and difference between datasets, and scanning for missing or duplicate water use information.

The deliverables include a water data catalog providing the available sources of water use data or alternative data in the absence of water use data. In order to provide context, this report includes water volumes used in western Canada compiled for the 2014 annual report.

Important findings from this report include:

- 1) There are 9 unique data sources currently used by GEOWA
- 2) A significant portion of water use data for upstream oil and gas is available through volume reporting systems based on oil and gas production regulations requiring measurement of fluids produced and injected. The Petrinex volume reporting system is used in Alberta and Saskatchewan. The remainder of water use data can be identified through provincial water authorizations if the licensee is required to submit water use records. Unfortunately some water license types and jurisdictions have not consistently required water use reporting as a condition of the authorization and there are instances where GEOWA has included the allocated water volumes in the absence of water use data.
- 3) The estimate of water used for drilling and hydraulic fracturing is considerably higher in Alberta as compared to other jurisdictions since it is based on water allocation as opposed to water use for temporary diversion licenses. The majority of this water use information exists and is reported through the well completion requirements under Alberta Energy Regulator Directive 059 although it is not currently available to reconcile the artificially high water volumes. Table 11 compares short-term approvals across the provinces of Alberta, BC, and Saskatchewan. In Alberta only 29 out of 6842 temporary diversion license records have a water use captured in the WURS database. Based on 29 records, Alberta upstream oil and gas companies use 48% of the water allocated to them. In BC upstream oil and gas companies used 10% of the water allocated to them and in Saskatchewan companies used 99% of the water allocated to them. It is possible that Saskatchewan use and allocation numbers do not differ substantially because of smaller water volumes needed for hydraulic fracturing or industrial water use fees per volume (\$14.78/1,000 m<sup>3</sup>).

**Table 11: Comparing 2014 allocation and use for short-term approvals**

Province	Approval Type	# of 2014 approvals	# of 2014 approvals reporting use	Volume used expressed as a % of volume allocated
Alberta	Temporary Diversion License	6842	29	48%
BC	Short-term water use approval	401	401	10%
Saskatchewan	Temporary Water Rights License	2010	1994	99%

The recommendations for water data enhancements include:

- 1) Refer to the annual CAPP statistical handbook for well counts and oil and gas production data unless it becomes a useful practice to compare water metrics across peer companies on an individual basis.
- 2) It is recommended that Alberta Environment and Parks (AEP) establish a working agreement with the Alberta Energy Regulator (AER) to submit water use data through WURS from industry-supplied electronic well completion records as per AER Directive 59. This will enhance public transparency without additional reporting burden for CAPP members. It is anticipated that the actual water volume used for hydraulic fracturing in Alberta will be considerably less than the allocated volumes currently reported in RCE.
- 3) Perform a periodic audit of the process to demonstrate data quality assurance and identify improvements in water use data availability as provincial systems and processes evolve.
- 4) Enhance fracfocus.ca to identify the type and source of water used for hydraulic fracturing rather than classifying all hydraulic fracturing fluid volumes as “water”.
- 5) Create a data dictionary to define the numerous fields within the Alberta Environment and Parks’ relational water tracking databases, specifically WURS and EMS.

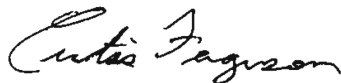


## Closure

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Curtis Ferguson, P.Eng.