

HYDRAULIC FRACTURING
IN THE RED DEER RIVER
WATERSHED:

**RECOMMENDATIONS
TO KEY STAKEHOLDERS**

March 2020



PURPOSE

The purpose of this document is to provide guidance and recommendations to decision-making authorities, industry groups, and community members regarding hydraulic fracturing and land and water resources in the Red Deer River watershed.

WHO WE ARE

The Red Deer River Watershed Alliance (RDRWA) is the designated Watershed Planning and Advisory Council (WPAC) for the Red Deer River watershed. WPACs are multi-sector, collaborative, not-for-profit organizations that assess watershed conditions, lead in watershed planning, and promote the good stewardship and proper management of water resources.

Our activities support the three pillars of Alberta's Water for Life Strategy: 1) Healthy aquatic ecosystems; 2) Reliable quality water supplies for a sustainable economy; and, 3) Safe, secure drinking water. The RDRWA works to achieve these goals by serving as a forum for information exchange and dialogue, raising awareness of critical watershed issues, and by promoting the use of best practices and integrated management of land and water resources. As a science-based organization, the RDRWA has engaged a broad network of stakeholders across multiple sectors to support the development of a State of the Watershed report (2009), Blueprint: An Integrated Watershed Management Plan for the Red Deer River watershed (2016), and ongoing research and policy recommendations related to multiple watershed management issues.

BACKGROUND

- The Red Deer River watershed is the largest headwater sub-basin of the South Saskatchewan River Basin in Alberta (49,650 km²). Home to approximately 300,000 people, the watershed originates in the Rocky Mountains and includes 55 urban centres and 18 rural municipalities across central Alberta.
- The presence of important shale gas, tight gas, and tight oil reserves, coupled with readily available water supplies, has led to an intensification of hydraulic fracturing activity within parts of the Red Deer River watershed. Geological target formations in the region include the Duvernay, Montney, and Cardium formations, among others.
- Watershed management is founded on the basis that Alberta's water resources must be managed within the capacity of individual watersheds. It considers the fundamental connections between human activities, land uses, surface water and groundwater, and the health of ecosystems; across spatial scales and over time.

APPROACH

Engagement with selected representatives from across sectors was conducted throughout 2019 and early 2020 (see Appendix). While subject matter experts from multiple sectors provided data and expertise to inform the RDRWA's process, these recommendations do not represent a comprehensive review of the lifecycle of hydraulic fracturing as it relates to key watershed management considerations and potential environmental impacts. For example, many of the recommendations herein address water quantity, while more work is needed to address surface and groundwater quality. Engagement with a broader network of stakeholders was beyond the scope of this process, however the RDRWA expects these recommendations to inform ongoing discussions as part of adaptive watershed management.

RECOMMENDATIONS

- 1. Seek approval for the draft Water Conservation Policy for Upstream Oil and Gas, and engage key stakeholders in the watershed throughout implementation.**

Target Audience: Alberta Environment and Parks and the Alberta Energy Regulator

Issue: There is currently no comprehensive policy regarding water conservation for hydraulic fracturing in Alberta.

Background: Alberta Environment and Parks previously committed to expand the Water Conservation and Allocation Policy for Oilfield Injection (2006) to include water conservation measures for hydraulic fracturing following engagement with Albertans through the Water Conversation in 2013. According to Our Water Our Future - A Plan for Action (2014), actions for the Government of Alberta included to:

- Expand the 2006 Water Conservation and Allocation Policy for Oilfield Injection to include water conservation measures for hydraulic fracturing.
- Develop a policy guideline setting out water conservation practices for hydraulic fracturing.

While a Water Conservation Policy for Upstream Oil and Gas Operations (2016) has been drafted by Alberta Environment and Parks and reviewed by several key stakeholders, it is unclear if the draft policy will be finalized and implemented. The draft policy emphasizes minimizing or avoiding the use of high-quality non-saline (fresh) water, in favour of low quality non-saline water, saline water, and technological alternatives (e.g., recycled industrial and municipal wastewater).

The RDRWA encourages Alberta Environment and Parks to seek approval for the draft policy, and to work with the Alberta Energy Regulator to engage regional stakeholders in the development of implementation guidelines. This recommendation aligns with a similar recommendation advanced by a multi-stakeholder panel in 2017 as part of an area-based regulation pilot project in the Municipal District of Greenview [1].

2. Establish a robust streamflow monitoring network in areas with increasing water demand and high aquatic habitat sensitivity, and augment winter flow monitoring for tributaries.

Target Audience: Alberta Environment and Parks and Industry

Issue: There are important gaps in streamflow monitoring and reporting in parts of the watershed.

Background: As water demands rise, particularly at a sub-watershed scale, there is potential for tributaries and small streams to be impacted by water diversions, especially in winter months when flows tend to be lower, during droughts, or during high temperature events.

Hydrometric data along streams and rivers are collected by the Water Survey of Canada, in partnership with Alberta Environment and Parks, using a network of hydrometric gauging stations. To fully understand surface streamflow conditions across seasons and inform allocation decisions, enhancements are needed in the surface streamflow monitoring network, particularly in areas with higher hydraulic fracturing activity. According to the RDRWA's 2009 State of the Watershed Report, the overall condition of the Blindman and Medicine sub-watersheds was considered "Poor", and these sub-watersheds also coincide with higher levels of hydraulic fracturing activity. The Government of Alberta and industry are encouraged to work in partnership to identify additional monitoring locations to assess streamflows, to improve temperature monitoring of local streams, to ensure regular analysis and reporting of collected data, and to explore shared funding options.

Some hydrometric gauging stations are active year-round, while others are not active during the winter. To inform allocation decisions related to winter water withdrawals, there is also a need to augment winter flow data, through the addition of more active year-round gauging stations (e.g., Blindman river), improved winter flow estimation, and/or required industry monitoring.

¹ 2017. Enabling the use of alternatives to high-quality non-saline water by the oil and gas sector in the MD of Greenview. Recommendations to the Alberta Energy Regulator and Alberta Environment and Parks from the multi-stakeholder panel for the area-based regulation pilot project.

3. Expand the regional Groundwater Observation Well Network in the Red Deer River watershed.

Target Audience: Alberta Environment and Parks, Alberta Energy Regulator, Industry

Issue: Strategic improvements to the groundwater monitoring network are needed in areas with higher levels of hydraulic fracturing activity.

Background: A robust groundwater monitoring system is needed to understand the quality and quantity of regional groundwater resources, and assess potential changes over time. While the Groundwater Observation Well Network (GOWN) operated by the Alberta Government includes multiple groundwater monitoring wells in the Red Deer River watershed, there remain gaps in the current monitoring network, particularly in locations with a higher intensity of activity, and in areas where important groundwater-surface water interactions occur (e.g., alluvial aquifers).

This recommendation aligns with Blueprint: An Integrated Watershed Management Plan for the Red Deer River Watershed (Phase One: Water Quality), Recommendation 8: Establish a robust monitoring program for groundwater quality [2]. The Canadian Association of Petroleum Producers' (CAPP) has also called for industry to work with government and regulators to design and implement regional groundwater monitoring programs for groundwater quality and quantity [3].

The Red Deer River Watershed Alliance encourages the Government of Alberta and industry to work in partnership to identify additional groundwater monitoring locations, to ensure regular analysis and reporting of collected data, and to explore shared funding options. A key goal should be to coordinate and leverage monitoring required for Water Act approvals. A conceptual framework for an enhanced regional monitoring network in the Red Deer River watershed has previously been developed that can be leveraged as an input to these efforts [4].

² [Blueprint: An Integrated Watershed Management Plan for the Red Deer River Watershed \(Phase One: Water Quality\)](#).

³ [CAPP Hydraulic Fracturing Guiding Principles and Operating Practices 4 O2 Planning and Design, 2013.](#)

⁴ [Background Technical Report: Surface water quantity and groundwater resources. Prepared for the Red Deer River Watershed Alliance.](#)

4. Develop and implement science-based standards for mandatory baseline water well testing near hydraulic fracturing operations.

Target Audience: Alberta Environment and Parks and the Alberta Energy Regulator

Issue: Without baseline water quality and quantity data for water wells around hydraulic fracturing production zones, it is difficult to identify and characterize potential environmental impacts.

Background: There is currently no regulatory requirement for baseline water well testing around hydraulic fracturing production zones in Alberta. In contrast, baseline water well testing is required for coal bed methane operations above the base of groundwater protection [5].

In *Our Water, Our Future: A Plan for Action* (2014), the Government of Alberta committed to develop and implement science-based standards for baseline water well testing near hydraulic fracturing operations. However, determining an appropriate science-based radius for baseline well testing near hydraulic fracturing operations in Alberta remains a subject of discussion among experts.

According to CAPP's *Guiding Principles and Operating Practices*, it is recommended that companies test domestic water wells within 250 metres of shale gas, tight gas and tight oil development in Alberta.

Baseline water well testing is needed to safeguard regional water supplies and the aquatic environment, while building stakeholder and public confidence in the regulatory system. Landowners should also be provided access to baseline water testing results, where applicable.

⁵ Alberta Energy Regulator, Directive O35: Baseline Water Well Testing Requirement for Coalbed Methane Wells Completed Above the Base of Groundwater Protection, (May 8 2006), <http://www.aer.ca/documents/directives/DirectiveO35.pdf>

5. Conduct research on the possible effects of hydraulic fracturing on surface and groundwater quantity and quality in the Red Deer River watershed.

Target Audience: Academic Institutions, Government of Alberta, Industry

Issue: The cumulative effects of hydraulic fracturing development on hydrological function and ecosystem health have not been assessed at regional, watershed, and sub-watershed scales.

Background: Research into the cumulative effects of hydraulic fracturing on water resources is needed to inform water management at watershed and sub-watershed scales. Appropriate subject matter experts should be engaged to frame the risks of hydraulic fracturing activity on water quantity and quality (e.g., risk mapping), identify critical gaps, and provide management recommendations. For example, areas of increasing development and water demand - notably the Medicine, Blindman, Waskasoo, and Threehills sub-watersheds - would benefit from additional research exploring links between historical streamflows, science-based instream flow needs, rates of groundwater recharge, climate variability, and forecasts related to water allocation and use over time. The consumptive use of water from runoff sources (e.g., dugouts, ditches), in particular, should be evaluated in order to understand potential impacts to groundwater recharge, aquifers, and water availability over time. Forecasts of future hydraulic fracturing activity in the basin may also be beneficial for ongoing management.

This recommendation also aligns with Action 5.3 in Blueprint: An Integrated Watershed Management Plan for the Red Deer River Watershed:

- Report on the research of the possible effects of hydraulic fracturing on surface and groundwater quality in the Red Deer River watershed, particularly in areas with high hydraulic fracturing activity.

Research related to water quality should address source water protection, surface water, and deep and shallow groundwater.

6. Review the instream objectives for rivers and streams in areas with higher hydraulic fracturing activity to reflect modern science-based environmental flow criteria.

Target Audience: Alberta Environment and Parks

Issue: It is unclear if existing Instream Objectives in key sub-watersheds (e.g., Medicine, Blindman, Threehills) provide adequate environmental flow protection.

Background: In areas with increasing development, rising demand for surface water from rivers, streams, and runoff sources must be balanced with the need to maintain ecological flows to protect aquatic ecosystem health. The Medicine and Blindman Rivers lie in the 5,941 km² Red Deer River Basin Water Management Area (WMA) 05CC. Demand for term water license and Temporary Diversion License (TDL) abstractions has been increasing in WMA 05CC due to hydraulic fracturing operations, and these licenses are regulated by a maximum diversion rate, a Red Deer River mainstem Water Conservation Objective (WCO), and Instream Objectives (IO) (minimum flows below which no withdrawals are permitted).

Although IOs have been set for the Medicine River, Blindman River, and Lasthill Creek (and in other areas), IOs predate more modern approaches to assess flow requirements, and there is a need to investigate whether they provide adequate environmental flow protection to support aquatic ecosystem health, based on the best available science and management considerations.

For streams without an existing IO, Alberta Environment and Parks (AEP) and the Alberta Energy Regulator (AER) apply the Surface Water Allocation Directive (SWAD) implemented by AEP in 2019. SWAD facilitates economic growth without compromising the natural ecological health of Alberta's streams by incorporating scientifically rigorous environmental flow criteria. The existing IOs in the Medicine and Blindman River basins do not take into consideration AEP's implementation of the SWAD environmental flow criteria.

We recommend that Alberta Environment and Parks and the Alberta Energy Regulator review the scientific basis of the Instream Objectives being applied in WMA 05CC (and other areas with IOs where higher hydraulic fracturing activities occurs [6]); and compare with results derived by application of the Surface Water Allocation Directive. Modernizing the Instream Objectives to align with policy and regulatory enhancements may represent an important water management opportunity in the area.

⁶ There are 12 streams in the Red Deer River watershed with established Instream Objectives.

⁷ Relevant groups may include, but are not limited to: Canadian Association of Petroleum Producers, Explorers and Producers Association of Canada, South Duvernay Operators Group.

7. Encourage and promote the implementation of beneficial management practices by operators.

Target Audience: Industry [7], Synergy Alberta

Issue: Continually improving the environmental performance of hydraulic fracturing in the region will require industry coordination and the ongoing implementation of beneficial management practices.

Background: Industry associations and local Synergy groups have developed a range of beneficial management practices related to water and hydraulic fracturing. Operators are encouraged to adopt beneficial management practices that safeguard regional water quantity and quality, and to participate in forums that bring local community members and industry representatives together.

Synergy groups operating in the Red Deer watershed include Central Alberta Synergy, West Central Stakeholders, Sindre Petroleum Operators Group, and the Central Mountainview Advisory Group.

Industry associations that promote peer-to-peer sharing of best practices include the Canadian Association of Petroleum Producers and the Explorers and Producers Association of Canada. The latter may be an important avenue to engage smaller operators.

Resources that describe beneficial management practices include:

- [Canadian Association of Petroleum Producers Guiding Principles and Operating Practices](#)
- West Central Stakeholders [Best Operating Practices \(BOPs\)](#)

8. Modify end-of-pipe intake screen sizes in freshwater sources and the timing of operations to prevent entry of small fish fry in spring.

Target Audience: Industry Operators, Industry Associations, Alberta Energy Regulator

Issue: Screen sizes used on some intake pipes in water sources may allow entry of small fish fry.

Background: Some fish fry, including mountain whitefish (*Prosopium williamsoni*), are able to pass through intake screens in the spring, even when screens are sized in accordance with the federal Freshwater Intake End-of-Pipe Fish Screen Guideline. Some industry operators have voluntarily opted to modify intake screen sizes to protect fish species with fry smaller than 25 mm, and/or have modified the timing of their operations to avoid affecting small fry. These are beneficial management practices that should be encouraged, and/or included as conditions in licenses for water diversions in areas where mountain whitefish are present.

9. Enhance seismic monitoring, evaluation, reporting, and communications to the public in relation to oil and gas activity in the Red Deer region.

Target Audience: Alberta Energy Regulator, Alberta Geological Survey, Industry Operators

Issue: Hydraulic fracturing has been linked to induced seismic events in the region, and additional precautionary measures are needed.

Background: As of December 2019, companies operating in the Red Deer region must comply with Subsurface Order No.7, which establishes seismic monitoring, reporting, and setback requirements in the region. The order prohibits hydraulic fracturing within five kilometres of the Dickson Dam if drilling operations are targeting the Duvernay Formation, or within three kilometres if operations are targeting shallower formations (e.g., Cardium, Rock Creek, and Falher Formations). The Dickson Dam is owned by Alberta Environment and is primarily used for water storage and flow control upstream of the City of Red Deer.

A study by the Alberta Energy Regulator / Alberta Geological Survey indicates that recent earthquakes (19 March 2018 – ML 3.13; 4 March 2019 – ML 4.18) in the Red Deer region were induced by hydraulic fracturing [8], and other smaller clusters of events in the Duvernay East Shale Basin were also induced. Under Subsurface Order No. 7, companies operating in the region are required to follow a traffic light protocol (TLP) to monitor seismic activity and manage the hazard of induced earthquakes through operations. CAPP has also developed a guide with best practices related to hydraulic fracturing and induced seismicity [9].

A prudent and precautionary approach for managing the potential risk of induced seismicity from hydraulic fracturing is required in the region, particularly given the proximity of recent earthquakes to population centres, and recognizing overlap between geological target formations, areas upstream of the City of Red Deer, and shallow groundwater systems. Additional opportunities to better manage risks of induced seismicity, potential impacts to water, and public safety should be explored, including enhancements in regional seismic monitoring capability, and potential operational guidelines.

⁸ Schultz, R., Pawley, S.M. and Hauck, T.E. 2019. Preliminary overview of the 2018 and 2019 earthquakes near Red Deer, Alberta; Alberta Energy Regulator/Alberta Geological Survey, AER/AGS Open File Report 2019-12. 10p.

⁹Canadian Association of Petroleum Producers. [Hydraulic Fracturing Guiding Principles and Operating Practices: Anomalous Induced Seismicity: Assessment, Monitoring, Mitigation, and Response.](#)

APPENDIX

The RDRWA would like to thank the following individuals who shared their expertise and insights related to hydraulic fracturing and watershed management as part of this process. Their involvement does not imply endorsement of the recommendations herein.

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