geoconvention
Virtual Event
September 21-23
2020
CSPG • CSEG • CWLS • GAC • MAC • IAH

Characterizing dissolved methane in groundwater in the Peace Region, Northeast BC, using a regional, dedicated groundwater monitoring well network

A. Maximilian Goetz, Andrew J. Allen, Bethany Ladd, Aaron G. Cahill, Laurie Welch, Chelton Van Geloven, Bernhard Mayer, Dirk Kirste, Roger D. Beckie.

The University of British Columbia, Simon Fraser University, The University of British Columbia, Heriot-Watt University, British Columbia Oil and Gas Commission, Ministry of Forests, Lands, Natural Resource Operations and Rural Development, University of Calgary, Simon Fraser University, The University of British Columbia, British Columbia

Summary

The occurrence of methane in shallow groundwater systems is a topic of increasing interest in regions of active oil and gas development. Although methane is commonly naturally present in shallow groundwater, anthropogenic methane sourced from leaky energy wells can migrate into these aquifers, potentially causing deleterious effects, such as degradation in groundwater quality (Cahill et al., 2017). Using a newly installed, purpose built groundwater monitoring well (MW) network, groundwater chemistry is being determined and monitored in the Peace Region of Northeast BC, with a specific focus on the distribution, concentration and origin of dissolved methane.

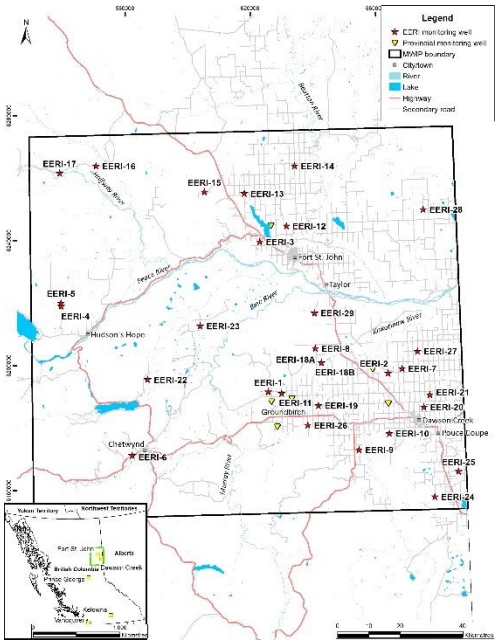

Figure 1: Locations of 29 monitoring wells completed for this project.

Theory / Method / Workflow

The project bounds, located within the Peace River Regional District, was delineated to encompass both major population centers and areas of historic and ongoing oil and gas

development (Ladd et al. 2020). At the outset of the project, criteria were developed to strategically select locations for potential MWs, defined as either "baseline" locations distant from oil and gas activity or as "proximal" locations within areas oil and gas activity. Over the course of five drilling campaigns, 29 MWs were successfully installed (Figure 1). The majority of the MWs are short-screened standpipe MWs, the exceptions being a few nested multilevel MWs and 2 Westbay installations. Periodic groundwater sampling of the MW network and lab analysis of samples are ongoing.

Results, Observations

The average static water levels encountered in MWs was 26 meters below top of casing (mbtoc), ranging from artesian to 66 mbtoc. Most MWs were screened in Cretaceous shale/siltstone units, with the most productive MWs screened in sandstone. Several MWs were screened in buried valley sand/gravel aquifers, which are confined by thick (10-65 meter) clay diamict units. In many cases, it was found that the most productive bedrock zone existed near the overburden/bedrock interface. Typically, the top 5-15 meters of bedrock was less competent than the underlying units. This is likely due to glacial processes having reworked the top of bedrock, creating the observed enhanced permeability relative to competent bedrock counterparts. A drill rig capable of switching between sonic and air rotary drilling methods was used to allow for effective installation of MWs in the characteristically unpredictable and complex geology encountered across the Peace Region.

Novel/Additive Information

Through this study, regional, near-surface groundwater systems of the Peace Region will be systematically characterized. As a legacy to this study, the installed well network will provide permanent regional monitoring infrastructure to measure background conditions and groundwater trends in the Peace Region. These purpose built MWs are likely to be used to collect data for future studies in groundwater quality/quantity and downhole seismicity.

Acknowledgements

This project was funded by Geoscience BC, the British Columbia Oil and Gas Commission, MITACS, and BC Ministry of Energy, Mines, and Petroleum Resources.

References

Cahill, A.G., Steelman, C.M., Forde, O., Kuloyo, O., Emil Ruff, S.,Mayer, B., Mayer, K.U., Strous, M., Ryan, M.C., Cherry, J.A. and Parker, B.L. (2017): Mobility and persistence of methane in groundwater in a controlled-re lease field experiment; Nature Geoscience, v. 10, no. 4, p. 289–294, URL <https://doi.org/10.1038/ngeo2919> [April 2017].

Ladd, B., Cahill, A.G., Goetz, M., Allen, A., Welch, L., Mayer, B., van Geloven, C., Kirste, D. and Beckie, R. (2020): Installation of a purpose built groundwater monitoring well network to characterize groundwater methane in the Peace Region, northeastern British Columbia (NTS 093P/09–16, 094A/01–08); *in* Geoscience BC Summary of Activities 2019: Energy and Water, Geoscience BC, Report 2020-02, p. ##–##.