

Groundwater – Surface Water Interaction at Nose Creek

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The study area is within the City of Calgary at the confluence of Nose Creek and the Bow River, and the intersection of the two valleys associated with these water bodies. A landfill operated in this area from the 1920s to 1967, during which time waste materials were deposited within abandoned oxbows, former creek channels and other low-lying areas.

Initial subsurface investigations have identified groundwater impacts that have potential to reach ecological receptors within Nose Creek. The purpose of the current program was to better understand the fate of groundwater impacts encountered within the landfill. To serve that purpose, a groundwater investigation program was therefore undertaken with three primary objectives:

- To evaluate the distribution of groundwater impacts in the area of the landfill, both vertically (with depth and between the different hydrostratigraphic units) and in as close proximity to Nose Creek as possible;
- To assess the groundwater flow regime in three dimensions within the landfill; and,
- To assess the physical and chemical interaction between the local groundwater and Nose Creek.

There are over 40 previously installed groundwater monitoring wells in the area of the landfill adjacent to Nose Creek and the Bow River – primarily single screen-interval installations. The current investigation added seven nested well installations across the study area, one additional stand alone well upgradient of the landfill deposits, five creek bank wells directly adjacent to Nose Creek, and two water level gauges within Nose Creek.

Initial results reflect a snapshot of conditions that speak to the three primary program objectives, and can be summarized as follows:

- Groundwater impacts generally diminish rapidly with distance from the landfill deposits, both vertically within the different hydrostratigraphic units underlying the landfill and horizontally toward Nose Creek. Groundwater concentrations directly adjacent to Nose Creek are significantly lower than those measured within the landfill footprint. For some parameters and units, however, potential impacts remain in proximity to the Creek and are being evaluated relative to potential interaction with Creek waters.
- Vertical groundwater flow between the various hydrostratigraphic units was generally downward from the waste deposits and native fine-grained (overbank) deposits to the underlying coarse-grained fluvial deposits and into the shallow bedrock. Upward moving groundwater from bedrock has not been observed despite the valley setting of the landfill and may be a seasonal occurrence.
- Horizontal groundwater flow appears to be sub-parallel to Nose Creek within the study area, until it is captured by the larger influence of the Bow River. Further data gathering is ongoing regarding interaction between groundwater and the creek.

The conclusions of this study are that groundwater impacts appear to attenuate prior to reaching Nose Creek; with further data analysis and risk assessment pending in order to refine this conclusion. Significant changes in geochemical conditions (oxidation reduction zones) are also evident and an important factor contributing to natural attenuation of dissolved organic compounds leached from the landfill waste. The instrumentation now installed is anticipated to provide data to further evaluate the physical and chemical interaction between groundwater and the creek in the coming months.

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Marc Adams has been in the engineering industry since 1985, with 21 years experience in engineering – initially as an engineering technologist and most recently with over 16 years as a geo-environmental engineer. He obtained a B.Sc. in Civil Engineering from the University of Saskatchewan in 1992, a M.Sc. in Civil Engineering from the University of Alberta in 1995, and has been a professional engineer since 1994. He has worked within consulting, industry, municipal government and academic research settings – specializing in site assessment and remediation. He is currently the project manager of the Nose Creek Landfill Remediation Project.

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Sean Buckles is a Project Engineer and Client Team Leader in EBA's Environmental Practice in Calgary, Alberta. He has over 13 years of experience in the geo-environmental consulting field on a variety of projects in Ontario and Alberta. He obtained a B.Sc. in Geological Engineering from Queen's University in 1995 and has been a professional engineer since 1997. Areas of expertise include the fields of environmental engineering and geology, where he has managed and undertaken environmental site assessments, risk management and remediation programs for projects related to the oil and gas industry, commercial, industrial and residential development. Most recently Mr. Buckles has specialized in urban site management.