Briefing Note

Groundwater and Wildlife

Increased exploitation of oil and gas and mineral resources are creating growing pressures on the quantity and quality of both surface water and groundwater resources in Canada.[1] Groundwater is a major link in the hydrologic cycle, and is therefore intricately connected with surface water within this cycle.[1,2] For example, groundwater may flow into streams, rivers, marshes, lakes and oceans, or it may discharge in the form of springs and flowing wells.[2]

The Ɂehdzo Got'ı̨nę Gots'ę́ Nákedı (Sahtú Renewable Resources Board, or 'the Board') maintains an interest in potential impacts to groundwater, particularly in regards to potential groundwater extraction and contamination, since these could lead to impacts on surface water and wildlife/wildlife habitat. As the NWT Water Stewardship Strategy recognizes, "Lakes, rivers, groundwater and wetlands help to ensure the survival of fish species, other animals such as waterfowl, furbearers, moose and caribou, and plants."[3] Being the "main instrument of wildlife management" in the Sahtú Region with a mandate to "conserve and protect wildlife and wildlife habitat" under the *Sahtú Dene and Métis Comprehensive Land Claim Agreement*, groundwater issues are of significant concern to the Board.

According to the Water Matters Society of Alberta, substantial changes to groundwater can create long-lasting and difficult-to-reverse changes to surface waters:

> "Groundwater is a fundamental part of the hydrological cycle. It is always moving beneath us and often contributes to or is recharged by surface waters. However, unlike surface water bodies (i.e., rivers, lakes, and wetlands), water in underground aquifers moves very slowly. Consequently, groundwater aquifers take much longer to recover from substantial changes in either water quantity or quality that are caused by industrial activity. Therefore, it is critical to develop an integrated understanding of regional groundwater quantity, flow, and quality prior to approving groundwater-intensive developments, so that groundwater and surface waters are sustainably managed and any substantial risks to them are minimized."[4]

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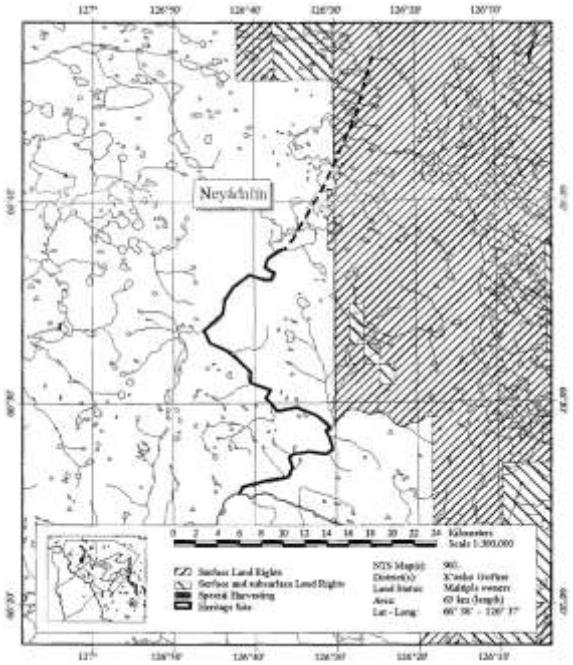
[1] Expert Panel on Groundwater. (2009). *The sustainable management of groundwater in Canada*. Ottawa: The Canadian Council of Academies.
[2] Environment Canada. (2013). *Groundwater.* http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=300688DC-1#sub1
[3] Government of the Northwest Territories and Aboriginal Affairs and Northern Development Canada. (2010). *Northern Voices, Northern Waters: NWT Water Stewardship Strategy.* http://www.enr.gov.nt.ca/_live/documents/content/NWT_Water_Stewardship_Strategy.pdf, p.6.
[4] Julia Ko and William F. Donahue (2011), *Drilling Down: Groundwater Risks Posed by In Situ Oil Sands Development* (Water Matters Society of Alberta, July 2011), 4. http://www.water-matters.org/docs/drilling-down.pdf

In the Sahtú Region, changes to the permafrost caused by climate warming such as active-layer thickening and permafrost degradation can lead to increased water infiltration, greater groundwater storage, lower spring runoff and increase in base flow of rivers.[5] As a result, groundwater will have greater influence on stream flows, and this will also impact surface-water quality.[6]

Not enough baseline research has been done on groundwater in the Sahtú Region. However, we do know that groundwater is important to the land and important to the Sahtú people. During the 1980s, researchers investigated and mapped over 100 springs, seeps and mineralized ponds within the Central Mackenzie Valley. The springs in the Central Mackenzie Valley are mainly buried (discharging through overburden); however, several springs flow directly from cracks in exposed bedrock.[7]

An important story in the history of the K'asho Got'ine people is one of an underground river (Neyádalín) that flows about 20 kilometres from Lac Belot (Odarah Tué), southwest of Colville Lake, to springs on the north bank of the Hare Indian River (Xaistá Niljné). Dr. Derek Ford of McMaster University, one of the world's leading karst experts, conducted four days of aerial surveys in the NWT in July 2007 to locate, photograph, and describe some of the karst landform sites in the Sahtú region. Karst develops within types of rock that dissolve in water (such as limestone), creating features like sinkholes, caves, dry valleys and gorges, and underground rivers. Dr. Ford found that the collection of karst formations between Great Bear Lake and the Mackenzie River are one of the most significant, if not *the* most significant, karst known within a permafrost zone anywhere in the world.[8]



The location of Neyádalín, the Underground River.

Neither Alberta nor British Columbia has yet put in place a management regime that would ensure the sustainability of their groundwater resources (and the groundwater's ability to sustain healthy surface waters). For example, Alberta legislation does not define "sustainable groundwater yield." According to the Water Matters Society of Alberta:

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[5] Woo, M.-K., Lewkowicz, A.G., and Rouse, W.R. (1992). Response of the Canadian permafrost environment to climate change. *Physical Geography, 13,* p.287-317.
[6] Michel, E.A., and van Everdingen, R.O. (1994). Changes in hydrogeologic regimes in permafrost regions due to climate change. *Permafrost and Periglacial Processes, 5,* p.191-195.
[7] F.A. Michel, ―Hydrogeology of the Central Mackenzie Valley,‖ Journal of Hydrology, 85 (1986).
[8] Derek Ford, Mapping Known and Potential Karst Areas in the Northwest Territories, Canada (2009). http://www.nwtpas.ca/documents/document-NWT_Karst_Report-Region5_NorthernFranklinMntns.pdf

> "Often, a sustainable or safe yield is interpreted as that which ensures the long-term balance between the amount of groundwater withdrawn annually and the annual amount recharged to the aquifer via precipitation and surface water seepage. However, groundwater aquifers support stream, spring, wetland, and other groundwater-dependent ecosystems, in addition to human uses... For this reason, the sustainable pumping rate (or yield) must be significantly less than an aquifer's recharge rates, in order for the aquifer to continue to provide the amount and quality of freshwater necessary to sustain the surface ecosystems that rely upon it. Sustainable management of groundwater demands a detailed understanding of groundwater-surface water interactions and flow or supply rates in aquifers themselves."[9]

Next door to Alberta, the Auditor General of British Columbia concluded in a 2010 report that:

> The [B.C.] Ministry of Environment's information about groundwater is insufficient to enable it to ensure the sustainability of the resource;
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> Groundwater is not being protected for depletion and contamination or to ensure the viability of the ecosystems it supports; and
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> Control over access to groundwater is insufficient to sustain the resource and that key organizations lack adequate authority to take appropriate local responsibility.[10]

The Board has learned from these examples in Alberta and British Columbia that if we are to properly manage our groundwater resources here in the Northwest Territories, we must first recognize and begin to understand the important connections between groundwater and surface water. The Board intends to work with other co-management boards and regulatory agencies in making these connections.

[9] Ko and Donahue, *Drilling Down*, 14.
[10] Karen Campbell and Matt Horne, *Shale Gas in British Columbia: Risks to B.C.'s Water Resources* (Pembina Institute, September 2011), 24-25. http://www.pembina.org/pub/2263