Regional and Local Vulnerability and Risk to Potential Groundwater Contamination

Town of High River, Alberta

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Overview

- Objectives, Project Context and Terms
- Regional aquifer vulnerability and risk
  - Aquifer used by town for drinking water, DRASTIC
- Local vulnerability and risk
  - Active production wells, capture zones
- Summary
- Questions
Project Objectives

• Evaluate potential risks to water quality from urban and industrial growth for the Town, and
• Provide recommendations for source water protection
"The first barrier to the contamination of drinking water involves protecting the sources of drinking water."

Justice Dennis O'Connor, Walkerton Inquiry 2002
Project Context - Study Area
Project Context

Groundwater Flow – Sand and Gravel Aquifer
Project Context

- Groundwater Flow – Sandstone Aquifer
Project Context

Groundwater Flow – Local Sand and Gravel Aquifer
Terms - Risk

The combination of likelihood and consequence of an event occurring.

Alberta Environment: Groundwater Management Framework Northern Athabasca Oil Sands Region, 2010
Risk – Project Context

- Threat/Contaminant Source
  - Waste disposal
  - Chemical use
  - Waste handling practices

- Pathway/Vulnerability
  - Well capture zone
  - Vulnerable aquifer

- Receptor
  - Aquifer & Well
Vulnerability (Regional)

- D - Depth to water
- R - Recharge
- A - Aquifer media
- S - Soil media
- T - Topography
- I - Impact of the vadose zone
- C - Hydraulic Conductivity

\[ V = 5D_r + 4R_r + 3A_r + 2S_r + T_r + 5I_r + 3C_r \]
Vulnerability (Regional)

Depth to water
Recharge/ discharge
Aquifer media

Soil type
Topography (%slope)
Impact of vadose zone
Conductivity (hydraulic)

Rating
10 High
1 Low
Vulnerability (Regional)

Results

DRASTIC - Overall Rating
A - Low
- 37 - 65
- 65 - 81
- 81 - 95
- 95 - 109
B - Medium
- 109 - 123
- 123 - 138
- 138 - 153
C - High
- 153 - 169
- 169 - 188
- 188 - 230
Potential Contaminant Sources

Natural Rivers Authority
Potential Contaminant Sources (Regional)

Main Agricultural Landuse:
- Hay & pasture
- Cereal- barley
Potential Contaminant Sources (Regional)
Risk (Regional)

- Cropland
Risk (Regional)

- Industrial Activity

Vulnerability Rating

10 High

1 Low
Vulnerability (Local)

- Evaluated based on existing Town production wells
Well capture zone potential contaminant sources

- Oil & gas facilities, pipelines, gas stations, USTs
- Lumber yard
- Abandoned wells
- Industrial area/railway (% of zone)
- Sanitary sewer pipes (m/m²)
- Storm water pipes (m/m²)
Potential contaminant sources ranked

- Each contaminant grouping given a potential risk score according to:
  - Density of potential contaminant source in wellhead capture zone
  - Contaminant source rank
  - Likelihood of contaminant release
  - Flood risk (area ranking)
Well Capture Zone - Flood Potential
Potential Risk (Local)

- Well Capture Zones Ranking

Wellhead Capture Zone Ranking

- Low
  - 0
  - 1
- Low-Moderate
  - 2
  - 3
  - 4
- Moderate-High
  - 5
  - 6
  - 7
- High
  - 8
  - 9
  - 10

Wells
- Active Production Well
- Inactive Production Well (Not connected into water main system)
- Shut-In Production Well
- Observation Well
- Test Hole
Local Monitoring Groundwater Network
Vulnerability and Risk Results Summary

- **Source prioritization** - Identified wells with least and greatest potential risk.

- **Focussed monitoring** - Specific contaminants sources of potential concern identified, and gained a better understanding of the Town’s water supply.

- **Focused source water protection planning for:**
  - Future land use development
  - Potential support for agricultural and industrial in areas of high aquifer vulnerability
  - Identified abandoned wells for appropriate well closure.