The Remediation Benefits of a Tier 2 Evaluation for a Hydrocarbon Contaminated Site in Calgary, Alberta

October, 2011



Benefits of a AENV Tier 2 Evaluation



- Introduction
- Site Background & Assessment History
- Approach & Rationale for Tier 2
- Benefits of Tier 2
- Summary

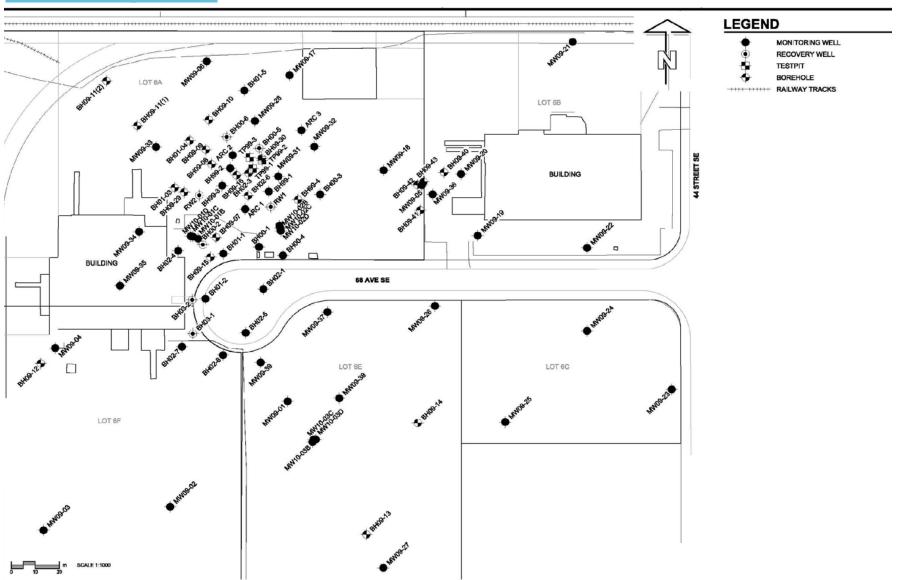


<u>Introduction – Aerial View of Site</u>



Site Background





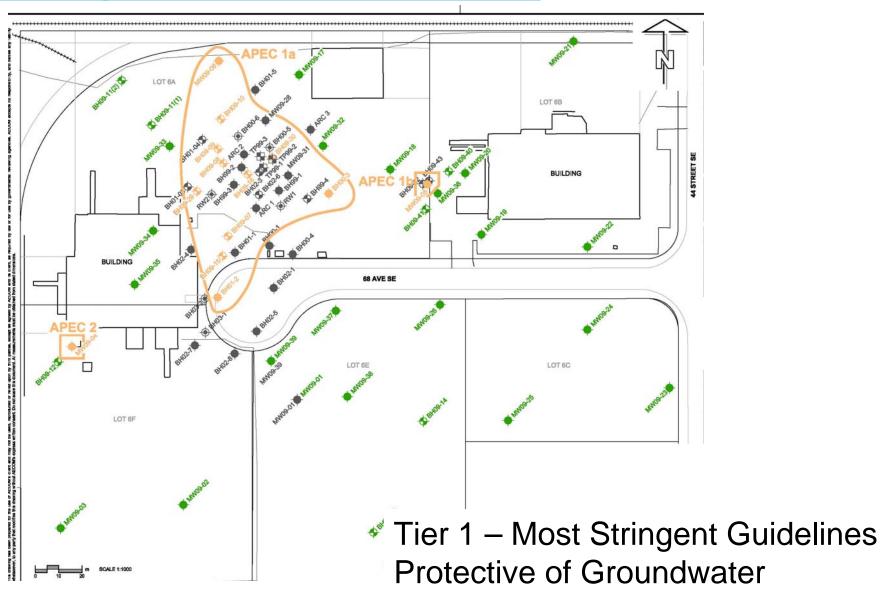
Site Background & Assessment History



- •Site Developed Between 1981 & 1983
- •4500L Diesel Underground Storage Tank (UST) Installed
- •Cir. 1999 Tank Decommissioned & 10L of Product Removed
- Cir. 1999 First Assessments Conducted & Multi-Phase Extract.
- 2000-2002 Site Monitoring, more Assessments & Multi-Phase Expansion
- •2003 Risk Assessment Conducted (Humans most at Risk)
- •2004-2008 No Information
- •2008 Site goes into Receivership & Phase I conducted
- •2009 to 2010 several assessments & Remedial Action Plan
- Late 2010 Tier 2 Evaluation
 Benefits of a AENV Tier 2 Evaluation

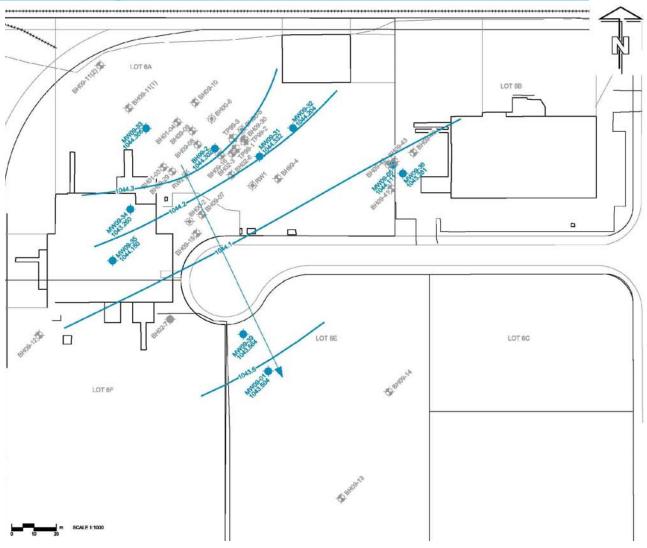
<u>Site Background – Tier 1 Soil Contamination</u>







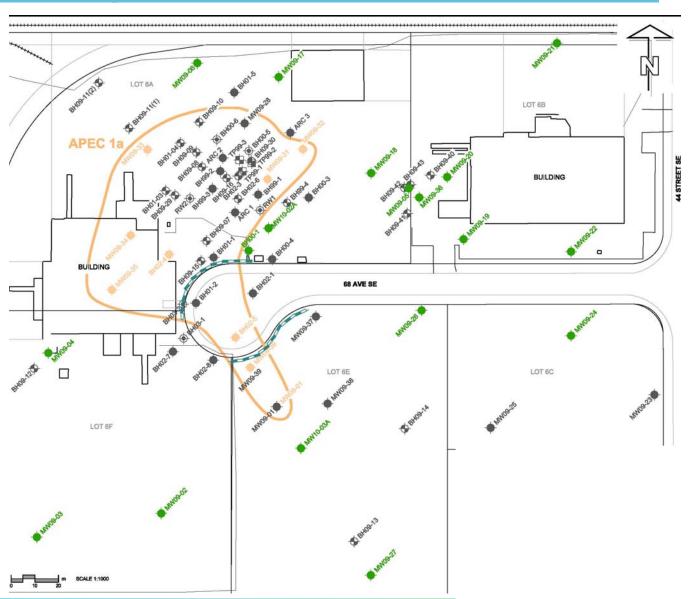




GROUNDWATER FLOW DIRECTION



<u>Site Background – Tier1 Groundwater Contamination</u>





<u>Site Background – Tier 1 Proposed Remediation & Cost</u>

Soils

- Contaminated Soil Volume 11,250 m³ (4,500 m² area)
- Remediation Depth to 7.0 m (into bedrock)

Remedial Costs to Soil: \$1,250,000

<u>Groundwater</u>

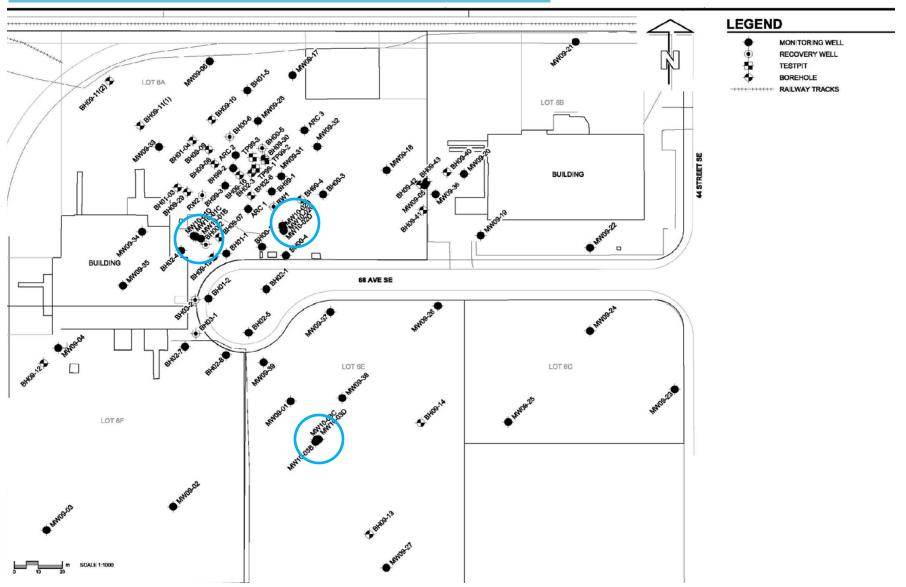
Contaminated GW Area 6570 m²

Remedial Costs to GW: \$250,000 to \$500,000

Tier 2 Evaluation Costs - ~\$75,000

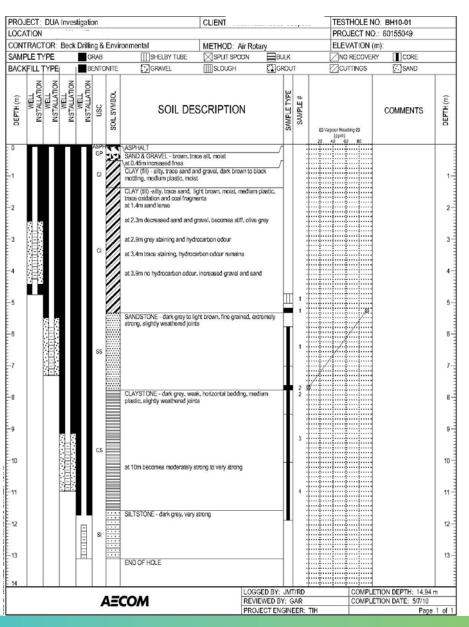
Rationale & Approach for Tier 2 Evaluation



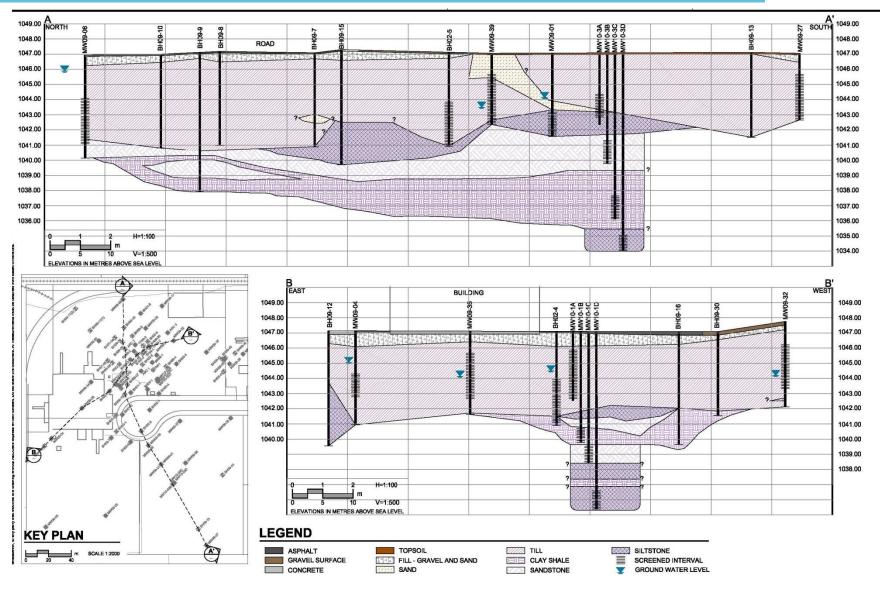


Rationale & Approach for Tier 2 Evaluation - MW Installation





Rationale & Approach for Tier 2 Evaluation – Cross-Sections A=COM



Rationale & Approach for Tier 2 Evaluation – GW Velocities AECOM



Well	Geology	Analytical Method	Hydraulic Conductivity Estimate (m/s)	
MW10-01A	Silty Clay Till	Hvorslev	3.5 x 10 ⁻⁷	
		Bower & Rice	2.7 x 10 ⁻⁷	
MW10-01B	Sandstone	Hvorslev	9.8 x 10 ⁻⁷	
		Bower & Rice	7.8 x 10 ⁻⁷	
MW10-01C	Claystone	Hvorslev	5.3 x 10 ⁻⁸	
		Bower & Rice	4.5 x 10 ⁻⁸	
MW10-01D	Siltstone	Hvorslev	2.5 x 10 ⁻⁹	
		Bower & Rice	1.8 x 10 ⁻⁹	
MW10-02A	Silty Clay Till	Hvorslev	1.1 x 10 ⁻⁷	
		Bower & Rice	8.3 x 10 ⁻⁸	
MW10-02B	Sandstone	Hvorslev	1.1 x 10 ⁻⁶	
		Bower & Rice	8.2 x 10 ⁻⁷	
MW10-02C	Claystone	Hvorslev	5.1 x 10 ⁻⁹	
		Bower & Rice	3.9 x 10 ⁻⁹	
MW10-02D	Siltstone	Hvorslev	6.9 x 10 ⁻⁹	
		Bower & Rice	5.2 x 10 ⁻⁹	
MW10-03A	Silty Clay Till	Hvorslev	5.7 x 10 ⁻⁸	
		Bower & Rice	4.5 x 10 ⁻⁸	
MW10-03B	Claystone	Hvorslev	8.5 x 10 ⁻⁹	
		Bower & Rice	6.5 x 10 ⁻⁹	
MW10-03C	Sandstone	Hvorslev	1.3 x 10 ⁻⁸	
		Bower & Rice	9.8 x 10 ⁻⁹	
MW10-03D	Siltstone	Hvorslev	8.2 x 10 ⁻⁸	
		Bower & Rice	1.1 x 10 ⁻⁷	

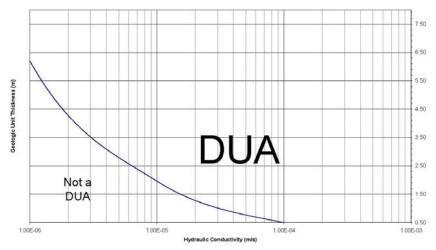
Rationale & Approach for Tier 2 Evaluation - Hydrogeology



Well	Geology	Maximum Unit Thickness (m)	Aquifer Type	Analytical Method	Most Conservative Hydraulic Conductivity (m/s)	Available head (m)	DUA (Yes/No)
MW10-02A	Silty Clay Till	5.0	Unconfined	Hvorslev	1.1 x 10 ⁻⁷	2.4	No
MW10-02B	Sandstone	2.5	Confined	Hvorslev	1.1 x 10 ⁻⁶	2.8	No
MW10-01C	Claystone	2.0	Confined	Bower & Rice	4.5 x 10 ⁻⁸	4.4	No
MW10-03D	Siltstone	1.9	Confined	Bower & Rice	1.1 x 10 ⁻⁷	6.3	No

Rationale & Approach for Tier 2 Evaluation – DUA Criteria





Source: AENV Tier 2 Soil & Groundwater Remediation Guidelines, Appendix E.

Figure 1. Minimum thickness required to meet DUA condition for a confined aquifer. Site-specific calculations can be made using the method in Section E.4

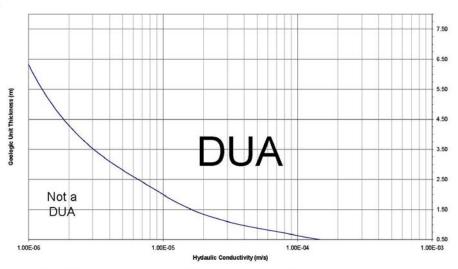
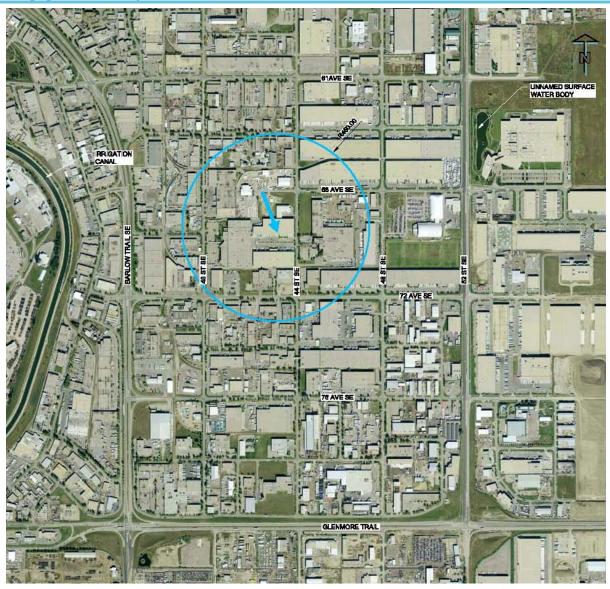


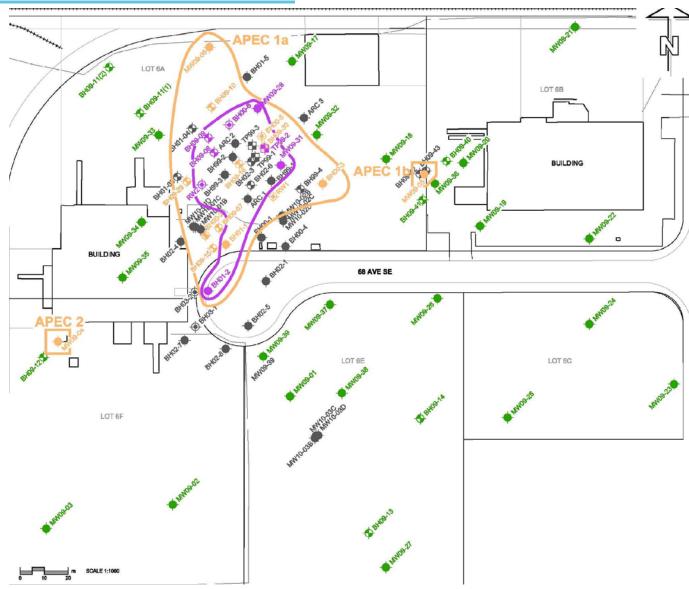
Figure 2. Minimum thickness required to meet DUA condition for an unconfined aquifer. Site-specific calculations can be made using the method in Section E.4

Rationale & Approach, Tier 2 Evaluation – Site & Surface Water A=COM



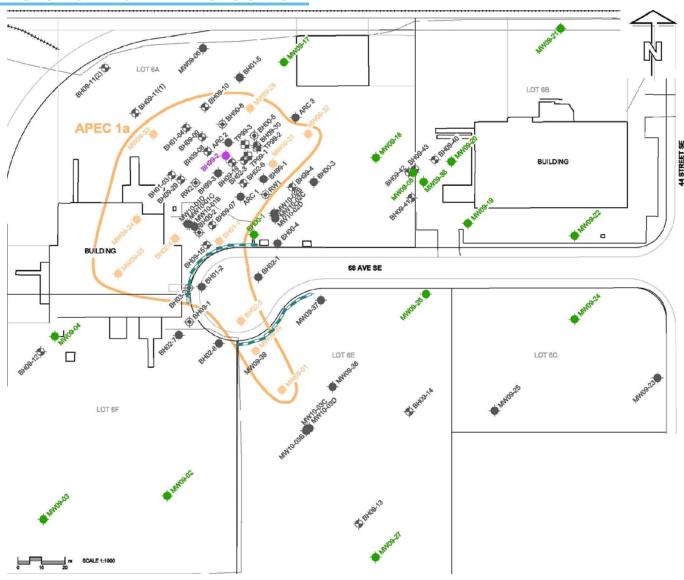
Benefits of a Tier 2 Evaluation





Benefits of a Tier 2 Evaluation





Benefits of a AENV Tier 2 Evaluation



Soils

- Contaminated Soil Volume reduced from 11,250 m³ to 5520 m³
- Remediation Maximum Depth reduced from 7.0 m to 4.3 m
- Contaminated Soil Area reduced from 4500 m² to 1725 m² Remedial Costs to Soil Reduced From:

\$1,250,000 to ~\$610,000

Groundwater

•Contaminated GW Area reduced from 6572 m² to 2900 m²

Costs to GW reduced to:

~\$250,000 to ~\$150,000

Summary



- Site Developed in 1983
- 4500L UST containing Diesel
- Several in-situ techniques employed & several assessments
- Tier 2 Evaluation looked at potential DUAs beneath Site
- Compared Collected Date to AB Tier 2 Guidelines
- Determined Pathway Exclusions-Groundwater & Surface Water
- Tier 2 acknowledge By Alberta Environment
- Significantly Reduces Area, Volume and Remediation Cost.

Thousands of \$\$\$ Saved All for The Price of \$75,000



Thanks! Questions?