



SNC•LAVALIN
Environment

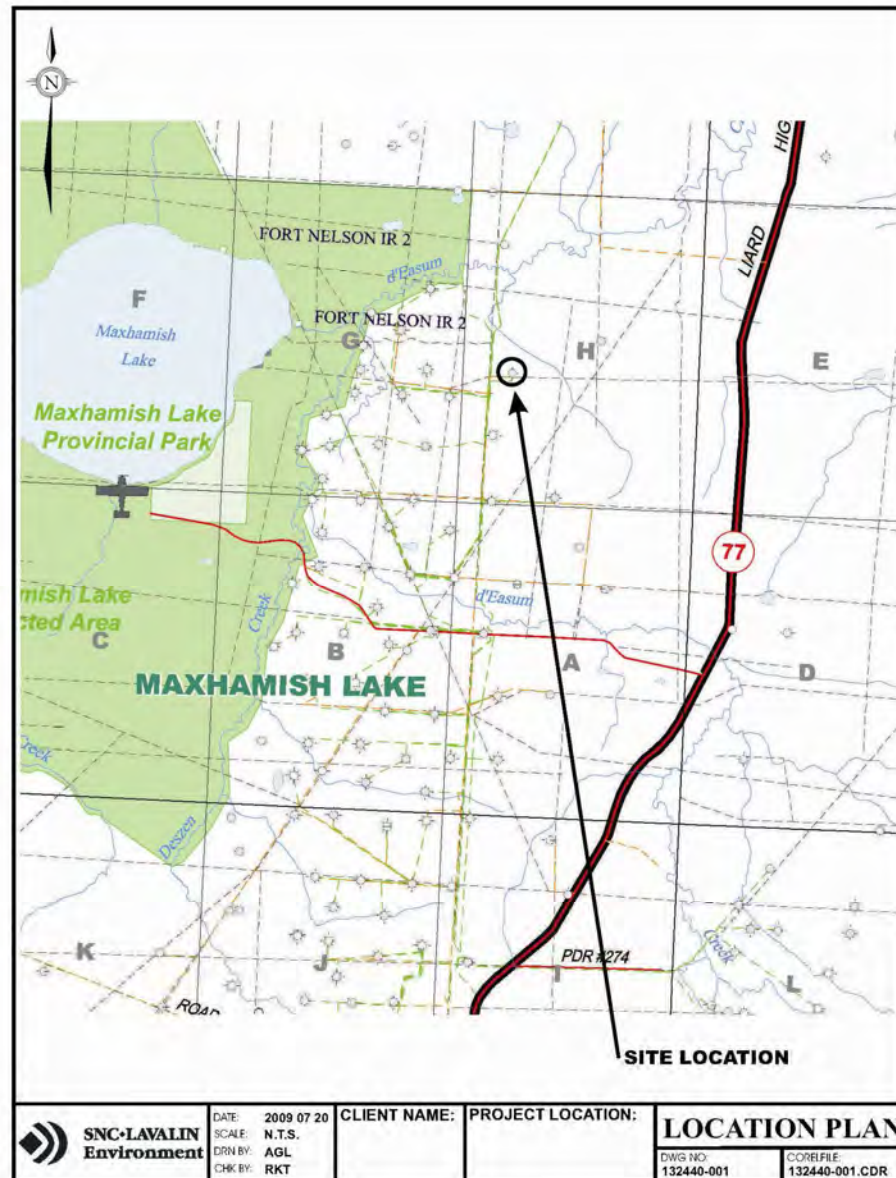


SCREENING LEVEL RISK ASSESSMENT (SLRA)

Case Study

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Case Study 1 – Maxhamish Field



SLRA – 5 Main Steps

1. Problem Formulation
2. Exemptions / Precluding Conditions
3. SLRA Questionnaire
4. Acceptable / Unacceptable Risk
5. Reporting



STEP 1 – Problem Formulation

Phase 1 / Phase 2 Site Assessment

- Identify Areas of Potential Environmental Concern (APECs) / Potential Contaminants of Concern (PCoCs)
- Investigate Soil and Groundwater Quality
- Soil vapour investigation if applicable – Site Classification Tool Priority Thresholds 9 and 10



Phase I ESA

Historical Records Review

- ◆ Information Sources (OGC / Client files)
- ◆ Spud Date 1997
- ◆ Drilled and Abandoned (1998)
- ◆ Gel Chem Drilling Mud
- ◆ Sump location not identified on-site or remote
- ◆ Site Reconnaissance – depressions, surface impacts



Phase 2 ESA

APECS / PCOCs

- ◆ Well Center
- ◆ Sump
- ◆ Depressions
- ◆ Background
- ◆ PCoCs – petroleum hydrocarbons (BTEX / VPH, EPH, PAH), metals, salinity (Na, Cl)



Site Plan



Sampling & Analysis Plan

- ◆ 22 boreholes
- ◆ 3 monitoring wells (dry)
- ◆ Analytical Program
 - 38 BTEX/VPH, EPH (10 samples < 1 m depth)
 - 17 PAH (5 samples < 1 m depth)
 - 21 metals (6 samples < 1 m depth)
 - 47 Na, Cl (21 samples < 1 m depth)



CSR Standards

- ◆ Not in ALR
- ◆ No DW
- ◆ AW applicable
- ◆ Wildlands land use (OGC guidance)
 - PL < 1 m depth
 - CL > 1 m depth

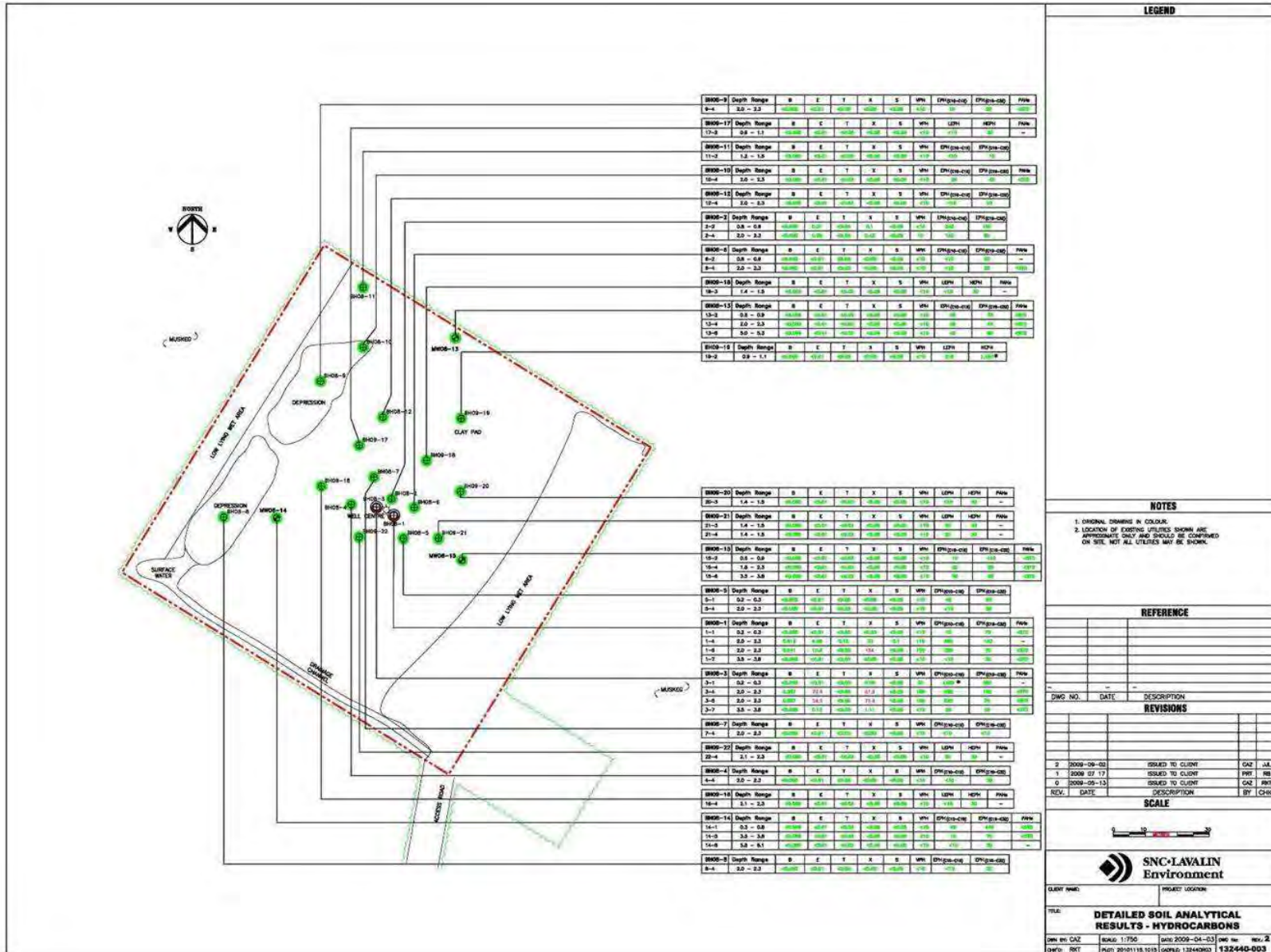


Results

- ◆ LEPH / HEPH exceedances in surface soils
 - Protocol 2 Statistical Evaluation
 - Separate populations (well center, depressions)
- ◆ BH08-1 – 2.0 m - 2.3 m Xylenes
- ◆ BH08-2 – 2.0 m - 2.3 m Ethylbenzene, Xylenes



Petroleum Hydrocarbons - Soil



Sample ID	Depth Range	B	E	T	X	S	WH	EPH(pas-c10)	EPH(pas-c15)	PHW
MW08-9	2.0 - 2.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-17	0.8 - 1.3	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-11	1.5 - 1.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-10	2.0 - 2.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-12	0.8 - 0.8	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-2	2.0 - 2.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-8	0.8 - 0.8	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-16	0.4 - 1.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-13	0.8 - 0.8	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-15	2.0 - 2.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-18	0.8 - 1.1	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-20	1.4 - 1.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-21	1.4 - 1.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-19	0.8 - 0.8	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-14	1.8 - 2.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-5	3.5 - 3.8	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-3	0.2 - 0.3	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-1	2.0 - 2.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-7	2.0 - 2.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-22	2.1 - 2.3	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-4	2.0 - 2.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-14	0.2 - 0.8	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-14	5.8 - 6.1	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND
MW08-8	2.0 - 2.5	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	ND	ND	ND

LEGEND

NOTES

- ORIGINAL DRAWING IN COLOUR.
- LOCATION OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND SHOULD BE CONFIRMED ON SITE. NOT ALL UTILITIES MAY BE SHOWN.

REFERENCE

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
2	2009-09-03	ISSUED TO CLIENT	CAZ	JL
1	2009-07-17	ISSUED TO CLIENT	PHB	PHB
0	2009-05-13	ISSUED TO CLIENT	CAZ	PHB

SCALE

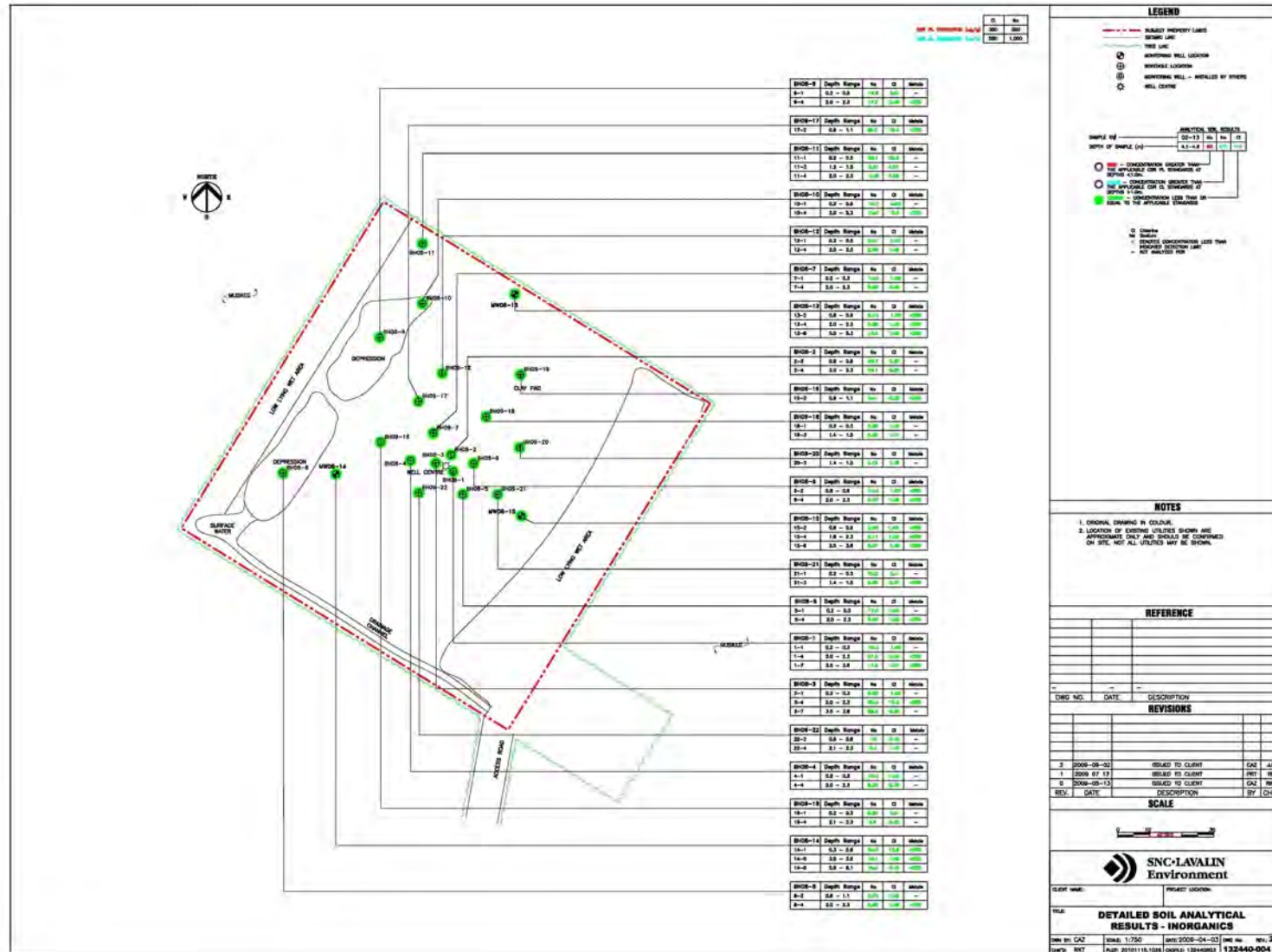


CLIENT NAME: PROJECT LOCATION:

FILE: **DETAILED SOIL ANALYTICAL RESULTS - HYDROCARBONS**

OWN BY: CAZ SCALE: 1:750 DATE: 2009-04-03 DWG NO: REV: 2
 DWG: RKT PLAN: 20101118.1015 GPRID: 13244903 132440-003

Inorganics - Soil



Precluding Conditions

Check for precluding conditions

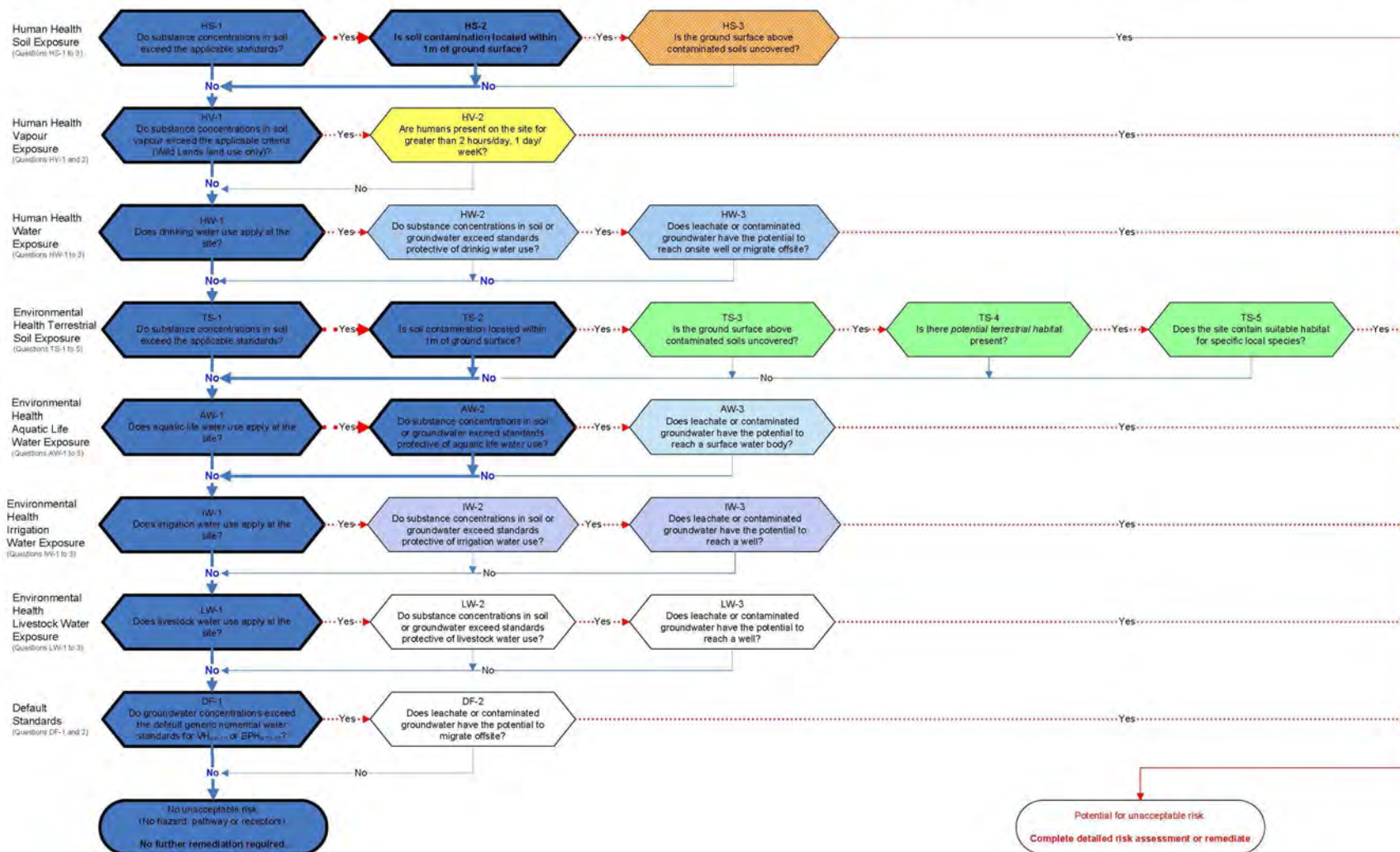
- ◆ Priority Site (OGC Site Classification Tool)
- ◆ AL landuse requires pre-approval of director



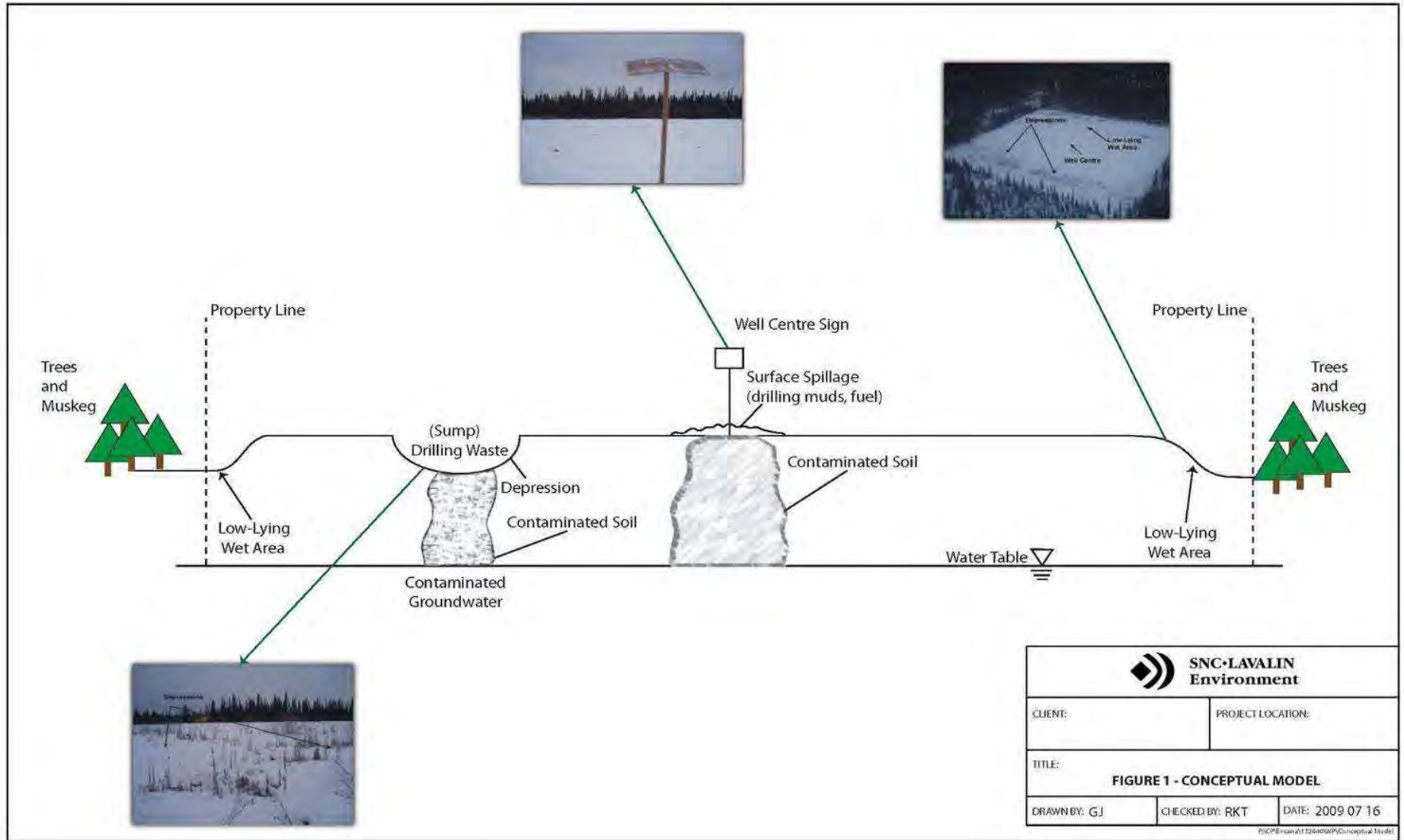
SLRA Flowsheet


FIGURE 1. Screening Level Risk Assessment Flowchart.

(Note: this flowchart is provided for illustrative purposes only. The questionnaire included in SLRA must be completed and takes precedence over this flowchart).



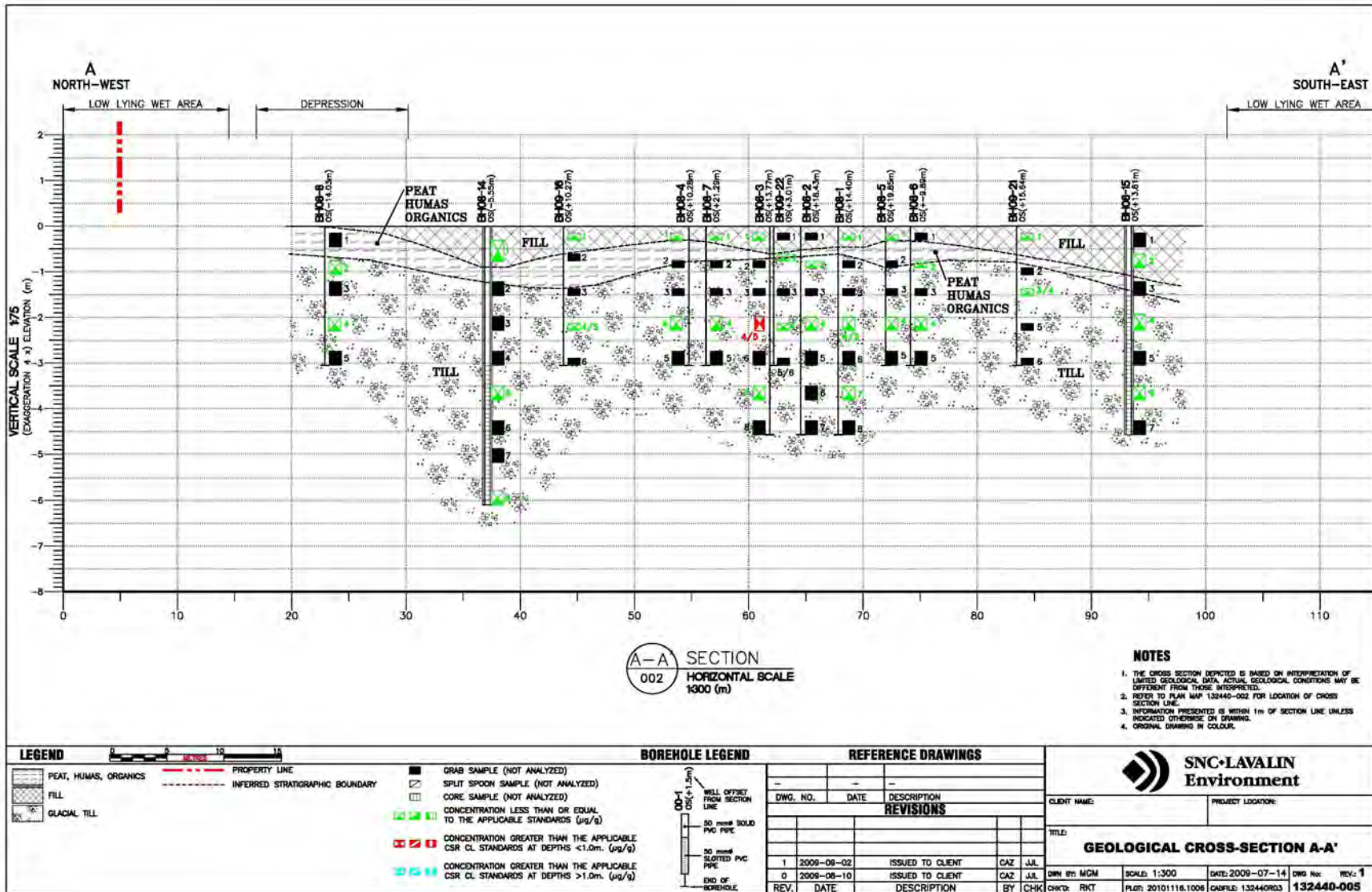
Conceptual Model



 SNC-LAVALIN Environment		
CLIENT:	PROJECT LOCATION:	
TITLE: FIGURE 1 - CONCEPTUAL MODEL		
DRAWN BY: GJ	CHECKED BY: RKT	DATE: 2009 07 16

P:\CP\Environ\11204000\PC\Conceptual Model

Cross-Sectional Representation



SLRA Reporting

- ◆ Background information including summary of previous reports
- ◆ SLRA questionnaire including supporting documents, cross-section(s), conceptual model
- ◆ Professional Statement, SLRA prepared in accordance with Protocol 13
- ◆ Approved Professional sign-off not required



Conclusion

Site passes SLRA and meets CSR risk based standards

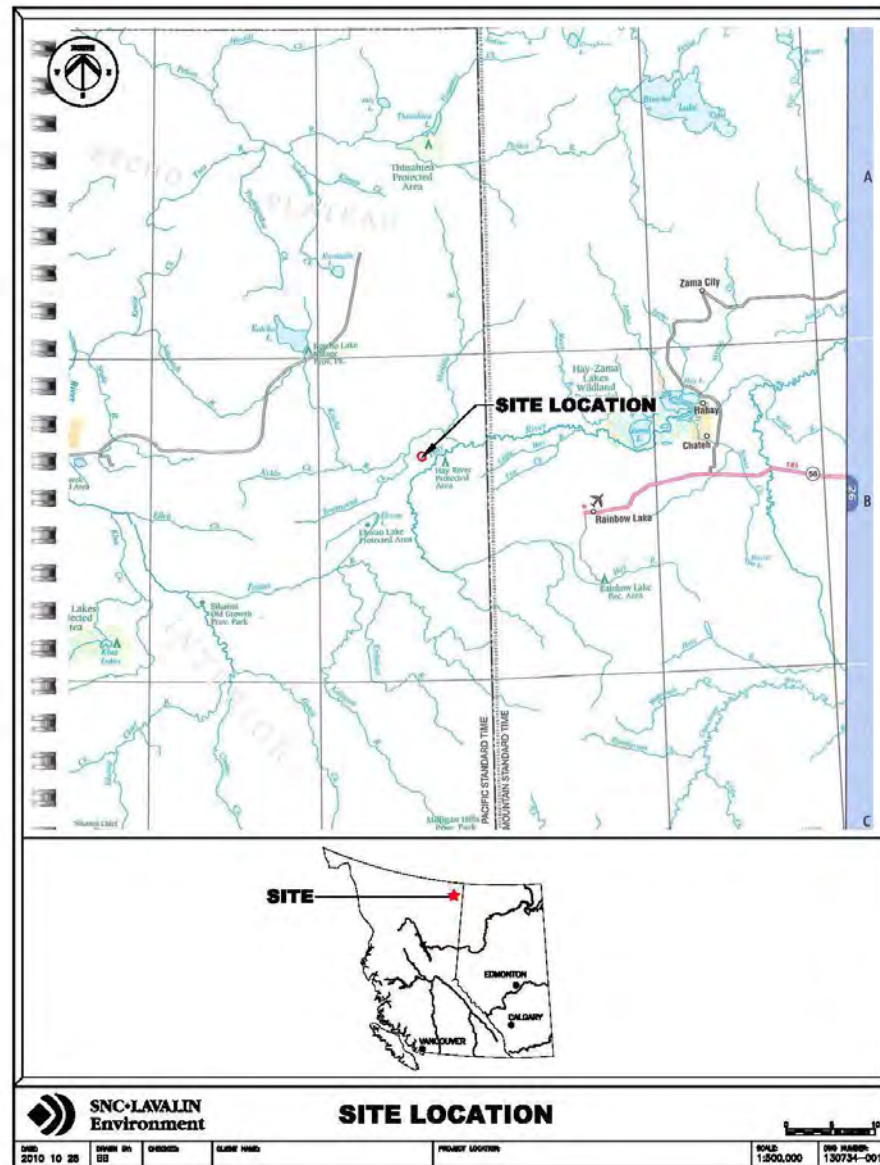


Case Study 2 (Hay Field)

- ◆ In progress
- ◆ Drilled and Abandoned (1996)
- ◆ Remote Sump
- ◆ Stream bisects lease
- ◆ No precluding conditions



Site Location

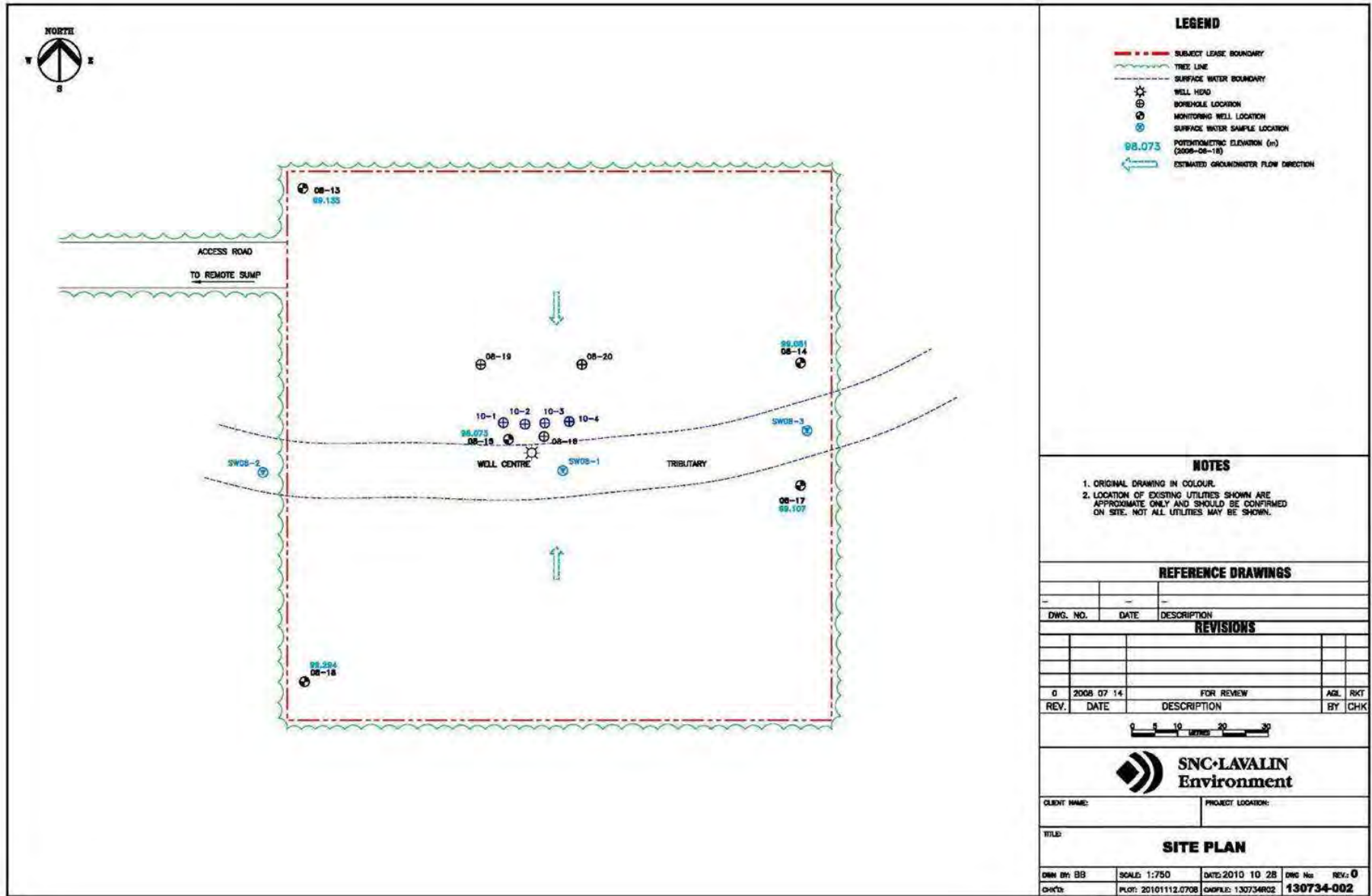


Sampling and Analysis Plan

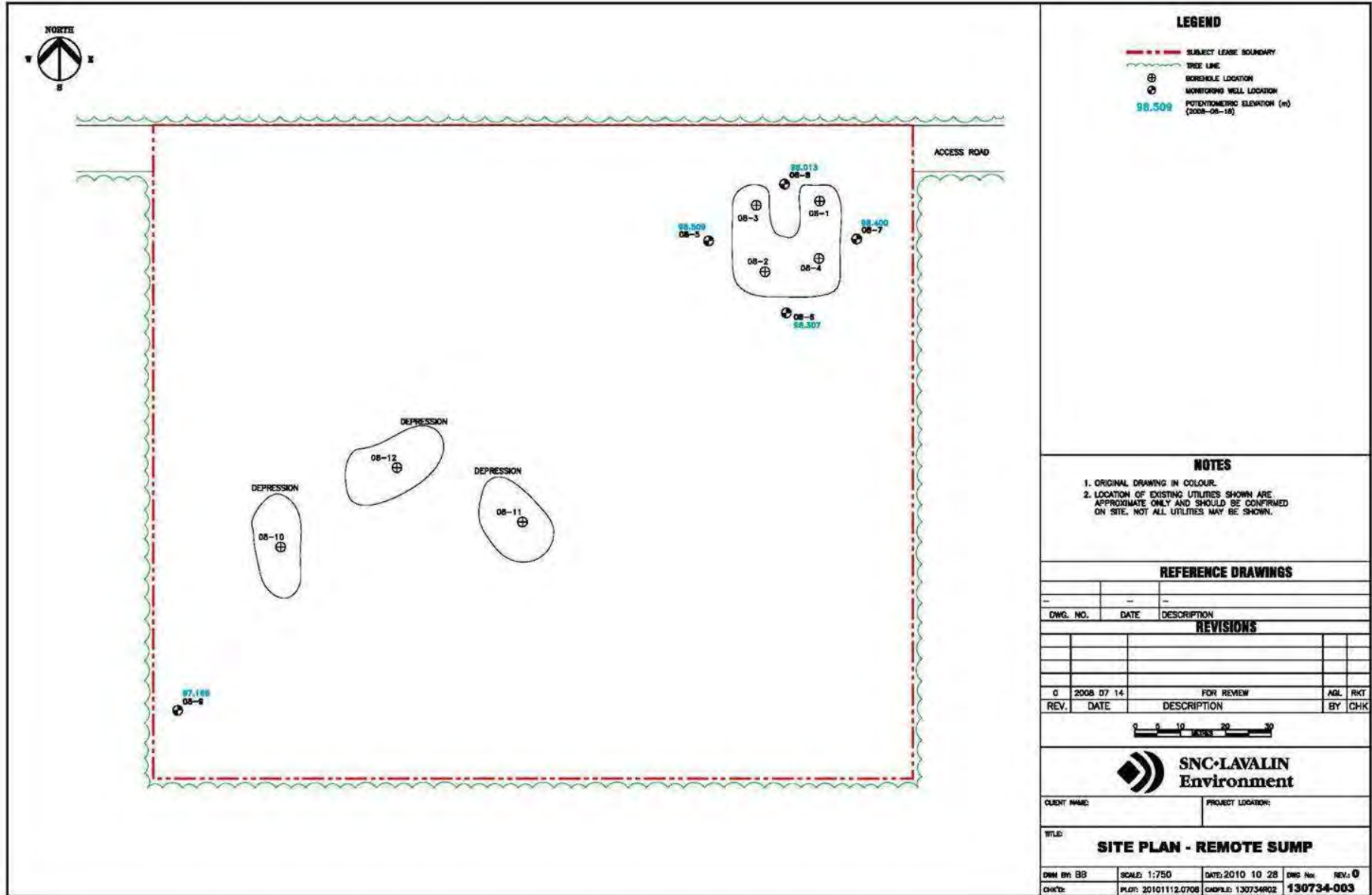
- ◆ 20 boreholes
- ◆ 11 monitoring wells
- ◆ Stream sampling
- ◆ Sediments?



Site Plan



Remote Sump



Results

- ◆ Barite Site
- ◆ GW at 1 to 3 m bgs, no GW CSR exceedances
- ◆ Soil CSR Standards
 - VPH, EPH (3.5 – 3.8 m) in sump
 - Chloride (6.6 – 6.9 m) in sump



Results

- ◆ **VPH, EPH**
 - partitioning equations
 - soil leachate, predicted GW concentration, predicted GW concentration at receptor
- ◆ **Chloride**
 - Leach tests



Conclusion

Anticipated that site will pass SLRA

