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**PHASE II ENVIRONMENTAL SITE ASSESSMENT**

**AGRICORE-UNITED FERTILIZER PLANT**  
**SE33-11-11W, R.M. OF NORTH NORFOLK, MANITOBA**

Submitted to:  
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## EXECUTIVE SUMMARY

AMEC Earth & Environmental Limited (AMEC) of Winnipeg, Manitoba was retained by Mr. Allan Merritt, General Manger of Portage La Prairie Consumers Co-operative Limited (Co-op) to conduct a Phase II Environmental Site Assessment (ESA) of the Agricore-United Fertilizer Plant at SE33-11-11W in the R.M. of North Norfolk, Manitoba. The purpose of the Phase II ESA was to determine the subsurface soil and groundwater conditions related to the existing fertilizer storage and handling operations at the site prior to the purchase of the site by Co-op.

On 16 July 2002, AMEC completed a total of six test holes at the site. The soil profile at the test hole locations, in descending order, generally consisted of granular and clay fill up to 0.8 m thick. A thin layer of organic clay was encountered below the fill zone followed by a fine grained silty sand to a depth of 1.4 to 1.8 m below grade. Underlying the silty sand was a silty clay that extended to the maximum test hole depth of 7.6 m below grade.

The field measured concentrations of nitrate in the soil ranged from 0 to 100 ppm with elevated levels measured in TH1, TH3, TH4 and TH5 as compared to the remaining samples. Laboratory analysis of samples TH3-3 at 1.5m and TH4-4 at 2.3 m indicated that elevated concentrations of nitrate-n (above Manitoba Agriculture guidelines) were present in the samples. As compared to the other samples analysed, sample TH4-4 at 2.3 m also appeared to have elevated levels of ammonia. TH1, TH4 and TH5 were located in the vicinity of the granular fertilizer operations along the east side of the site and TH3 was located adjacent to the anhydrous ammonia tank at the northwest corner of the site.

The water levels measured on 19 July 2002 ranged from 1.4 to 4.2 m below grade and indicated an inferred groundwater flow direction to the northeast; however, it is likely that the water levels had not yet fully stabilized at the time of monitoring. The field measured nitrate levels in groundwater ranged from 0 to 500 ppm with elevated levels measured in TH3, TH5 and TH6. The remaining sample (TH1) was expected to be near background levels. The analytical results of the groundwater testing indicated that concentrations of nitrate in TH3 and TH5 and nitrite in TH3 exceeded the applicable Canadian Council of Ministers of the Environment (CCME) guidelines. The remainder of the parameters had nutrient concentrations less than the applicable guidelines. TH3 and TH5 were located in the vicinity of the fertilizer operations and TH6 was located adjacent to the chemical shed.

Based on information provided by Manitoba Agriculture, the soil samples analysed for salinity were slightly alkaline and the majority of the water samples collected appeared to be slightly saline. The concentrations of manganese in all of the groundwater samples analysed, exceed the applicable CCME community water criteria. However, the remainder of the parameters tested for had concentrations less than the applicable guidelines.

A basic herbicide scan was conducted on one soil and one groundwater sample collected from TH6, which was located adjacent to the chemical shed. All of the constituents tested for had concentrations less than the applicable CCME criteria.



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## **1.0 INTRODUCTION**

AMEC Earth & Environmental Limited (AMEC) of Winnipeg, Manitoba was retained by Mr. Allan Merritt, General Manger of Portage La Prairie Consumers Co-operative Limited (Co-op) to conduct a Phase II Environmental Site Assessment (ESA) of the Agricore-United Fertilizer Plant at SE33-11-11W in the R.M. of North Norfolk, Manitoba. The subject property is subsequently referred to as the 'site' in this report. The location of the site is shown on Figure 1.

The purpose of the Phase II ESA was to determine the subsurface soil and groundwater conditions related to the existing fertilizer storage and handling operations at the site. The Phase II ESA was to be completed prior to the purchase of the site by Co-op.

## **2.0 SITE AND AREA HISTORY**

As part of the Phase II ESA, AMEC conducted a brief historical review of the site and surrounding properties. The historical review included a review of available Manitoba Conservation (the Provincial regulator) records and interviews. The site and surrounding properties are not listed on the Provincial petroleum storage tank list, the hazardous waste registrants list or on the impacted sites list. According to Co-op, the site was developed in the early 1990 with the existing fertilizer operations for Trans Canada Agro. The property was later purchased by Agricore (currently Agricore-United) and has remained relatively unchanged since that time.

Other than the adjacent roadways to the south and east, the neighboring properties have remained undeveloped agricultural land.

## **3.0 INVESTIGATIVE METHODOLOGY**

### **3.1 SURROUNDING LAND USE**

A visual survey of the surrounding land uses was conducted during the course of AMEC's site investigation. The purpose of the survey was to identify specific land uses (i.e. agricultural, residential, commercial or industrial) adjacent to the site in order to assess potential sensitivities to soil and groundwater impacts. The surrounding land uses are detailed in Table 1 and shown on Figure 2.

### **3.2 SERVICE LOCATIONS**

Prior to the start of the drilling program, Manitoba Telephone Systems, Manitoba Hydro, Centra Gas, and the R.M. of North Norfolk were contacted with respect to underground utility locations. Drilling locations were cleared by the various utility companies and B. Burton Enterprises Limited of Minnedosa, Manitoba provided located any private underground utilities located on-site.

### **3.3 DRILLING AND SAMPLING PROGRAM**

The test hole drilling program was conducted on 16 July 2002 and consisted of a total of six test holes (TH1 to TH6). The test holes were drilled to a depth of 4.6 to 7.6 m below grade with a

continuous flight auger rig using 125 mm solid stem augers. The drill rig was supplied and operated by Paddock Drilling Ltd. of Brandon, Manitoba. Ms. Megan Tucker of AMEC supervised the drilling program on a full time basis. Test hole locations were placed in areas most likely to be impacted at the site and are shown on Figure 4.

Soil samples were recovered from the auger cuttings during drilling near the ground surface and at approximately 0.8 m depth intervals. If required, additional soil samples were also obtained in zones of visual contamination and/or at stratigraphic changes. Disturbed soils from the outside of the cuttings were removed to minimize potential cross contamination. Soil samples were classified according to the Modified Unified Soil Classification system and observed for visual evidence of contamination. Soil samples were field screened for fertilizer and petroleum hydrocarbon (PHC) impacts.

Based on the results of the field screening and visual observations, select duplicate soil samples were obtained and placed in laboratory prepared sample jars and stored in an insulated cooler while on site and during transport to the laboratory. The field protocols and QA/QC procedures utilized by AMEC were in accordance with standard industry protocols.

The test holes were horizontally and vertically located in relation to a temporary benchmark with an assumed elevation of 100.00 m.

### **3.3.1 Field Screening**

Field screening for the presence of fertilizer impacts was conducted using E. M. Quant nitrate test strips and a portable electrical conductivity (EC) meter. Field screening for nutrients in water was accomplished by collecting groundwater samples from monitor wells installed in TH1, TH3, TH5 and TH6 on completion of drilling. After installation of the wells, clear groundwater samples (with the majority of the sediments settled out) were collected with a dedicated disposable bailer and placed in standard 125 ml laboratory prepared glass jars and tested at the site for nitrates and EC.

On completion of drilling, the duplicate soil samples were kept cool and transported to AMEC's Winnipeg soil laboratory. Select soil samples were then screened for nitrates and EC using E. M. Quant test strips and a portable EC meter. The screening was conducted by taking a equal measure (by weight) of the soil sample and distilled water and placing it in a standard 250 ml laboratory prepared soil jar. The solution was then agitated by hand with a stir stick or shaken until the majority of the soil sample was in solution. The solution was allowed to settle for 30 minutes and the extract was tested as with the groundwater samples. As the extract was relatively clear at the time of testing, the extract was not filtered.

It should be noted that the E. M. Quant test strips determine the concentration of nitrates in the sample by means of a colorimetric process. The strips also indicate whether nitrite was present in the sample by a positive / negative response. As the test strips convert all nitrate to nitrite in the colorimetric process, a positive nitrite response may lead to overestimation of nitrate levels.

All soil samples were also field screened for volatile hydrocarbon vapours using ambient temperature headspace (ATH) techniques and a hexane calibrated, GasTech combustible vapour analyzer set in the no methane response mode. The ATH method involved half filling and sealing a 3.0 litre plastic bag with soil and allowing the vapours to accumulate for about twenty minutes prior to analyzing the headspace. Accumulated vapours were measured in

parts per million (up to 600 ppm<sub>v</sub>) and/or percent lower explosive limit (% LEL; above 600 ppm<sub>v</sub>, or 5% LEL). The results of the hydrocarbon screening are shown on the appropriate test hole logs Figures 5 to 10.

### 3.4 MONITOR WELL INSTALLATIONS AND SAMPLING

As part of the Phase II ESA, monitor wells were installed in four of the six test holes (TH1, TH3, TH5 and TH6). The wells were installed in order to monitor subsurface vapour concentrations, establish the groundwater conditions at the site and allow for the future collection of groundwater samples. The monitor wells installed on 16 July 2002 were constructed with 50 mm diameter Schedule 40 PVC, number 10 slot well screen and 50 mm diameter Schedule 40 PVC solid riser pipe to the surface. Flush mount steel casings were installed over the wells for protection. The monitor well construction details are shown on the appropriate test hole logs on Figures 5 to 10.

Prior to leaving the site on 16 July 2002 and on 19 July 2002, AMEC conducted well monitoring. The site monitoring program included the following (in order):

- Determination of groundwater levels;
- Development and purging of all wells;
- Field measurement of nitrate concentrations and EC; and
- Collection of groundwater samples for possible laboratory analysis.

Nitrate and EC levels were measured using test strips by E. M. Quant and a portable EC meter as stated above. Groundwater levels were measured with an electronic interface probe. The monitor wells were developed and purged dry using dedicated equipment (PVC bailer or Waterra pump) in accordance with standard hydrogeological procedures. Groundwater samples were collected with dedicated PVC bailers and placed in clean certified bottles provided by the laboratory. Samples collected for confirmatory laboratory analysis were stored in an insulated cooler while on site and during transport to the laboratory. As with the soil sampling program the field protocols and QA/QC procedures utilized by AMEC during Site monitoring were in accordance with standard industry protocols.

### 3.5 ASSESSMENT CRITERIA

Manitoba Conservation, the Provincial regulatory body, currently references the environmental assessment criteria as outlined in the following document produced by the Canadian Council of Ministers of the Environment (CCME):

- CCME. 1999. Canadian Environmental Quality Guidelines (EQGs).

Based on the current CCME documents and Manitoba Conservation's (formerly Manitoba Environment) 1993 document "*A Guideline for the Environmental Investigation and Remediation of Petroleum Storage Sites in Manitoba*", AMEC carried out a modified Tier II assessment of the Site, which involved an evaluation of the applicable exposure pathways based on AMEC's sensitivity assessment of the Site and an evaluation of the predominant soil texture at the site. The modified Tier II assessment did not include the modification or recalculation of the formulas used to derive the criteria values. A copy of the assessment is provided in Appendix A.

Based on AMEC's review, the site and neighboring properties have a high sensitivity ranking for groundwater, given the subsurface conditions and that near surface groundwater is used for domestic purposes. As indicated in Section 4.3, the area of the site is identified as a hazard area on the Provincial groundwater pollution hazard maps. A review of Provincial water well records indicate there are numerous wells located within 2.0 km of the site including those located in the Town of Austin (located about 1.6 km southwest) and a domestic well located on the site. Based on the above and as outlined in section one of the site sensitivity assessment, in Appendix B, AMEC has chosen the CCME generic groundwater criteria for a community (potable) water supply as the applicable groundwater criteria for the site.

There are currently no CCME guidelines for nutrients in soil. Given that a major concern with excessive nitrogen levels in the soil is leaching and affecting potentially potable groundwater sources, Manitoba Agriculture and Food provides good practice guidelines for nitrate (which reduces to the more toxic nitrite) to minimize the possibility of nitrate leaching. Therefore, AMEC has utilized the guidelines as stated in Table F, Monitoring Soil Nitrate of the Manitoba Agriculture and Foods 1994 document "Farm Practice Guidelines" for reference purposes.

Grain size analysis was conducted at AMEC's Winnipeg materials laboratory on a representative sample collected during the field investigation to determine soil grain size designation. Based on the sieve analysis, sample TH5-3 at 1.5 m was analysed to have 28.3% passing the 0.075 mm sieve. On this basis, the sample is considered to be coarse grained according to CCME guidelines. Given the subsurface conditions identified at the site, the coarse grained soil texture is expected to be dominant soil classification.

### **3.6 LABORATORY ANALYSIS**

Four soil and four groundwater samples were submitted for confirmatory laboratory analysis at EnviroTest Laboratories in Winnipeg, Manitoba. The soil and water samples submitted to the laboratory for analysis were based on an evaluation of the subsurface conditions, location, depth and soil type. As nutrients were suspected as a potential source of contamination; the soil and water laboratory analysis program was developed to include the analyses of nitrate-N, nitrite-N, total Kjeldhal nitrogen (TKN), ammonia-N, total phosphorous and salinity. As agricultural chemicals were also stored / handled at the site, one soil and one groundwater samples were also analysed for a general herbicide scan.

EnviroTest's Winnipeg laboratory is certified with the Canadian Association of Environmental Analytical Laboratories (CAEAL). The laboratory QA/QC is provided in Appendix B along with the certificates of analyses.

## **4.0 ASSESSMENT RESULTS**

### **4.1 SITE AND AREA DESCRIPTION**

#### **4.1.1 Site and Surrounding Land Use**

The surrounding land uses observed at the time of the test drilling program are summarized in Table 1.

TABLE 1: SURROUNDING LAND USE		
Direction	Land Use	Distance (m)
Site	Industrial (bulk fertilizer plant and chemical storage)	--
North	Undeveloped agricultural land	Adjacent
South	Public roadway (gravel access road followed by Hwy. No. 1)	Adjacent
East	Municipal road followed by undeveloped agricultural	Adjacent / 20
West	Undeveloped agricultural land	Adjacent

#### 4.1.2 Site Description

The site was located at the southwest corner of Highway No.1 and a municipal grid road approximately 1.6 km east of Austin, Manitoba in the R.M. of North Norfolk. At the time of the Phase II ESA, the site was developed with a fertilizer bulk plant and agricultural chemical supply operation. The site was occupied with an office building at the north end, granular fertilizer storage and handling operations along the east side and northwest corner, anhydrous ammonia storage at the northwest corner and a chemical storage shed along the west side. The site was relatively flat lying and largely surfaced with granular fill. The site appeared relatively well maintained and no surficial soil staining was evident. A small quantity of granular fertilizer was noted on the loading pad near the blender unit located along the east side of the site. Site details and photographs are shown on Figures 2 and 3, respectively.

#### 4.1.3 Service Locations

Underground utilities identified on-site included a water well and septic tank, private electrical and communications services as shown on Figure 4. A groundwater well was present along the south side of the office building and a septic holding tank was located along the west side. Underground communications and private electrical lines were located between the chemical shed and the office building and private electrical also extended to the control building along the east side of the site. Hydro was primarily supplied to the site via overhead lines.

### 4.2 SOIL CONDITIONS

#### 4.2.1 Local Geology

Based on available geological maps (*Groundwater Availability Map Series*, Manitoba Natural Resources, Water Resources Division, 1985) and Manitoba Conservation water well records, the surficial soils in this area of Manitoba normally consist of surficial lacustrine deposits of clay, silt and sand to depths of up to 30 m below grade. The underlying bedrock is of the Boissevain and Riding Mountain Formations and consists of a combination of grey, soft shale and hard, fractured black shale.

#### 4.2.2 Stratigraphy

The soil profile at the test hole locations, in descending order, generally consisted of granular and clay fill up to 0.8 m thick. A thin layer of organic clay was encountered below the fill zone followed by a fine grained silty sand to a depth of 1.4 to 1.8 m below grade. Underlying the silty sand was a silty clay that extended to the maximum test hole depth of 7.6 m below grade. The subsurface soil stratigraphy encountered at the test hole locations is summarized in detail on the test hole logs on Figures 5 to 10.

#### 4.2.3 Field Observations and Fertilizer Screening Results

Field observations and fertilizer field screening results from the 16 July 2002 field investigation are summarized in Table 2. The results of the hydrocarbon screening are shown on the test hole logs Figures 5 to 10.

TABLE 2: FIELD OBSERVATIONS AND FERTILIZER SCREENING RESULTS - SOIL						
Test Hole No.	Test Hole Depth (m)	Soil Staining Zone (m)	Sample Location	Field EC (mS)	Field Nitrate (ppm)	Nitrite Present (Y / N)
TH1	4.6	None	TH1-1 @ 0.3m	0.30	25	N
			TH1-2 @ 0.8m	0.20	0	N
			TH1-3 @ 1.5m	0.40	50	N
			TH1-4 @ 2.3m	0.30	Undetermined	N
TH2	7.6	None	TH2-1 @ 0.3m	1.70	0	N
			TH2-3 @ 1.5m	0.20	Undetermined	N
			TH2-4 @ 2.3m	0.20	Undetermined	N
			TH2-5 @ 3.0m	0.10	0-5	N
TH3	4.6	None	TH3-1 @ 0.3m	0.20	10	N
			TH3-2 @ 0.8m	0.20	0	N
			TH3-3 @ 1.5m	0.40	100	Y
TH4	4.6	None	TH4-1 @ 0.3m	0.30	25	N
			TH4-2 @ 0.8m	0.30	50	N
			TH4-3 @ 1.5m	0.40	50	N
			TH4-4 @ 2.3m	0.20	100	Y
TH5	4.6	None	TH5-1 @ 0.3m	0.30	25	N
			TH5-2 @ 0.8m	0.30	25	N
			TH5-3 @ 1.5m	0.40	25	N
TH6	4.6	None	TH6-1 @ 0.3m	0.20	0	N
			TH6-2 @ 0.8m	0.20	0	N
			TH6-3 @ 1.5m	0.20	0	N
			TH6-4 @ 2.3m	0.30	0	N

Notes:

- EC – electrical conductivity using ECTester (high) by Oakton Instruments.
- Field nitrate and presence of nitrite test carried out as per Section 2.3.1 using nitrate test strips by E. M. Quant.
- Headspace vapour concentrations measured with a GasTech combustible vapour analyzer, calibrated to hexane with methane exclusion.
- ppm<sub>v</sub> - parts per million total organic vapour

As indicated in Table 2, the field measured concentrations of nitrate in the soil ranged from 0 to 100 ppm with elevated levels of nitrate-N measured in TH1, TH3, TH4 and TH5, as compared

to the remaining samples. Based on the field measurements, TH4 appeared to have the most extensive impacts. TH1, TH4 and TH5 were located in the vicinity of the granular fertilizer operations along the east side of the site and TH3 was located adjacent to the anhydrous ammonia tank at the northwest corner of the site. The test hole locations are shown on Figure 4.

#### 4.2.4 Laboratory Results

Based on the field test results and field observations, a total of four soil samples were submitted for laboratory analysis and are summarized in Tables 3 to 5. Copies of the detailed analytical reports are provided in Appendix B.

Sample Location	EC Lab / (Field) (mS)	Field Nitrate	Nitrate-N	Nitrite-N	TKN (%)	Ammonia-N	Total Phosphorous
TH2-1 @ 0.3m	3.81 (1.70)	0-10	1.4	0.23	0.12	17.3	506
TH3-3 @ 1.5m	1.27 (0.40)	100	<b>34.4</b>	0.84	<0.03	1.3	531
TH4-4 @ 2.3m	0.86 (0.20)	100	<b>23.4</b>	1.82	0.03	1440	577
Manitoba Agriculture FPG	No Guideline	75 ( $\leq$ 1.2m below grade) 10 (1.2 – 3.6m below grade)		No Guideline			
CCME Industrial EQG	4	No Guideline					

Notes:

- All concentrations in micrograms per gram (ug/g) unless otherwise stated
- EC – electrical conductivity. Field result shown in brackets and carried out as per Section 2.3.1 using ECTester (high) by Oakton Instruments.
- Field nitrate test carried out as per Section 2.3.1 using nitrate test strips by E. M. Quant.
- < - less than the analytical detection limit
- NT – not tested
- Manitoba Agriculture FPG – good practice guideline for nitrate at various depth ranges as outlined in Appendix F of Manitoba Agriculture's "Farm Practice Guidelines," 1994.
- CCME EQG Criteria - applicable land use criteria for future land use as outlined in the Canadian Council of the Ministers of the Environment (CCME) "Canadian Environmental Quality Guidelines", 1999. EC values taken from Section 7, Table 2 of the 1999 CCME EQGs. Values represent 1991 CCME interim values reproduced in the 1999 CCME EQGs.
- See laboratory report for detection limits, testing protocols and QA/QC procedures. Laboratory analysis was performed by AMEC's Edmonton Laboratory.

The laboratory results indicate that elevated concentrations of nitrate-n (above applicable guidelines) were noted in samples TH3-3 at 1.5m and TH4-4 at 2.3 m. As compared to the other samples analysed, sample TH4-4 at 2.3 m also appeared to have elevated levels of ammonia. TH3 was located in the vicinity of the anhydrous ammonia tank and TH4 was located at the north end of the granular fertilizer operations along the east side of the site.

Sample Location	EC Lab / (Field) (mS)	Calcium	Magnesium	Potassium	Sodium	Sodium Adsorption Ratio	pH @25° C
TH2-1 @ 0.3m	3.81 (1.70)	410	325	16.0	152.0	1.4	7.91
TH3-3 @ 1.5m	1.27 (0.40)	97.1	65.7	5.0	41.1	0.79	7.94
TH4-4 @ 2.3m	0.86 (0.20)	91.7	32.9	4.8	11.1	0.25	7.76
CCME Industrial EQG	4	No Guideline			12	6-8	

Notes:

- All concentrations in micrograms per gram (ug/g) unless otherwise stated
- EC – electrical conductivity. Field result shown in brackets and carried out as per Section 2.3.1 using ECTester (high) by Oakton Instruments.
- < - less than the analytical detection limit
- CCME EQG Criteria - applicable land use criteria for future land use as outlined in the Canadian Council of the Ministers of the Environment (CCME) "*Canadian Environmental Quality Guidelines*", 1999. Values taken from Section 7, Table 2 of the 1999 CCME EQGs. Values represent 1991 CCME interim values reproduced in the 1999 CCME EQGs.
- See laboratory report for detection limits, testing protocols and QA/QC procedures. Laboratory analysis was performed by AMEC's Edmonton Laboratory.

None of the parameters analysed had concentrations exceeding the applicable CCME industrial guidelines. Based on information provided by Manitoba Agriculture, the above soil samples were slightly alkaline.

Parameter	Results	CCME Industrial EQG
	TH6-2 @ 0.8m	
2, 4-D	<0.01	NG
Bromoxynil	<0.01	NG
Dicamba	<0.01	NG
Diclofop-Methyl	<0.01	NG
MCPA	<0.01	NG
Picloram	<0.01	NG
Triallate	<0.01	NG
Trifluralin	<0.01	NG

Notes:

- All concentrations in micrograms per gram (ug/g) unless otherwise stated
- NG – No CCME guideline available
- < - less than the analytical detection limit
- CCME EQG Criteria - applicable land use criteria for future land use as outlined in the Canadian Council of the Ministers of the Environment (CCME) "*Canadian Environmental Quality Guidelines*", 1999.
- See laboratory report for detection limits, testing protocols and QA/QC procedures. Laboratory analysis was performed by AMEC's Edmonton Laboratory.

The concentration of the above listed herbicide constituents were less than the laboratory's analytical detection limits. There are currently no CCME criteria for herbicides in soil.

### 4.3 GROUNDWATER CONDITIONS

#### 4.3.1 Regional Hydrogeology

According to geological maps and water well records provided by the Water Resources Branch of Manitoba Conservation, potable groundwater in the area surrounding the site, is typically drawn from the near surface sand and gravel deposits at depths less than 30 m below grade. A search of available water well records indicated that there are numerous domestic wells located within 2.0 km of the site including those located in the Town of Austin (located about 1.6 km southwest) and a domestic well located on the site. Water well records indicate the on-site well (located south of the site office) has a depth of 24 m below grade and draws water from the underlying sands and sandy / silty clays. The site is located in a groundwater pollution area as indicated on the Department of Mines, Resources and Environmental Management's Ground Water Pollution Hazard Map (Province of Manitoba, 1978), due to the near surface deposits of sands and gravels which are capable of producing potable water.

#### 4.3.2 Site Hydrogeology

The results of the site monitoring, conducted on 16 and 19 July 2002, are summarized in Table 6.

Test Hole No.	Test Hole Depth (m)	Ground Elevation (m)	Screen Interval (m)	Groundwater Depth (m)		Groundwater Elevation (m)	
				16 July 2002	19 July 2002	16 July 2002	19 July 2002
				TH1	4.6	99.75	0.8-4.6
TH3	4.6	99.60	0.8-4.6	1.59	1.61	98.01	97.99
TH5	6.1	99.43	0.8-4.6	2.25	1.43	97.18	98.00
TH6	6.1	99.77	0.8-4.6	3.99	1.82	95.78	97.95

Notes:

- Elevation relative to temporary benchmark with an assumed elevation of 100.00 m.

The water levels on the completion of drilling on 16 July 2002 ranged from 1.6 to 4.0 m below grade in TH3, TH5 and TH6 and TH1 was dry. The water levels on 19 July 2002 ranged from 1.4 to 4.2 m below grade. Based on the 19 July 2002 monitoring event, the inferred groundwater flow direction is to the northeast; however, it is likely that the water levels had not yet fully stabilized at the time of monitoring.

#### 4.3.3 Field Observations and Fertilizer Screening Results

Field observations and screening results for water from the 19 July 2002 monitoring event are summarized in Table 7.

TABLE 7: FIELD OBSERVATIONS AND FERTILIZER SCREENING RESULTS – GROUNDWATER			
Test Hole No.	Field EC (Ms)	Field Nitrate <sup>1</sup> Level	Nitrite Present (Y/N) <sup>2</sup>
	Monitoring date: 19 July 2002		
TH1	1.00	0-10	N
TH3	NM	250-500	Y
TH5	NM	50-100	N
TH6	NM	10-25	Y
CCME EQG for a Community Water Supply		10	3.2

Notes:

- All concentrations in parts per million (ppm) unless otherwise stated.
- EC – electrical conductivity. Field result shown in brackets and carried out as per Section 3.3.1 using ECTester (high) by Oakton Instruments.
- Field nitrate test carried out as per Section 2.3.1 using nitrate test strips by E. M.
- <sup>1</sup> – measured as nitrate nitrogen (sum of nitrate and nitrite concentrations).
- <sup>2</sup> – indicates presence of nitrite in sample which may affect nitrate concentration
- < - less than the analytical detection limit
- NM – not measured
- CCME EQG Criteria - criteria for a community water supply (drinking water) as outlined in Section 2, Table 2, of the Canadian Council of the Ministers of the Environment (CCME) “*Canadian Environmental Quality Guidelines*”, 1999.

As indicated in Table 7, the field measured groundwater nitrate levels ranged from 0 to 500 ppm with elevated levels present in TH3, TH5 and TH6. The remaining sample (TH1) is expected to be near background levels. TH3 and TH5 were located in the vicinity of the fertilizer operations and TH6 was located adjacent to the chemical shed.

#### 4.3.4 Laboratory Results

A total of four groundwater samples were submitted for nutrient analysis and one sample was submitted for a analysis of herbicides. The results of the confirmatory laboratory analysis conducted on the selected groundwater samples are summarized in Table 8 to 10. Copies of the detailed analytical reports are provided in Appendix B.

Sample No.	EC Lab /(Field) (mS)	Field Nitrate 19 July 2002	Nitrate-N	Nitrite-N	TKN	Ammonia-N	Total Phosphorous
TH1	1.56 (1.00)	0-10	1.73	0.08	0.7	0.32	0.224
TH3	5.19 (NM)	250-500	<b>389</b>	<b>27.6</b>	<0.2	0.05	0.202
TH5	2.38 (NM)	50-100	<b>56.8</b>	0.02	<0.2	0.03	0.166
TH6	1.80 (NM)	10-25	2.87	0.92	0.4	0.05	0.221
CCME EQG for a Community Water Supply		10		3.2	No Guideline		

Notes:

- All concentrations in milligrams per liter (mg/L) or parts per million (ppm) unless otherwise stated
- EC – electrical conductivity. Field result shown in brackets and carried out as per Section 2.3.1 using ECTester (high) by Oakton Instruments.
- NM – Not measured
- Field nitrate test carried out as per Section 2.3.1 using nitrate test strips by E. M. Quant
- < - less than the analytical detection limit
- CCME EQG Criteria - criteria for a community water supply (drinking water) as outlined in Section 2, Table 2, of the Canadian Council of the Ministers of the Environment (CCME) "*Canadian Environmental Quality Guidelines*", 1999.
- See laboratory report for detection limits, testing protocols and QA/QC procedures. Laboratory analysis was performed by AMEC's Edmonton Laboratory.

The analytical results indicate that the concentrations of nitrate in TH3 and TH5 and nitrite in TH3 exceeded the applicable guidelines. The remainder of the parameters had concentrations less than the applicable guidelines. TH3 was located in the vicinity of the anhydrous ammonia tank and TH5 was located along the west side of the site in the granular fertilizer off-lad area.

Sample No.	EC Lab /(Field) (mS)	Calcium	Magnesium	Potassium	Manganese	Sodium	Chloride	Sulphate	PH @25° C
TH1	1.56 (1.00)	156	97.9	8.6	<b>0.399</b>	33.6	10	475	8.00
TH3	5.19 (NM)	432	223	2.1	<b>0.110</b>	43.7	12	389	6.98
TH5	2.38 (NM)	204	98.3	2.9	<b>0.061</b>	37.0	73	401	7.46
TH6	1.80 (NM)	117	62.3	2.4	<b>0.057</b>	25.9	13	356	7.53
CCME EQG for a Community Water Supply		No Guideline			≤0.05 <sup>AO</sup>	≤200 <sup>AO</sup>	≤250 <sup>AO</sup>	≤500 <sup>AO</sup>	6.5-8.5 <sup>AO</sup>

Notes:

- All concentrations in milligrams per liter (mg/L) or parts per million (ppm) unless otherwise stated
- EC – electrical conductivity. Field result shown in brackets and carried out as per Section 3.3.1 using ECTester (high) by Oakton Instruments. 19 July 2002 field data shown.
- < - less than the analytical detection limit
- <sup>AO</sup> – aesthetic objective – value indicates an aesthetic objective only which are less than those considered to constitute a human health concern. No human health values have been derived for these parameters.
- CCME EQG Criteria - criteria for a community water supply (drinking water) as outlined in Section 2, Table 2, of the Canadian Council of the Ministers of the Environment (CCME) "*Canadian Environmental Quality Guidelines*", 1999.
- See laboratory report for detection limits, testing protocols and QA/QC procedures. Laboratory analysis was performed by AMEC's Edmonton Laboratory.

Based on the above laboratory results, the majority of the water samples collected appear to be slightly saline. The concentrations of manganese in all of the samples analysed exceed the applicable criteria.

TABLE 10: GROUNDWATER LABORATORY RESULTS – HERBICIDES		
Parameter	Results	CCME EQG for a Community Water Supply
	TH6	
2, 4-D	<0.05	100
Bromoxynil	<0.02	0.005
Dicamba	<0.02	120
Diclofop	0.5	NG
MCPA	<0.05	NG
Picloram	<0.2	190
Triate	<0.2	NG
Trifluralin	0.24	45

Notes:

- All concentrations in milligrams per liter (ug/L) or parts per billion (ppm) unless otherwise stated
- < - less than the analytical detection limit
- CCME EQG Criteria - criteria for a community water supply (drinking water) as outlined in Section 2, Table 2, of the Canadian Council of the Ministers of the Environment (CCME) "Canadian Environmental Quality Guidelines", 1999.
- See laboratory report for detection limits, testing protocols and QA/QC procedures. Laboratory analysis was performed by AMEC's Edmonton Laboratory.

The concentration of the above listed herbicide constituents were less than the applicable CCME criteria. Concentrations of Diclofop and Trifluralin above the laboratory's method detection limit were present in the sample. The remainder of the constituents tested for had concentrations less than the laboratory's analytical detection limits.

## 5.0 SUMMARY

The soil profile at the test hole locations, in descending order, generally consisted of granular and clay fill up to 0.8 m thick. A thin layer of organic clay was encountered below the fill zone followed by a fine grained silty sand to a depth of 1.4 to 1.8 m below grade. Underlying the silty sand was a silty clay that extended to the maximum test hole depth of 7.6 m below grade.

The field measured concentrations of nitrate in the soil ranged from 0 to 100 ppm with elevated levels measured in TH1, TH3, TH4 and TH5 as compared to the remaining samples. Laboratory analysis of samples TH3-3 at 1.5m and TH4-4 at 2.3 m indicated that elevated concentrations of nitrate-n (above Manitoba Agriculture guidelines) were present in the samples. As compared to the other samples analysed, sample TH4-4 at 2.3 m also appeared to have elevated levels of ammonia. TH1, TH4 and TH5 were located in the vicinity of the granular fertilizer operations along the east side of the site and TH3 was located adjacent to the anhydrous ammonia tank at the northwest corner of the site.

The water levels measured on 19 July 2002 ranged from 1.4 to 4.2 m below grade and indicated an inferred groundwater flow direction to the northeast; however, it is likely that the water levels had not yet fully stabilized at the time of monitoring. The field measured nitrate levels in groundwater ranged from 0 to 500 ppm with elevated levels measured in TH3, TH5 and TH6. The remaining sample (TH1) was expected to be near background levels. The analytical results of the groundwater testing indicated that concentrations of nitrate in TH3 and TH5 and nitrite in TH3 exceeded the applicable guidelines. The remainder of the parameters had nutrient concentrations less than the applicable guidelines. TH3 and TH5 were located in the vicinity of the fertilizer operations and TH6 was located adjacent to the chemical shed.

Based on information provided by Manitoba Agriculture, the soil samples analysed for salinity were slightly alkaline and the majority of the water samples collected appeared to be slightly saline. The concentrations of manganese in all of the groundwater samples analysed, exceed the applicable CCME community water criteria. However, the remainder of the parameters tested for had concentrations less than the applicable guidelines.

A basic herbicide scan was conducted on one soil and one groundwater sample collected from TH6, which was located adjacent to the chemical shed. All of the constituents tested for had concentrations less than the applicable CCME criteria.

## 6.0 CLOSURE

The American Society for Testing and Materials Standard of Practice notes that no environmental site assessment can wholly eliminate uncertainty regarding the potential for recognized environmental conditions in the connection with a property. Performance of a standardized environmental site assessment protocol is intended to reduce, but not eliminate, uncertainty regarding the potential for recognized environmental conditions in connection with the property, given reasonable limits of time and costs. The findings of this investigation are based on the interpretation of data from a limited number of test holes and analytical results pertaining to specific samples. The evaluation and interpretations do not preclude the existence of chemical substances other than those identified herein, or the possibility that contamination levels can vary between the areas of the investigation.

This report has been prepared for the exclusive use of the Portage La Prairie Consumers Co-operative Limited and their agents for specific application to the property identified in this report. The environmental assessment was conducted in accordance with generally accepted assessment practices. No other warranty, expressed or implied, is made. The general conditions of this report are specified in Appendix C.

We trust that this report meets your present requirements. If you have any questions or if we can be of further assistance, please contact our office.

Respectively submitted,

**AMEC Earth & Environmental Limited**



Patrick Campbell, B.Sc. (E.Sc.)  
Environmental Scientist  
E-mail: patrick.campbell@amec.com

Reviewed by:

Mark Humbert, P. Eng.  
Manager, Saskatoon Operations

PC/pc

Dist: (2) Addressee  
(1) Mr. Trevor Carlson, FCL Saskatoon

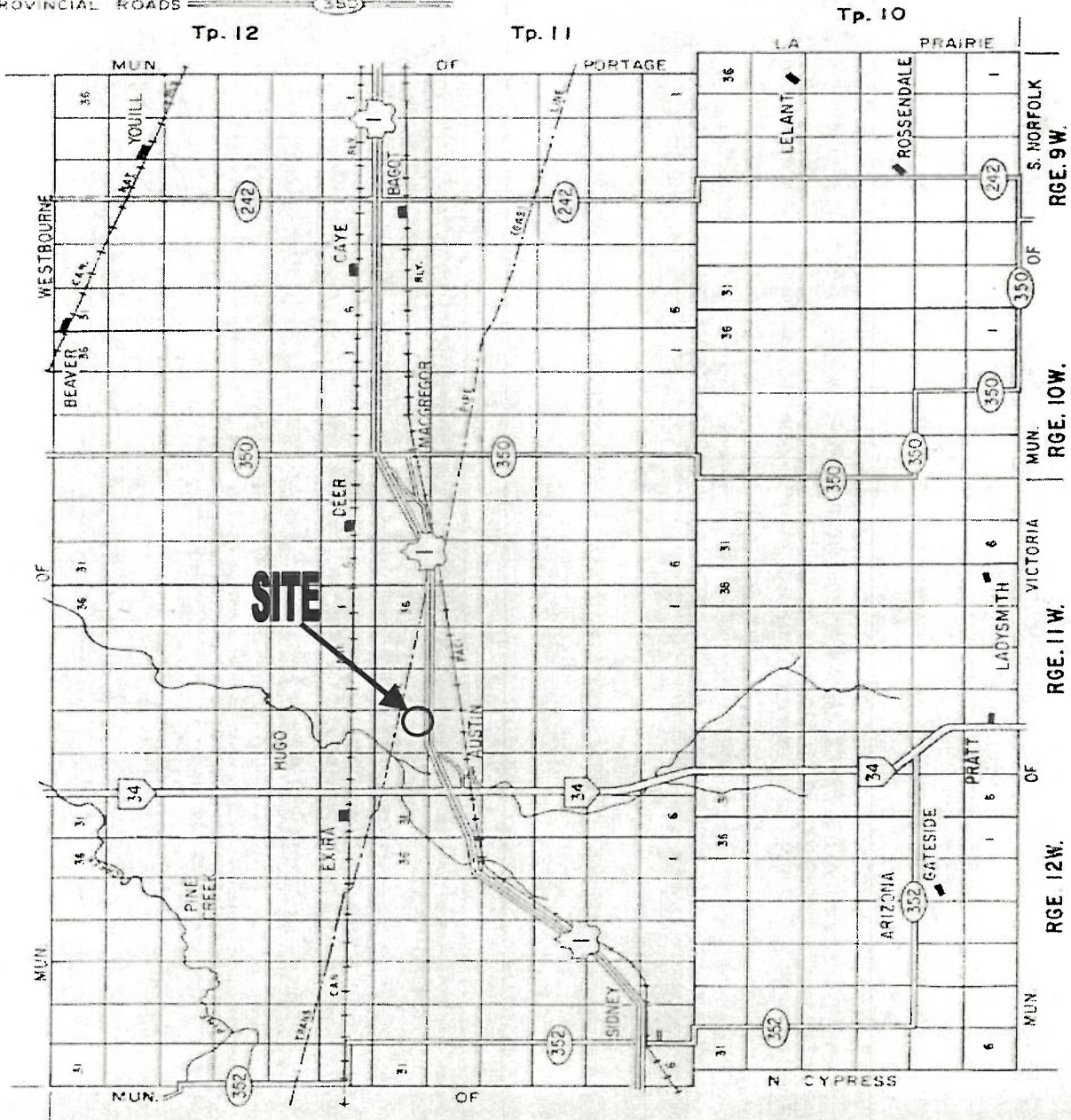
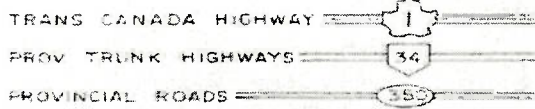
## FIGURES

# MUN. OF NORTH NORFOLK

Nº62

REVISED - 1986  
SEPT 1987  
JAN 1992

PROVINCE OF MANITOBA  
DEPARTMENT OF TRANSPORTATION  
DESIGN OFFICE  
WPG. JAN 1969  
SCALE: 1 in = 3 mi.



Earth & Environmental Limited

PORTAGE LA PRAIRIE CONSUMERS CO-OP

KEY PLAN  
PHASE II ENVIRONMENTAL SITE ASSESSMENT  
SE 33-11-11W  
RM OF NORTH NORFOLK, MANITOBA

Drawn: N/A

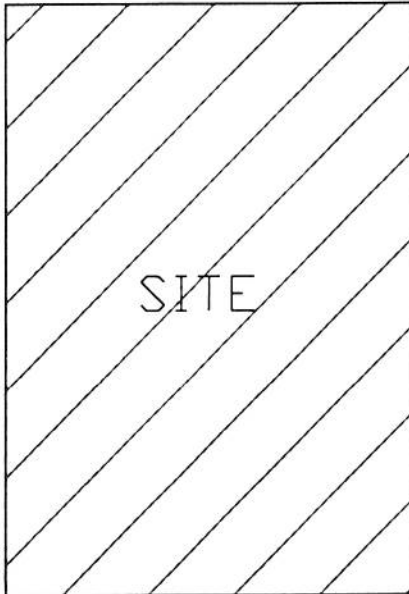
Scale: As Shown

Date: AUG/02

Project No.: WX05476

Figure: 1

UNDEVELOPED AGRICULTURAL



DITCH

GRAVEL ACCESS ROAD

UNDEVELOPED AGRICULTURAL



DITCH

GRAVEL ACCESS ROAD

DITCH

HWY #1

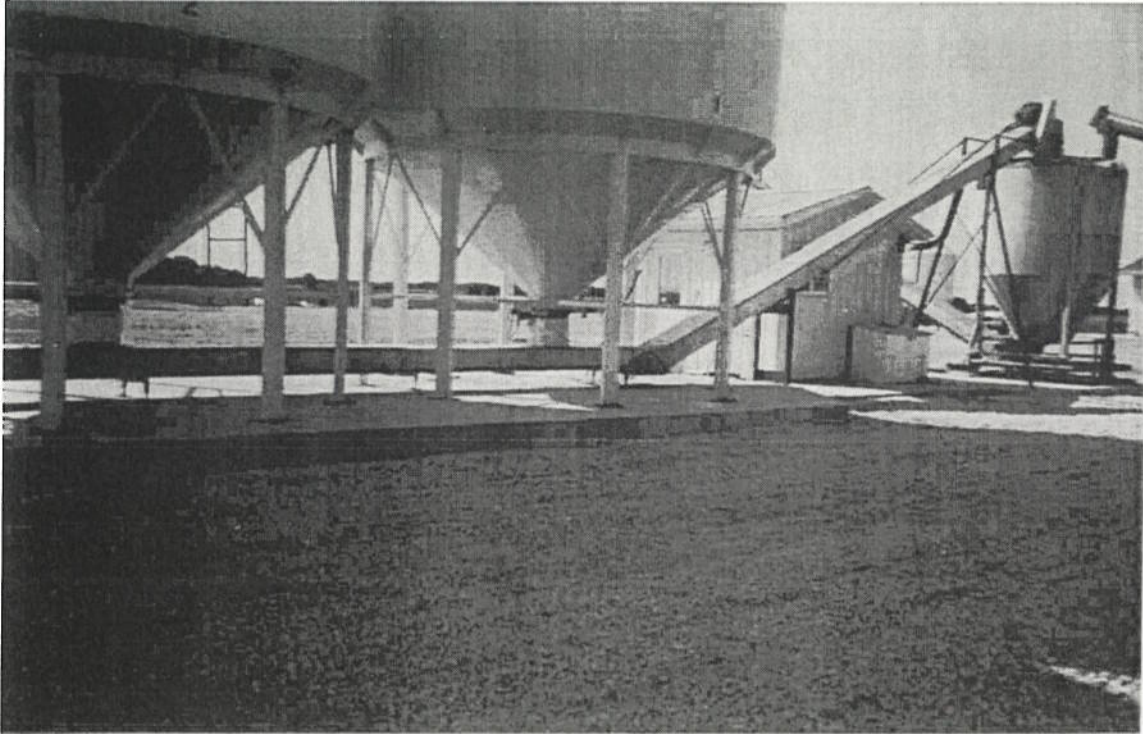


PHASE II ESA  
SURROUNDING LAND USE PLAN  
SE 33-11-11W  
RM OF NORTH NORFOLK, MB

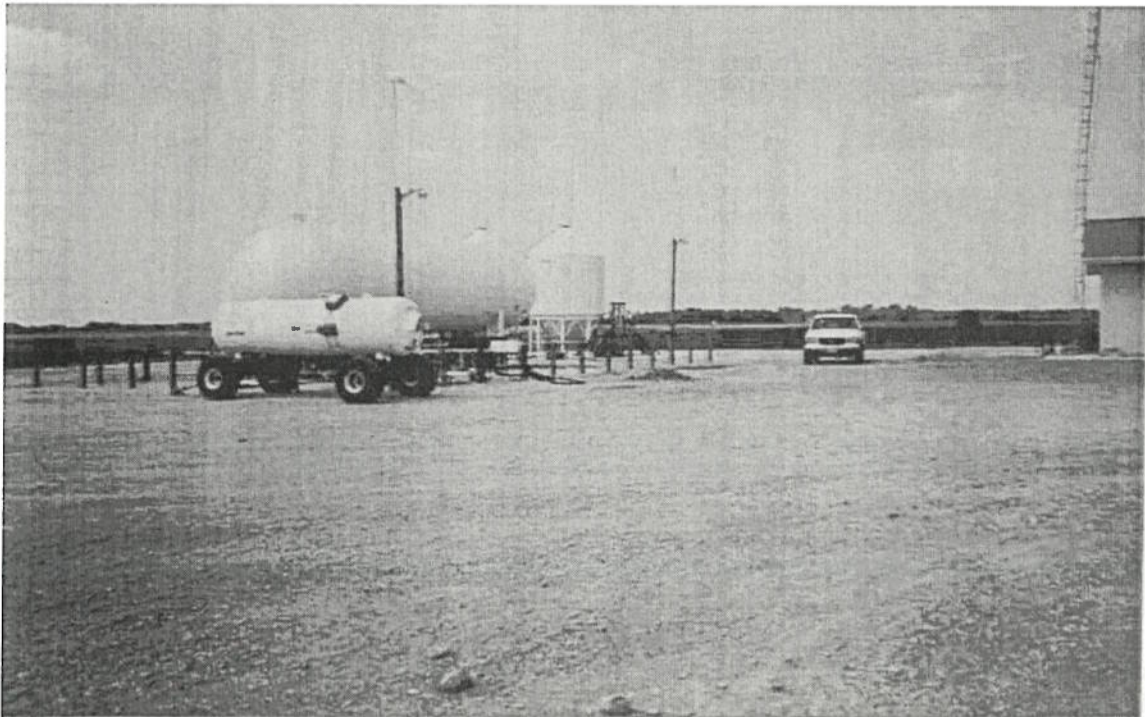
PORTAGE LA PRAIRIE CONSUMERS CO-OP

SCALE: 1 : 800  
DATE: AUGUST/2002  
DRAWN BY: SD  
PROJECT NO.: WX05476


FIGURE 2

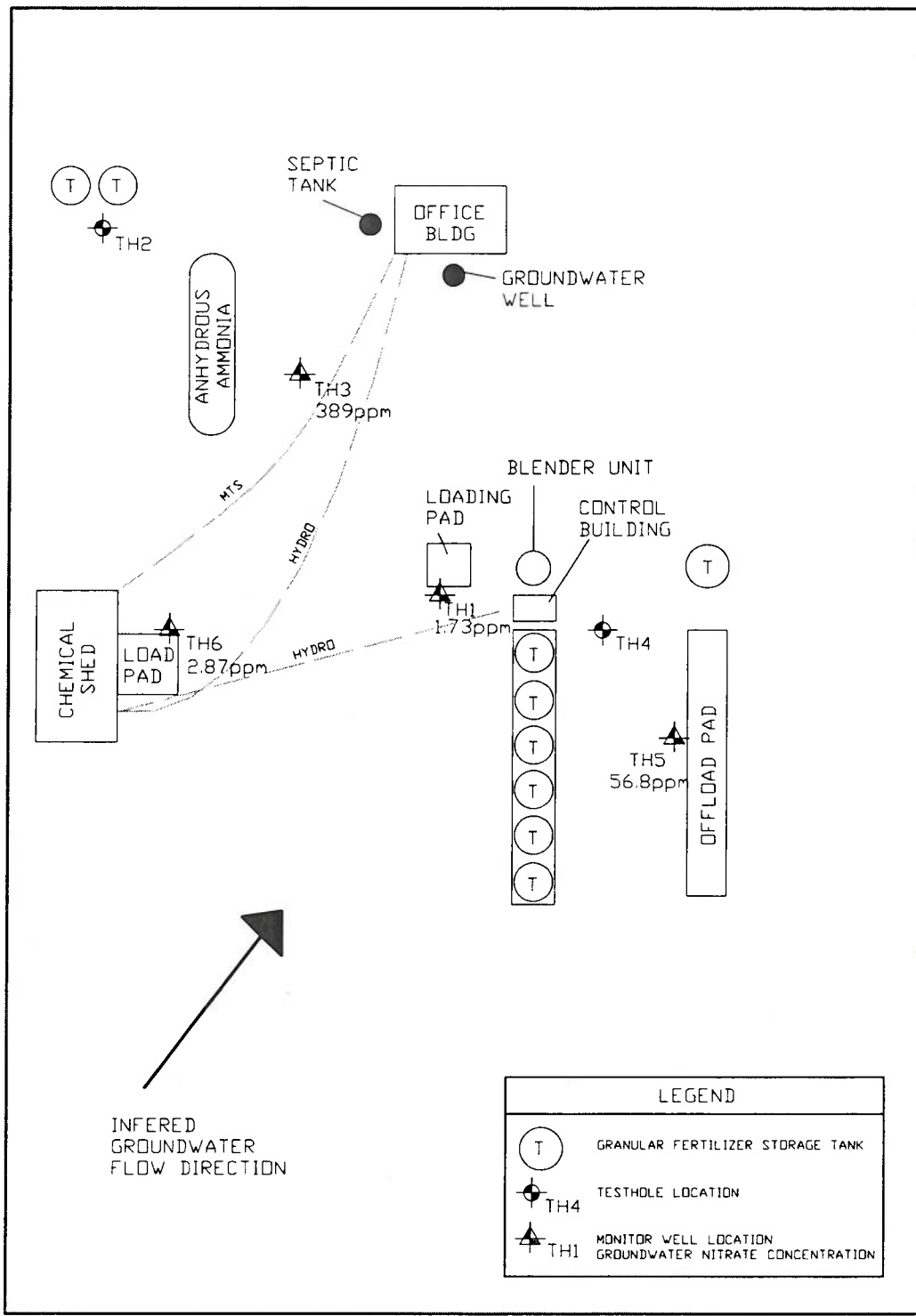


**PHOTOGRAPH 1:** Control building and blender along east side of site (viewed form south).

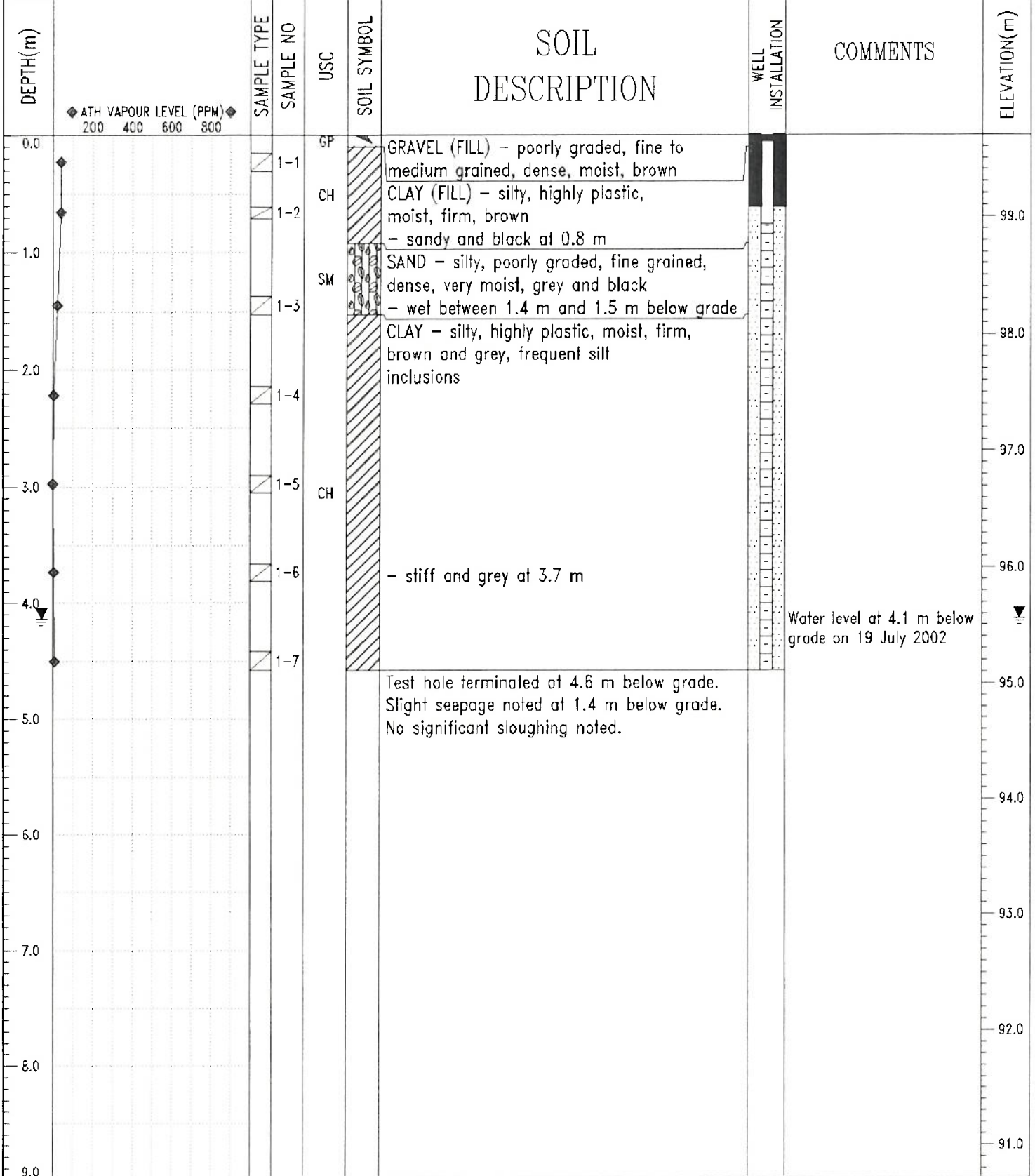


**PHOTOGRAPH 2:** Anhydrous ammonia storage as viewed from south. Note office building on right.

 Earth & Environmental Limited <b>PORTAGE LA PRAIRIE CONSUMERS CO-OP</b>		<b>SITE PHOTOGRAPHS</b> <b>PHASE II ENVIRONMENTAL SITE ASSESSMENT</b> <b>SE 33-11-11W</b> <b>RM OF NORTH NORFOLK, MANITOBA</b>		
Drawn: N/A	Scale: N/A	Date: AUG/02	Project No.: WX05476	Figure: 3

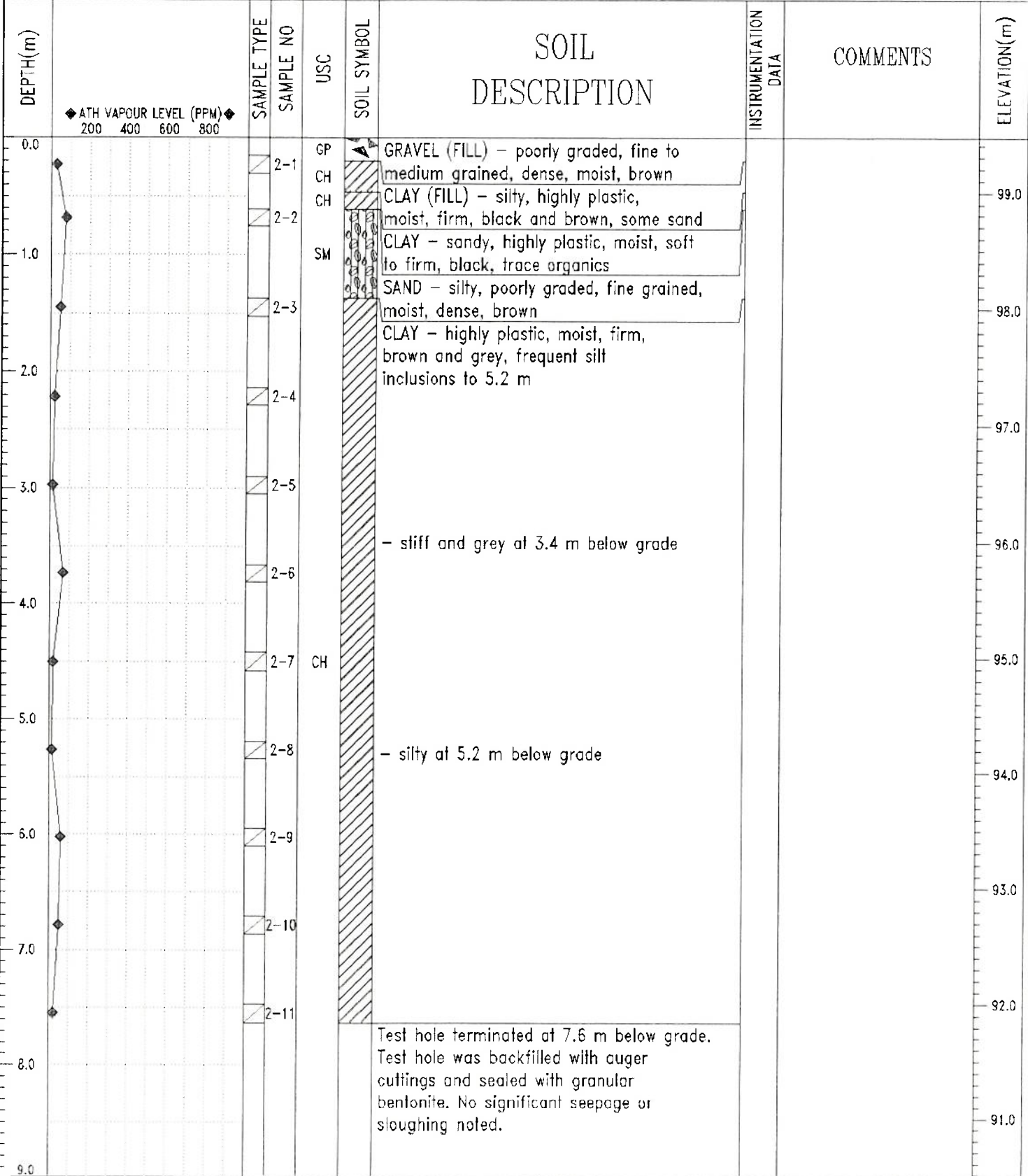


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Portage La Prairie Consumers Co-op	Rig: Brat 22	PROJECT NO: WX-05476				
Location: HWY #1 just east of HWY #34	Auger: 125 mm Solid Stem	ELEVATION: 99.695 m				
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BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



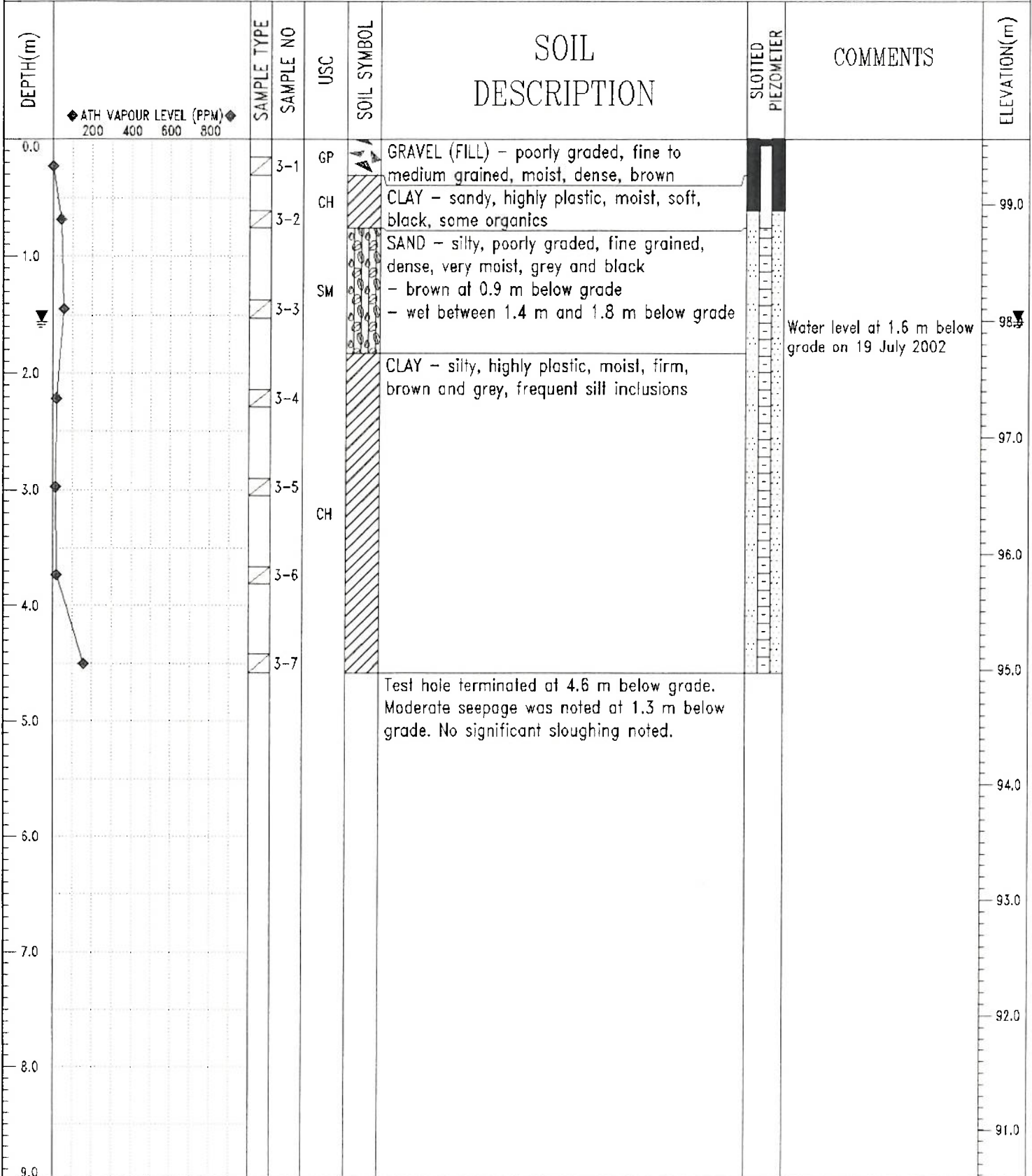
AMEC Earth & Environmental Limited Winnipeg, Manitoba	LOGGED BY: MT	COMPLETION DEPTH: 4.6 m
	REVIEWED BY: PC	COMPLETE: 16/07/02
	Fig. No: 5	Page 1 of 1

PH II Environmental Site Assessment	Contractor: Paddock Drilling LTD.	TEST HOLE NO: TH2				
Parlage La Prairie Consumers Co-op	Rig: Brat 22	PROJECT NO: WX-05476				
Location: HWY #1 just east of HWY #34	Auger: 125 mm Solid Stem	ELEVATION: 99.468 m				
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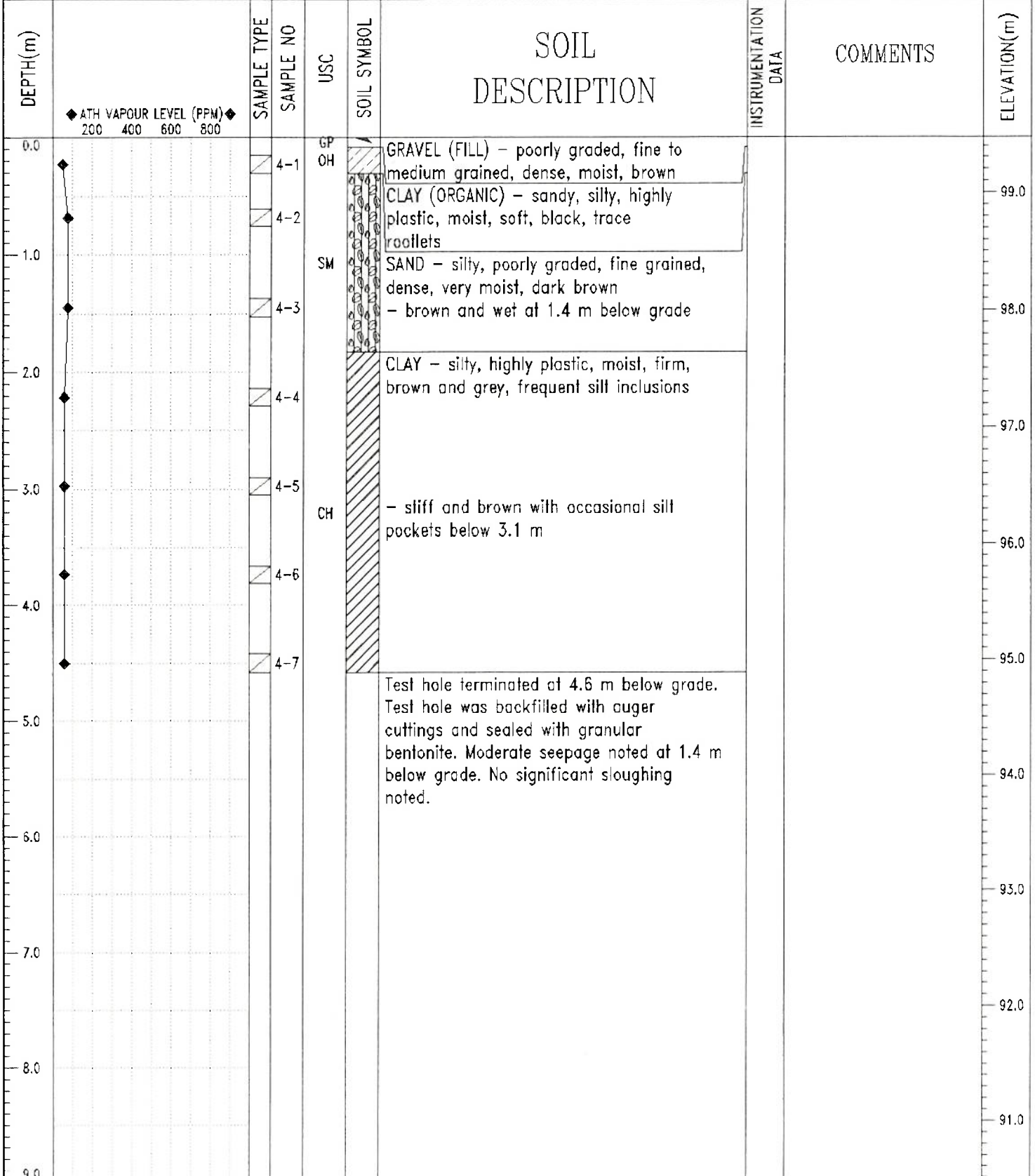
AMEC Earth & Environmental Limited Winnipeg, Manitoba	LOGGED BY: MT	COMPLETION DEPTH: 7.6 m
	REVIEWED BY: PC	COMPLETE: 16/07/02
	Fig. No: 6	Page 1 of 1

PH II Environmental Site Assessment	Contractor: Paddock Drilling LTD.	TEST HOLE NO: TH3				
Portage La Prairie Consumers Co-op	Rig: Bra1 22	PROJECT NO: WX-05476				
Location: HWY #1 just east of HWY #34	Auger: 125 mm Solid Stem	ELEVATION: 99.553 m				
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BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



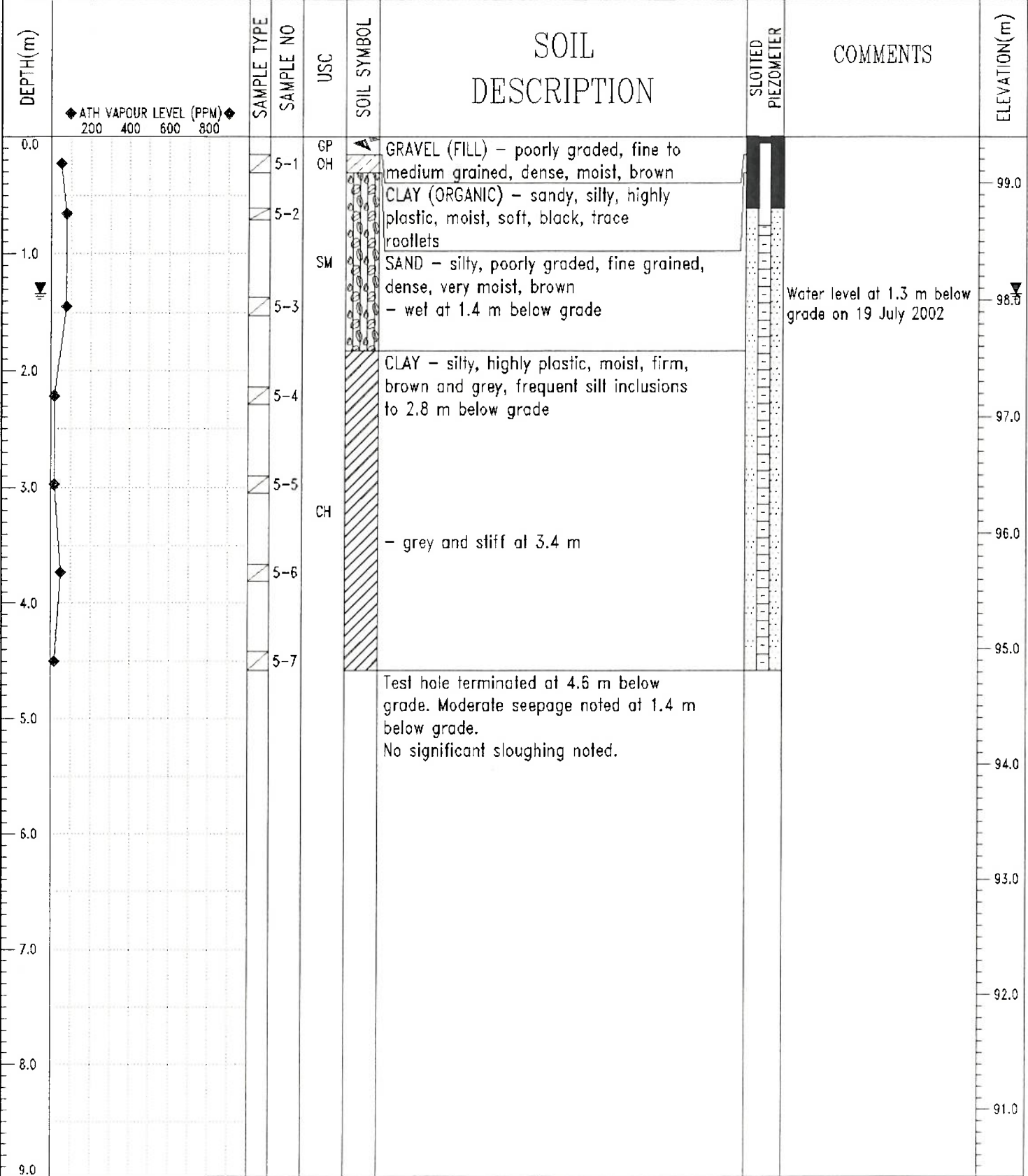
AMEC Earth & Environmental Limited	LOGGED BY: MT	COMPLETION DEPTH: 4.6 m
Winnipeg, Manitoba	REVIEWED BY: PC	COMPLETE: 16/07/02
	Fig. No: 7	Page 1 of 1

PH II Environmental Site Assessment	Contractor: Paddock Drilling LTD.	TEST HOLE NO: TH4				
Portage La Prairie Consumers Co-op	Rig: Brat 22	PROJECT NO: WX-05476				
Location: HWY #1 just east of HWY #34	Auger: 125 mm Solid Stem	ELEVATION: 99.471 m				
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BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



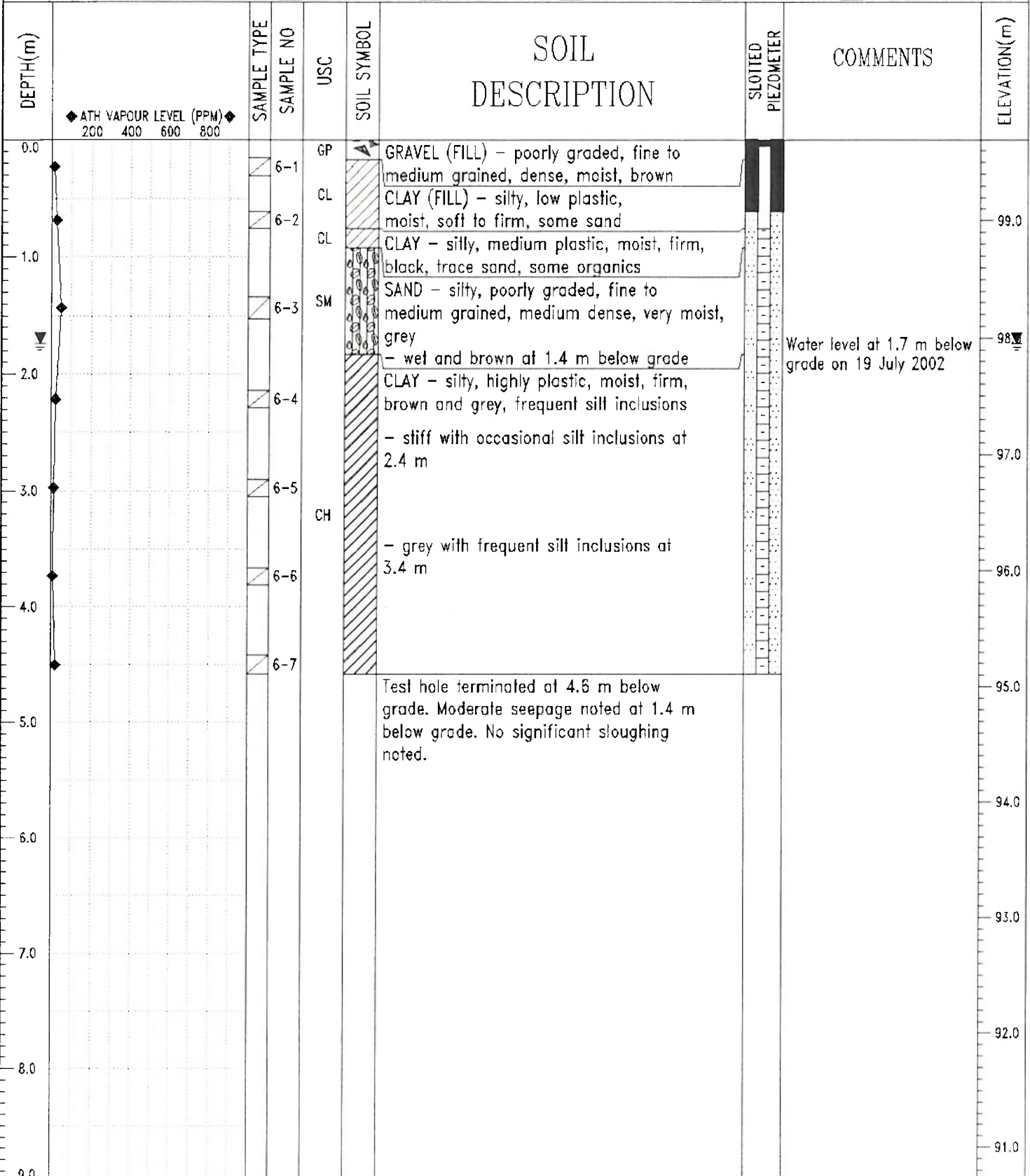
AMEC Earth & Environmental Limited Winnipeg, Manitoba	LOGGED BY: MT	COMPLETION DEPTH: 4.6 m
	REVIEWED BY: PC	COMPLETE: 16/07/02
	Fig. No: 8	Page 1 of 1

PH II Environmental Site Assessment	Contractor: Paddock Drilling LTD.	TEST HOLE NO: TH5
Parlage La Prairie Consumers Co-op	Rig: Brat 22	PROJECT NO: WX-05476
Location: HWY #1 just east of HWY #34	Auger: 125 mm Solid Stem	ELEVATION: 99.394 m
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BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND	



AMEC Earth & Environmental Limited Winnipeg, Manitoba	LOGGED BY: MT	COMPLETION DEPTH: 4.6 m
	REVIEWED BY: PC	COMPLETE: 16/07/02
	Fig. No: 9	Page 1 of 1

PH II Environmental Site Assessment	Contractor: Paddock Drilling LTD.	TEST HOLE NO: TH6
Portage La Prairie Consumers Co-op	Rig: Brat 22	PROJECT NO: WX-05476
Location: HWY #1 just east of HWY #34	Auger: 125 mm Solid Stem	ELEVATION: 99.69 m
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BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND		



AMEC Earth & Environmental Limited Winnipeg, Manitoba	LOGGED BY: MT	COMPLETION DEPTH: 4.6 m
	REVIEWED BY: PC	COMPLETE: 16/07/02
	Fig. No: 10	Page 1 of 1

**APPENDIX A**  
**SITE SENSITIVITY ASSESSMENT**

## Site Sensitivity Assessment

Receptor	Receptor Sensitivity	Likelihood of Impact	Sensitivity Ranking
<b>1. Water Usage</b>			
Groundwater which is or may be used for domestic supply – Domestic wells on-site and in vicinity of site	High	Medium	High
Surface water used for domestic supply – none	High	N/A	-
Surface water used for recreation, irrigation or supporting aquatic life – Pine Creek approx. 1.0 km west of site	Medium	Low	Low
Groundwater used for irrigation, etc. – None	Medium	Low	Low
<u>Site sensitivity ranking for water usage</u> – High			

<b>2. Inhalation Risk (vapours from soil and groundwater)</b>			
On-site present use – Slab on grade commercial buildings and open storage	Low	Medium	Low
On-site future use – As above	Low	Medium	Low
North: Undeveloped agricultural land (adjacent)	Low	Low	Low
West: – Grid road (adjacent) / undeveloped agricultural land (20m)	Low	Low	Low
East: Undeveloped agricultural land (adjacent)	Low	Low	Low
South: Access road (adjacent) followed by Hwy no. 1 (20m)	Low	Low	Low
<u>Site sensitivity ranking for inhalation risk</u> – Low			

<b>3. Ecological and Other Human Considerations</b>			
On-site ecological soil contact – surface soils ( $\leq 1.5$ m below grade)	High	High	High
On-site ecological soil contact – subsurface soils ( $> 1.5$ m below grade)	Medium	Medium	Moderate
<u>Site sensitivity ranking for ecological and other human considerations</u> – Moderate.			

### 4. Governing Risk Management Criteria

Groundwater: Based on the high sensitivity of the site in Section One, the CCME community water supply EQGs apply to the site.

Soil: Based on the low to moderate sensitivity of the site in sections two and three above and the guidelines provided by Manitoba Conservation, AMEC has chosen the following CCME commercial criteria:

- the generic values as indicated in the 1999 EQGs

Notes:

<sup>1</sup> – Sensitivity assessment based on Section 5 of the 1993 Manitoba Environment publication 'Petroleum Storage Sites: On-site Risk Management.'

**APPENDIX B**  
**LABORATORY RESULTS**

DATE: August 13 2002

AMEC LTD  
440 Dovercourt Drive  
Winnipeg MB R3Y 1N4

ATTN: CAMPBELL P

FAX: 489 8261  
FAX and Mail

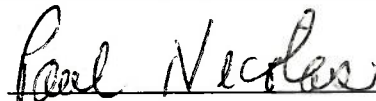
ENVIRO-TEST ANALYSIS REPORT

Lab Work Order #: W020719353 Submitted By: Campbell P  
Project Reference: Job #WX05476  
Project P.O. #: WX05476(2000) Date Received: 02/ 7/22

Comments:

AMENDED

APPROVED BY:



Paul Nicolas

Project Manager

For chemistry interpretation call (204)945-2503

For microbiology interpretation call (204)945-2348

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.  
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU  
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ACCREDITATIONS: STANDARDS COUNCIL OF CANADA (SCC), IN COOPERATION WITH THE CANADIAN ASSOCIATION FOR ENVIRONMENTAL ANALYTICAL  
LABORATORIES (CAEAL): FOR SPECIFIC TESTS AS LISTED IN THE SCC SCOPE OF ACCREDITATION  
(EDMONTON, CALGARY, WINNIPEG, SASKATOON, THUNDER BAY, WATERLOO, & GRAND PRAIRIE)  
SCC, IN COOPERATION WITH THE CANADIAN FOOD INSPECTION AGENCY (CFIA): FOR SPECIFIC FOOD RELATED TESTS AS  
LISTED IN THE SCC SCOPE OF ACCREDITATION (WINNIPEG)  
SCC, FOR SPECIFIC HEALTH RELATED TESTS AS LISTED IN THE SCC SCOPE OF ACCREDITATION (WINNIPEG)  
AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA): FOR INDUSTRIAL HYGIENE ANALYSIS (EDMONTON, WINNIPEG) AND  
FUNGI ANALYSIS (WINNIPEG)  
AGRICULTURE CANADA: UNDER THE CANADIAN FERTILIZER QUALITY ASSURANCE PROGRAM (SASKATOON)

ENVIRO-TEST ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	M.D.L.	UNITS	METHOD #	ANALYZED	ANALYST
02-A52175	TH1	AMEC Sample Type: Water - Ground Collected: 02/ 7/19						
		Inorganics						
		Ammonia-N Dissolved	0.32	0.01	mg/L N	A268.05	02/ 7/23	ALW
		Calcium - Dissolved	156.	0.05	mg/L	A500.08	02/ 7/24	LJW
		Chloride - Dissolved	10.	10.	mg/L	A268.05	02/ 7/23	ALW
		Conductivity	1560	20.	umhos/cm	A048.08	02/ 7/23	CDG
		Magnesium - Dissolved	97.9	0.02	mg/L	A500.08	02/ 7/24	LJW
		Manganese - Dissolved	0.399	0.005	mg/L	A500.08	02/ 7/24	LJW
		Nitrate-N Dissolved	1.73	0.01	mg/L	A268.04		Calculated
		NitrateNitrite-N Dissolve	1.81	0.01	mg/L	A268.05	02/ 7/23	ALW
		Nitrite-N Dissolved	0.08	0.01	mg/L	A259.01	02/ 7/23	ALW
		Nitrogen-Total Kjeldahl	0.7	0.2	mg/L N	A217.06	02/ 7/29	CLM
		pH	8.00	0.01	pH units	A048.08	02/ 7/23	CDG
		Phosphorus - Total	0.224	0.001	mg/L P	A208.10	02/ 7/25	MEB
		Potassium - Dissolved	8.6	0.2	mg/L	A500.08	02/ 7/24	LJW
		Sodium - Dissolved	33.6	0.2	mg/L	A500.08	02/ 7/24	LJW
		Sulphate - Dissolved	475.	10.	mg/L	A268.05	02/ 7/25	ALW
COMMENTS FOR LAB NUMBER 02-A52175								
LAB COMMENT								
The portion of the sample for dissolved metals was filtered and preserved in the lab.								
02-A52176	TH3	AMEC Sample Type: Water - Ground Collected: 02/ 7/19						
		Inorganics						
		Ammonia-N Dissolved	0.05	0.01	mg/L N	A268.05	02/ 7/25	ALW
		Calcium - Dissolved	432.	0.05	mg/L	A500.08	02/ 7/24	LJW
		Chloride - Dissolved	12.	10.	mg/L	A268.05	02/ 7/25	ALW
		Conductivity	5190	20.	umhos/cm	A048.08	02/ 7/23	CDG
		Magnesium - Dissolved	223.	0.02	mg/L	A500.08	02/ 7/24	LJW
		Manganese - Dissolved	0.110	0.005	mg/L	A500.08	02/ 7/24	LJW
		Nitrate-N Dissolved	389.	0.01	mg/L	A268.04		Calculated
		NitrateNitrite-N Dissolve	417.	0.01	mg/L	A268.05	02/ 7/29	ALW
		Nitrite-N Dissolved	27.6	0.01	mg/L	A259.01	02/ 7/23	ALW
		Nitrogen-Total Kjeldahl	< 0.2	0.2	mg/L N	A217.06	02/ 7/29	CLM
		pH	6.98	0.01	pH units	A048.08	02/ 7/23	CDG
		Phosphorus - Total	0.202	0.001	mg/L P	A208.10	02/ 7/25	MEB
		Potassium - Dissolved	2.1	0.2	mg/L	A500.08	02/ 7/24	LJW
		Sodium - Dissolved	43.7	0.2	mg/L	A500.08	02/ 7/24	LJW
		Sulphate - Dissolved	389.	10.	mg/L	A268.05	02/ 7/23	ALW

ENVIRO-TEST ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	M.D.L.	UNITS	METHOD #	ANALYZED	ANALYST
<p>COMMENTS FOR LAB NUMBER 02-A52176</p> <p style="text-align: center;">LAB COMMENT</p> <p style="text-align: center;">The portion of the sample for dissolved metals was filtered and preserved in the lab.</p>								
02-A52177	TH5	AMEC Sample Type: Water - Ground Collected: 02/ 7/19						
		Inorganics						
		Ammonia-N Dissolved	0.03	0.01	mg/L N	A268.05	02/ 7/23	ALW
		Calcium - Dissolved	204.	0.05	mg/L	A500.08	02/ 7/24	LJW
		Chloride - Dissolved	73.	10.	mg/L	A268.05	02/ 7/23	ALW
		Conductivity	2380	20.	umhos/cm	A048.08	02/ 7/23	CDG
		Magnesium - Dissolved	98.3	0.02	mg/L	A500.08	02/ 7/24	LJW
		Manganese - Dissolved	0.061	0.005	mg/L	A500.08	02/ 7/24	LJW
		Nitrate-N Dissolved	56.8	0.01	mg/L	A268.04		Calculated
		NitrateNitrite-N Dissolve	56.8	0.01	mg/L	A268.05	02/ 7/29	ALW
		Nitrite-N Dissolved	0.02	0.01	mg/L	A259.01	02/ 7/23	ALW
		Nitrogen-Total Kjeldahl	< 0.2	0.2	mg/L N	A217.06	02/ 7/29	CLM
		pH	7.46	0.01	pH units	A048.08	02/ 7/23	CDG
		Phosphorus - Total	0.166	0.001	mg/L P	A208.10	02/ 7/25	MEB
		Potassium - Dissolved	2.9	0.2	mg/L	A500.08	02/ 7/24	LJW
		Sodium - Dissolved	37.0	0.2	mg/L	A500.08	02/ 7/24	LJW
		Sulphate - Dissolved	401.	10.	mg/L	A268.05	02/ 7/25	ALW
<p>COMMENTS FOR LAB NUMBER 02-A52177</p> <p style="text-align: center;">LAB COMMENT</p> <p style="text-align: center;">The portion of the sample for dissolved metals was filtered and preserved in the lab.</p>								
02-A52178	TH6	AMEC Sample Type: Water - Ground Collected: 02/ 7/19						
		Inorganics						
		Ammonia-N Dissolved	0.05	0.01	mg/L N	A268.05	02/ 7/23	ALW
		Calcium - Dissolved	117.	0.05	mg/L	A500.08	02/ 7/24	LJW
		Chloride - Dissolved	13.	10.	mg/L	A268.05	02/ 7/23	ALW
		Conductivity	1800	20.	umhos/cm	A048.08	02/ 7/23	CDG
		Magnesium - Dissolved	62.3	0.02	mg/L	A500.08	02/ 7/24	LJW
		Manganese - Dissolved	0.057	0.005	mg/L	A500.08	02/ 7/24	LJW
		Nitrate-N Dissolved	2.87	0.01	mg/L	A268.04		Calculated
		NitrateNitrite-N Dissolve	3.79	0.01	mg/L	A268.05	02/ 7/29	ALW

ENVIRO-TEST ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	M.D.L.	UNITS	METHOD #	ANALYZED	ANALYST
		Nitrite-N Dissolved	0.92	0.01	mg/L	A259.01	02/ 7/23	ALW
		Nitrogen-Total Kjeldahl	0.4	0.2	mg/L N	A217.06	02/ 7/29	CLM
		pH	7.53	0.01	pH units	A048.08	02/ 7/23	CDG
		Phosphorus - Total	0.221	0.001	mg/L P	A208.10	02/ 7/25	MEB
		Potassium - Dissolved	2.4	0.2	mg/L	A500.08	02/ 7/24	LJW
		Sodium - Dissolved	25.9	0.2	mg/L	A500.08	02/ 7/24	LJW
		Sulphate - Dissolved	356.	10.	mg/L	A268.05	02/ 7/25	ALW
		Trace Organics						
		2 4-D	< 0.05	0.05	ug/L	A706.04	02/ 7/29	MDM
		Bromoxynil	< 0.02	0.02	ug/L	A706.04	02/ 7/29	MDM
		Dicamba	< 0.02	0.02	ug/L	A706.04	02/ 7/29	MDM
		Diclofop	0.5	0.1	ug/L	A706.04	02/ 7/29	MDM
		MCPA	< 0.05	0.05	ug/L	A706.04	02/ 7/29	MDM
		Picloram	< 0.2	0.2	ug/L	A706.04	02/ 7/29	MDM
		Triallate	< 0.2	0.2	ug/L	A706.04	02/ 7/29	MDM
		Trifluralin	0.24	0.02	ug/L	A706.04	02/ 7/29	MDM
COMMENTS FOR LAB NUMBER 02-A52178								
LAB COMMENT								
The portion of the sample for dissolved metals was filtered and preserved in the lab.								
02-A52179	TH4-4	AMEC						
		Sample Type: Soil						
		Collected: 02/ 7/16						
		Inorganics						
		Calcium - Extractable	91.7	0.05	mg/L	A500.08	02/ 7/27	MEB
		Conductivity Sat paste	859.	0.4	umhos/cm	A037.02	02/ 7/25	KMF
		Magnesium - Extractable	32.9	0.02	mg/L	A500.08	02/ 7/27	MEB
		pH sat. paste extract	7.76	0.01	pH units	A269.03	02/ 7/25	KMF
		Phosphorus - Total	577.	3.	mg/kg DWt*	A510.06	02/ 8/ 9	DAG
		Potassium - Extractable	4.8	0.2	mg/L	A500.08	02/ 7/27	MEB
		Sodium - Extractable	11.1	0.2	mg/L	A500.08	02/ 7/27	MEB
		Sodium Adsorption Ratio	0.25	0.03		A039.01		Calculated
		Other Analysis						
		Ammonia-N	1440	0.2	ug/g DWt*	A627.01	02/ 7/25	JPG
		Nitrate - Nitrite - N	25.2	0.4	ug/g DWt*	A624.01	02/ 7/24	JPG
		Nitrogen-Total Kjeldahl E	0.03	0.03	%	A621.02	02/ 7/25	JPG
		Project - Soils Lab	See Below	***		A999.01	02/ 8/13	JPG
		Saturation	42.	0.	%		02/ 7/24	JPG

ENVIRO-TEST ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	M.D.L.	UNITS	METHOD #	ANALYZED	ANALYST
<p>COMMENTS FOR LAB NUMBER 02-A52179</p> <p style="text-align: center;">SAMPLE COMMENT (GENERAL)</p> <p style="text-align: center;">NO3 = 23.4 ug/g NO2 = 18.2 ug/g</p>								
02-A52180	TH3-3	AMEC Sample Type: Soil Collected: 02/ 7/16						
		Inorganics						
		Calcium - Extractable	97.1	0.05	mg/L	A500.08	02/ 7/27	MEB
		Conductivity Sat paste	1270	0.4	umhos/cm	A037.02	02/ 7/25	KMF
		Magnesium - Extractable	65.7	0.02	mg/L	A500.08	02/ 7/27	MEB
		pH sat. paste extract	7.94	0.01	pH units	A269.03	02/ 7/25	KMF
		Phosphorus - Total	531.	3.	mg/kg DWt*	A510.06	02/ 8/ 9	DAG
		Potassium - Extractable	5.0	0.2	mg/L	A500.08	02/ 7/27	MEB
		Sodium - Extractable	41.1	0.2	mg/L	A500.08	02/ 7/27	MEB
		Sodium Adsorption Ratio	0.79	0.03		A039.01		Calculated
		Other Analysis						
		Ammonia-N	1.3	0.2	ug/g DWt*	A627.01	02/ 7/25	JPG
		Nitrate - Nitrite - N	35.2	0.4	ug/g DWt*	A624.01	02/ 7/24	JPG
		Nitrogen-Total Kjeldahl E	< 0.03	0.03	%	A621.02	02/ 7/25	JPG
		Project - Soils Lab	See Below	***		A999.01	02/ 8/13	JPG
		Saturation	31.	0.	%		02/ 7/24	JPG
<p>COMMENTS FOR LAB NUMBER 02-A52180</p> <p style="text-align: center;">SAMPLE COMMENT (GENERAL)</p> <p style="text-align: center;">NO3 = 34.4 ug/g NO2 = 0.84 ug/g</p>								
02-A52181	TH2-1	AMEC Sample Type: Soil Collected: 02/ 7/16						
		Inorganics						
		Calcium - Extractable	410.	0.05	mg/L	A500.08	02/ 7/27	MEB
		Conductivity Sat paste	3810	0.4	umhos/cm	A037.02	02/ 7/25	KMF
		Magnesium - Extractable	325.	0.02	mg/L	A500.08	02/ 7/27	MEB
		pH sat. paste extract	7.91	0.01	pH units	A269.03	02/ 7/25	KMF
		Phosphorus - Total	506.	3.	mg/kg DWt*	A510.06	02/ 8/ 9	DAG
		Potassium - Extractable	16.0	0.2	mg/L	A500.08	02/ 7/27	MEB
		Sodium - Extractable	152.	0.2	mg/L	A500.08	02/ 7/27	MEB
		Sodium Adsorption Ratio	1.4	0.03		A039.01		Calculated

ENVIRO-TEST ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	M.D.L.	UNITS	METHOD #	ANALYZED	ANALYST
		Other Analysis						
		Ammonia-N	17.3	0.2	ug/g Dwt*	A627.01	02/ 7/25	JPG
		Nitrate - Nitrite - N	1.6	0.4	ug/g Dwt*	A624.01	02/ 7/24	JPG
		Nitrogen-Total Kjeldahl E	0.12	0.03	%	A621.02	02/ 7/25	JPG
		Project - Soils Lab	See Below	***		A999.01	02/ 8/13	JPG
		Saturation	40.	0.	%		02/ 7/24	JPG
COMMENTS FOR LAB NUMBER 02-A52181								
SAMPLE COMMENT (GENERAL)								
NO3 = 1.4 ug/g NO2 = 0.23 ug/g								
02-A52182	TH6-2	AMEC						
		Sample Type: Soil						
		Collected: 02/ 7/16						
		Trace Organics						
		2 4-D	< 0.01	0.01	ug/g	D757.01	02/ 8/ 8	MDM
		Bromoxynil	< 0.01	0.01	ug/g	D757.01	02/ 8/ 8	MDM
		Dicamba	< 0.01	0.01	ug/g	D757.01	02/ 8/ 8	MDM
		Diclofop-Methyl	< 0.01	0.01	ug/g	D757.01	02/ 8/ 8	MDM
		MCPA	< 0.01	0.01	ug/g	D757.01	02/ 8/ 8	MDM
		Picloram	< 0.02	0.02	ug/g	D757.01	02/ 8/ 8	MDM
		Triallate	< 0.01	0.01	ug/g	D757.01	02/ 8/ 8	MDM
		Trifluralin	< 0.01	0.01	ug/g	D757.01	02/ 8/ 8	MDM

# ENVIRO-TEST LABORATORIES TEST METHODOLOGIES

Work Order W020719353

Conductivity, pH, Alkalinity in Water  
ETL Method Number: A048.08

References: APHA 4500B, 2510B, 2320B, 1998

**Principle of Method:**

Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.

pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.

Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. It is determined by titration with a standard solution of strong mineral acid to the successive  $\text{HCO}_3^-$  and  $\text{H}_2\text{CO}_3$  endpoints indicated electrometrically.

pH and Conductivity in Soil and Sediment, Calcium Chloride and Water Extractions

ETL Method Number: A037.02

References: Methods Manual for Forest Soil and Plant Analysis, NOR-X-319, 1991.

**Principle of Method:**

Approximately 20 grams of sample is extracted with either  $\text{CaCl}_2$  or deionized water. Conductivity of the solution is measured using an ohmmeter while pH is measured using a standard hydrogen electrode and a reference electrode.

Chloride, Fluoride, Nitrate-Nitrite, Sulphate, Ammonia in Water

ETL Method Number: A268.05

References: Lachat Quickchem Methods

**Principle of Method:**

Chloride - Colourimetric using Mercuric Thiocyanate

Fluoride - Ion selective electrode

Nitrate/Nitrite - Colourimetric, Cadmium with copper sulphate reduction

Sulphate - Turbidimetric

Ammonia - Colourimetric using Salicylate-nitroprusside and hypochlorite, in an alkaline phosphate buffer.

Nitrite in Water - Flow Injection Analysis

ETL Method Number: A259.01

References: APHA 4500, 1998

**Principle of Method:**

Nitrite present is reacted with sulfanilamide (an organic amine) to form the diazonium salt which is coupled in an acidic solution with N-(1-naphthyl)-ethylenediamine dihydrochloride, to form azo dye. The azo dye intensity is measured by a colorimeter at 520 nm using Flow Injection Analysis (FIA) techniques. The Omnion software compares the sample peak areas to a calibration curve and reports the concentration of nitrite in the sample as nitrogen.

Phosphorous in Water

ETL Method Number: A208.10

References: Lachat Quickchem Method 10-115-01-1-E

**Principle of Method:**

Samples are digested using a sulphuric acid-persulphate mixture to convert organic phosphorous to orthophosphate. The samples are analyzed by either the Flow Injection Analysis (FIA) or the Segmented Flow Analysis (SFA) method. The absorbance measured by the instrument is proportional to the concentration of orthophosphate in the sample, and is reported as phosphorous. Samples are analyzed for total or total dissolved phosphorous depending on the sample pretreatment. Quantitative soluble or dissolved orthophosphorous values can be determined by carrying out the procedure without the digestion step. Total particulate phosphorous is calculated by subtracting the dissolved result from the total result.

Nitrogen, Total Kjeldahl in Water

ETL Method Number: A217.06

References: Quickchem Method 10-107-06-2-E Lachat Instruments July 1993

**Principle of Method:**

Samples are digested with a sulphuric acid solution, cooled, diluted with water, and analyzed for ammonia. Total Kjeldahl nitrogen is the sum of free-ammonia and organic nitrogen compounds which are converted to ammonium sulphate through this digestion process. Analysis is performed by Flow Injection Analysis (FIA). The pH of the digested sample is raised to a known, basic pH by neutralization with a concentrated buffer solution. This neutralization converts the ammonium cation to ammonia. The ammonia

AMMONIA IN SOIL

ETL Method Number: A627.01

References: Carter, Soil sampling and Methods of Analysis

Principle of Method:

Approximately 25 grams soil sample is extracted with a potassium chloride solution. The extract is analyzed colorimetrically where hypochlorite reacts with ammonia to form indophenol blue that is proportional to the original ammonia concentration. The blue colour formed is intensified with sodium nitroprusside.

Nitrate-Nitrite-N in Soil

ETL Method Number: A624.01

References: Lloyd Hodgins, Technicon Newsletter

Principle of Method:

Approximately 25 grams of sample is extracted with a CaCl<sub>2</sub>/deionized water solution. The nitrate is reduced to nitrite by passage through a copperized cadmium column. The nitrite is diazotized with sulfanilamide and coupled with N-(1-naphyl)ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta colour which is measured at 520 nm.

Nitrogen-Available (TKN), in Plant Tissue and Soil, Block Digestor / Segmented Flow-Colormetric

ETL Method Number: A621.02

References: Kalra, Yash

Principle of Method:

The sample is heated in the presence of sulphuric acid for two and one half hours. The residue is cooled, diluted with water and analyzed for available ammonia (as TKN). Total Kjeldahl Nitrogen (TKN) is the sum of free-ammonia and organic nitrogen compounds which are converted to ammonium sulphate under the conditions of the digestion described. This digested sample may also be used for phosphorous determination by method A622.

Samples are analyzed using a Technicon Auto Analyzer Segmented Flow system. In this system, hypochlorite reacts with ammonia to form indophenol blue in a concentration proportional to the ammonia present in the sample. The blue color is intensified with sodium nitro prusside and is read colormetrically at 660 nm. The linear operating range is 0.5 to 8.0 mg/L.

Organic nitrogen is the difference obtained by subtracting the free-ammonia concentration from the Total Kjeldahl Nitrogen concentration. To analyze for free ammonia, samples are extracted for one hour using 2N KCl at a ratio of 1:2 sample weight to KCl volume, then filtered prior to analysis. Standards are brought to volume using 2N KCl. When requested, organic nitrogen is reported in the comment field of the sample report.

THE ABOVE ANALYTICAL RESULTS RELATE ONLY TO THE SAMPLES SUBMITTED FOR ANALYSIS

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**APPENDIX C**  
**GENERAL CONDITIONS**

produced is heated with salicylate and hypochlorite to produce blue colour which is proportional to the ammonia concentration.

#### Metals in Water and Cellulose Filters by ICP

ETL Method Number: A500.08

References: EPA 200.7, EPA 3015 modified

##### Principle of Method:

Samples are nebulized using a concentric glass nebulizer. The aerosol is transported through an inductively coupled plasma. Emission spectra are produced as the sample is heated to 6000 - 8000 degrees Kelvin within the plasma. Emission intensities at specific wavelengths are measured simultaneously, one for each element of interest. These intensities are converted to concentration values by the computer operating system.

Extractable: Samples are acidified prior to analysis as above.

Dissolved: Samples are filtered prior to acidification and analysis as above.

Total: Water samples are digested according to A350 prior to analysis as above.

Cellulose filters: Cellulose filters are digested according to A352 prior to analysis as above.

#### Metals, by Plasma-Mass Spectrometer (ICP-MS)

ETL Method Number: A510.06

References: EPA 200.8, 3050B

##### Principle of Method:

The sample is diluted to reduce the dissolved solids content, then nebulized. The resulting aerosol is transported through a Radio Frequency generated plasma, where it is ionized. The ions are extracted from the center of the plasma using a series of progressively increasing vacuums and directed into the quadrupole of the mass spectrometer by an ion lens. In the quadrupole, the ions are separated according to mass/charge ratio and passed through the discreet dynode detector for quantitation by the computer system.

##### Definitions:

- Total Metals: a sample that has been vigorously digested prior to analysis will be reported as total metal parameters. For waters, the sample is unfiltered and preserved.
- Extractable Metals: an unfiltered sample that has been preserved prior to analysis will be reported as extractable metal parameters
- Dissolved Metals: a sample filtered through a 0.45 um membrane prior to being preserved and analyzed will be reported as dissolved metal parameters

The following preparation methods are used to prepare indicated matrices for analysis by this procedure:

- Water, Wastewater and Leachates: Digested with HNO<sub>3</sub> according to A354
- Hair: Digested with HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub> according to A355
- Cellulose Filters: Digested with HNO<sub>3</sub> according to A352
- Soils, Sediments, Biologicals and Biosolids: Digested with HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub> according to A357
- Blood, Serum and Urine: Digested with HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub> according to A356
- Vegetation: Ashed, then digested with HNO<sub>3</sub> according to A353

#### METALS, HNO<sub>3</sub>/PEROXIDE HOTPLATE DIGESTION FOR ANALYSIS OF SOILS, SEDIMENTS, BIOLOGICAL AND BIOSOLIDS BY ICP OR ICP-MS

ETL Method Number: A357.03

References: EPA 3050B Revision 2, December 1996.

##### Principle of Method:

The soil or sediment sample is air dried, sieved and then digested using concentrated nitric acid and hydrogen peroxide and hotplate techniques. Biosolids are oven dried at 70 C to 80 C prior to sieving and digestion. If biosolids have been applied to soil samples, they may be dried at this temperature. Vegetation samples are oven dried, then ground prior to digestion. Tissue samples are not pre-treated prior to digestion and are reported as wet weight.

The extract is diluted to volume, and analyzed by Inductively Coupled Plasma by method A505 or by Inductively Coupled Plasma -Mass Spectrometry using method A510.

#### Pesticides, Herbicides and Polychlorinated Biphenyls in Water, Wastewater and Leachates

ETL Method Number: A706.04

References: APHA 6410B, 1998

##### Principle of Method:

A one litre sample of water is extracted with dichloromethane at slightly basic then acidic pHs using separatory funnel techniques. Extracts are concentrated and split; a portion is esterified with diazomethane and the remainder is cleaned using Florisil procedures.

Pesticides and herbicides in the sample are identified and quantified by GC-MSD. Organochlorinated pesticides may be analyzed by GC-ECD upon request. PCBs are analyzed by GC-ECD.

**AMEC Earth & Environmental Limited**  
**STATEMENT OF GENERAL CONDITIONS - ENVIRONMENTAL SERVICES**

1. **STANDARD OF CARE** - In the performance of professional services, the CONSULTANT will use that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its professional practicing in the same or similar localities. No other warranty expressed or implied is made or intended by this agreement or by furnishing oral or written reports of the findings made. The CONSULTANT is to be liable only for damage approximately caused by the negligence of the CONSULTANT. The CLIENT recognizes that subsurface conditions may vary from those encountered at the location where borings, surveys, or explorations are made by the CONSULTANT and that the data, interpretations and recommendation of the CONSULTANT are based solely on the information available to him. The CONSULTANT will not be responsible for the interpretation by others of the information developed.

2. **SITE INFORMATION** - The CLIENT agrees to fully cooperate with the CONSULTANT with respect to the provision of all available information on the past, present and proposed conditions of the Site known to it or otherwise requested by the CONSULTANT.

The CONSULTANT agrees to include a review of all historical information obtained by the CLIENT or provided by the Client to assist in the investigation of the Site unless and except to the extent that such a review is limited or excluded from the scope of work to be performed by the CONSULTANT.

3. **FULL DISCLOSURE** - The CLIENT acknowledges that in order for the CONSULTANT to properly advise and assist the CLIENT in respect of the investigation of the Site, the CONSULTANT is relying upon full disclosure by the CLIENT of all matters pertinent to an investigation of the Site.

4. **DELAYS AND INTERRUPTIONS** - Should the CONSULTANT be delayed or interrupted by others in the performance of its services or be required to perform additional services as a result of any delay or interruption caused by others, the CONSULTANT shall be equitably compensated by the CLIENT for all costs, charges and expenses which it may incur as a result of such delay or interruption and any such additional services to be performed and any and all consequences resulting from such delay or interruption.

5. **USE OF WORK PRODUCT** - The CONSULTANT agrees to provide to the CLIENT interim reports outlining the progress of the investigation of the Site on a periodic basis and a final comprehensive report upon the completion of the investigation of the Site.

6. **COMPLETE REPORT** - This document being a part of the Report is of a summary nature and is not intended to stand alone without reference to the instructions given to the CONSULTANT by the CLIENT, communications between the CONSULTANT and the CLIENT, and to any other reports, writings or documents prepared by the CONSULTANT for the CLIENT relative to the specific Site described herein, all of which constitute the Report. Wherever the word "Report" is used herein, it shall refer to any and all of the documents referred to herein.

In order to properly understand the suggestions, recommendations and opinions expressed herein, reference must be made to the whole of the Report. The CONSULTANT cannot be responsible for use by any part of portions of the report without reference to the whole report.

7. **LIMITATIONS ON SCOPE OF INVESTIGATION AND WARRANTY DISCLAIMER**

There is no warranty, expressed or implied, by the CONSULTANT that:

- a) The investigation shall uncover all potential contaminants, including asbestos, on the Site; or
- b) The Site will be entirely free of all Targeted Contaminants or other contaminants as a result of any cleanup work undertaken on the Site, since it is not possible, even with exhaustive sampling, testing and analysis, to document all potential contaminants on the Site.

Classification and identification of soils, rocks, geological units, contaminated materials and contaminant quantities have been based on commonly accepted practices in environmental consulting practice in this area.

The CLIENT acknowledges that:

- a) The investigation findings are based solely on the information generated as a result of the specific scope of the investigation authorized by the CLIENT;

- b) any assessment regarding the presence of contamination of the Site is based on the interpretation of conditions determined at specific sampling locations and depths and that conditions may vary between sampling locations;
- c) there can be no assurance that isolated pockets of contaminants are not located on the Site;
- d) any assessment is also dependent on and limited by the accuracy of the analytical data generated by the sample analyses;
- e) any assessment is also limited by the scientific possibility of determining the presence of contaminants for which scientific analyses have been conducted; and
- f) the analytical parameters selected are limited to those outlined in the CLIENT's authorized scope of investigation (in the absence of any evidence of potential contamination sources on the Site, which may warrant expanding the analytical parameters).

8. REMEDIATION COST ESTIMATES - Estimates of remediation costs can only be based on the specific information generated and the technical limitations of the investigation authorized by the CLIENT. Accordingly, estimated costs for remediation only represent the cost to clean up known contaminants that have been identified during the course of the investigation. As remediation of a Site is often an iterative exercise, estimated costs for remediation should only be interpreted to cover the first stage of any Site remediation until such time as verification samples indicate that the Site has been fully remediated and the CONSULTANT shall therefore not be liable for the accuracy of any estimates of remediation costs provided.

9. CONTROL OF WORK AND JOBSITE SAFETY - The CONSULTANT is only responsible for the activities of its employees on the jobsite. The presence of CONSULTANT personnel on the Site shall not be construed in any way to relieve the CLIENT or any contractors on Site from their responsibilities for Site safety. The CLIENT undertakes to inform the CONSULTANT of all hazardous conditions, or possible hazardous conditions which are known to him. The CLIENT also recognizes that the activities of the CONSULTANT may uncover previously unknown hazardous materials and that such a discovery may result in the necessity to undertake emergency procedures to protect CONSULTANT employees as well as the public at large and the environment in general. The CLIENT also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the CLIENT agrees that notification to such bodies by the CONSULTANT will not be a cause of action or dispute.

#### 10. LIMITATION OF RESPONSIBILITY

Limitation of Liability - The CLIENT hereby agrees that to the fullest extent permitted by the law the CONSULTANT's total liability to CLIENT for any and all injuries, claims losses, expenses or damages whatsoever arising out of or in anyway relating to the Project, the Site, or this agreement from any cause or causes including but not limited to the CONSULTANT's negligence, errors, omissions, strict liability, breach of contract, or breach of warranty shall not exceed the total amount paid by the CLIENT for the services of the CONSULTANT under this contract or \$50,000, whichever is greater.

No Special or Consequential Damages - CLIENT and CONSULTANT agree that to the fullest extent permitted by law the CONSULTANT shall not be liable to CLIENT for any special, indirect or consequential damages whatsoever, whether caused by the CONSULTANT's negligence, errors omissions, strict liability, breach of contract, breach of warranty or other cause of causes whatsoever.

Indemnification - To the fullest extent permitted by law, the CLIENT agrees to defend, indemnify and hold the CONSULTANT, its agents, subcontractors, and employees harmless from and against any and all claims, defense costs, including attorney's fees, damages, and other liabilities arising out of or in any way related to CONSULTANT's reports or recommendations concerning this Agreement, CONSULTANT's presence on the project property, or the presence, release, or threatened release of asbestos, hazardous substances, or pollutants on or from the project property; provided that the CLIENT shall not indemnify CONSULTANT against liability for damages to the extent caused by the negligence or intentional misconduct of CONSULTANT, its agents, subcontractors, or employees.