

5.0 HYDROCARBON CONTAMINATION EVALUATION

5.1 Vapour Phase Hydrocarbons

Flammable headspace vapour readings taken on the soil samples from the former UST excavation, the monitoring well and 8 testholes are presented in Table A. The measured soil vapour concentrations ranged from 100 ppm to >10,000 ppm.

As shown in Table B, the total downhole flammable vapour concentrations measured in TH2, 3, and 6 are very high (>10000 ppm). Flammable vapour concentrations measured in the remainder of the testholes and MW1 ranged from 40 ppm to 750 ppm which are considered low. However, soil vapour readings in excess of 100 ppm are considered elevated at this location. An approximate aerial soil vapour (>10,000 ppm) plume is shown on Plate 1D, appended.

It can be inferred from the soil vapour survey that evidence of vapour phase hydrocarbon contamination was detected to depths of 12' to 15' from grade and that the worse zone is located between 3' and 10' from grade. Laterally, the vapour phase hydrocarbons appear to migrate in a northerly direction (Plate 1D).

5.2 Free Phase Hydrocarbons

During our field investigation, free phase hydrocarbons were not detected in any of the testholes nor in MW1.

5.3 Dissolved Phase Hydrocarbons

Tests for dissolved BTEX in the perched water table of the former UST excavation were not conducted. However, due to the depths of the water table and the hydrocarbon soil contamination detected around the UST excavation, dissolved BTEX of considerable concentrations are considered present in the said perched water table. However, the presence of dissolved BTEX in the perched water table would have little environmental impact, as potable water is piped in from the City of Winnipeg and the existing building is basementless. In addition, the site sensitivity is rated low and the soil profile generally includes a thick layer of low permeability plastic clay.

6.0 ANALYTICAL CHEMISTRY RESULTS

The soil chemistry data from the Saskatchewan Research Council (SRC) are shown on Plate 5 enclosed. For comparison purposes, the chemical test data are tabulated in Table C, against the Manitoba

Environment (Level I to III) and the Canadian Council of Ministers of the Environment soil remediation criteria for commercial & Industrial lands. In addition, the aforesaid Provincial & Federal soil remediation criteria are enclosed in Table 1 & 2 appended, for ease of reference.

7.0 DISCUSSION

On the basis of the results of this investigation, the following environmental comments may be made.

7.1 Soil contamination by gasoline is present in the subsoils at and in the general vicinity of the former underground tank. Evidence of contamination includes elevated soil vapours, pungent petroleum odor and hydrocarbon staining in the soil samples. Vertically, the soil contamination extends to about 15' below grade with the worse zone being located between 3' and 10' from grade. Laterally, the soil contamination is still located within the subject property, as may be inferred from the hydrocarbon vapour plume on Plate 1D.

7.2 Slightly elevated levels of methane gas appear to be present in the subsoils of certain testholes put down at this site (Table A & B).

7.3 From the soil chemistry data (Table C), the soil contamination at TH3 (6.5') in terms of total volatile hydrocarbons as gasoline and BTX (benzene, toluene and xylene), has exceeded the Manitoba Level I to III and the CCME interim soil remediation criteria for commercial and industrial properties.

The soil contamination at TH9 (5'), has exceeded the Manitoba Level I to III criterion for total volatile hydrocarbons as gasoline and has marginally exceeded this criterion for benzene concentration (5.9 ug/g).

7.4 Considering the present land use of the site and adjacent properties (Plate 1C); ground water usage, geologic and hydrogeologic setting, type and location of existing underground structures and distance to the nearest surface water (Red River Floodway), the sensitivity of the site at 2477 Day Street is rated low.

8.0 RECOMMENDATIONS

To comply with the requirements stipulated in the letter dated September 26, 1994 from Mr. R. Lemoine, P. Geol. of Manitoba

October 21, 1994

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Environment and considering present land use and site sensitivity, the gasoline soil contamination detected at the former UST site and its general area should be cleaned up to meet the Manitoba Environment Level III (Low Sensitivity Site) and the Federal CCME interim soil remediation criteria for industrial and commercial lands.

Although there are many possible alternatives for remediating the gasoline contaminated soils, the most practical alternative is to physically excavate the contaminated soils exceeding the Manitoba Environment Level III criteria, haul and treat the said soils at a remote location of the site using the land farming technique. Once the soils are treated to meet the Manitoba Level III criteria, and subject to the approval of Manitoba Environment, they may be reused for backfilling the former UST excavation, for general site grading along the on site traffic areas or left on site as is. The excavated soil quantities (based on in-situ volume) to meet the Manitoba Level III criteria are estimated at approximately 1600 cubic yards. Approximately 1800 cubic yards of clean fill would be required to backfill this area since the existing UST excavation has not yet been backfilled at present.

Alternatively, the excavated, contaminated soils may be hauled to a licensed facility for permanent disposal. It should, however, be appreciated that substantial tipping fees will have to be paid to the disposal facility, especially for those contaminated soils which have exceeded the hazardous waste criteria.

For safety reason and to avoid further undermining of the existing interior slab, the former UST excavation should be enclosed with a temporary fence and the said excavation should be backfilled to grade with compacted clean fill materials (pitrun gravel fill preferred) as soon as possible.

Consideration was given to a risk management strategy. This would involve the installation of a series of monitoring wells around the UST excavation, from which soil vapour measurements are taken and water samples extracted for testing of BTEX on a quarterly basis. In view of the detected concentrations of the contaminants and possible higher long term clean up costs resulting from hydrocarbon migration to a larger area, we would not place this as a high priority alternative.

9.0 LIMITATIONS

This report has been prepared on the basis of generally accepted environmental investigation practice, for the exclusive use of our

GEOKWAN ENVIRONMENTAL LTD.

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client, Ms. Rhonda Smerchanski of Markwill Industries. Any distribution and use of this report by other parties is our client's sole responsibility. The information contained herein is considered representative of the general environmental conditions of the site, during the period of our site investigation.

Variations in the concentration, depth and type of the contaminants between our testholes or sample locations may occur. Contaminants other than those selected for testing in this study, may be present in the subject property and in areas not investigated.

Any queries about this report should be directed to the attention of the undersigned.

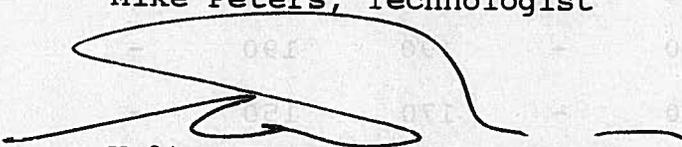
Yours truly,

GEOKWAN ENVIRONMENTAL LTD.

Per:



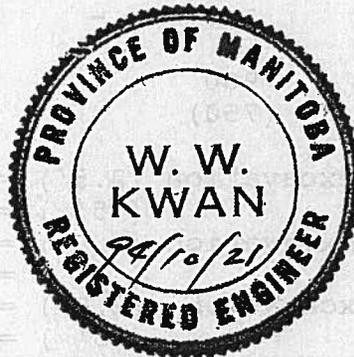
Mike Peters, Technologist



Walter Kwan, M. Eng., P. Eng.

WK:MP:dh

Encl.



GEOKWAN ENVIRONMENTAL LTD.

FLAMMABLE SOIL VAPOUR CONCENTRATIONS (PPM)
MARKWILL INDUSTRIES
2477 DAY STREET, WPG, MB

Location	Depth From Grade (feet)							
	2.5'	5'	6.5'	7.5'	8'	10'	12.5'	15'
MW1	130	130	-	130	130	-	-	-
TH3	280	1000 (900)	>10000 (>10000)	-	-	1350	-	-
TH4	150	130	-	100	-	100	120	140
TH5	140	160	-	4500 (1200)	-	340	-	-
TH6	1000 (600)	>10000 (>10000)	-	200	-	360	-	-
TH7	110	120	-	120	-	120	110	100
TH8	130	160	-	200	-	190	190	-
TH9	160	900 (750)	-	160	-	170	150	-
South wall of excavation	(2.5')	=	>10000				South Bottom of excavation	
	(5')	=	3200				540 ppm	
North wall of excavation	(2.5')	=	590				North Bottom of excavation	
	(5')	=	270				650 ppm	
East wall of excavation	(2.5')	=	310					
	(5')	=	790					
West wall of excavation	(2.5')	=	150					
	(5')	=	360					

TH2

1' under pump line	= 200
2' under pump line	= 1300, (700)
3' under pump line	= 1500, (1400)
4' under pump line	= 4000, (3800)
5' under pump line	= 2000, (1900)
6' under pump line	= >10000, (7600)
7' under pump line	= 950, 850

Notes:

- 1) MW = Monitoring Well
- 2) TH = Testhole
- 3) () = No Methane Response Reading

OCT. 27/94

SUBJECT: MAHWILL IND.

GEORVAN Report Oct. 21/94

RAP - 1600 yd³ to achieve Level III

HAZ WASTE TO MHWMC. All rest can
be treated on-site MAYBE.

SUBJECT TO ASSESSMENT OF SINGLE USE SITE.
SUBMISSION BY GEORVAN.

Need water tested. 1 sample = Worst Case

**TOTAL FLAMMABLE SOIL VAPOUR READINGS
MARKWILL INDUSTRIES
2477 DAY STREET, WPG, MB**

<u>Monitoring Well/ Testhole</u>	Total Flammable Soil Vapour Reading (ppm)	
	<u>TV</u>	<u>NMRR</u>
MW1	40	-
TH2	> 10000	> 10000
TH3	> 10000	> 10000
TH4	90	-
TH5	500	400
TH6	> 10000	> 10000
TH7	120	-
TH8	110	80
TH9	750	650

NOTES:

- TV = Total soil vapour concentration (ppm)
- NMRR = No methane response reading (ppm)

**SOIL SAMPLE TESTING RESULTS
MARKWILL INDUSTRIES
2477 DAY STREET, WINNIPEG, MANITOBA**

*HAZ
WASTE*

○ + Level III

<u>Contaminant</u>	<u>Sample Identification</u>		<u>Manitoba Environment</u>			<u>CCME Comm/Ind</u>
	<u>TH3-6.5'</u>	<u>TH9-5'</u>	<u>Level I</u>	<u>Level II</u>	<u>Level III</u>	
Benzene	16	5.9	0.05	0.5	5.0	5
Toluene	130	27	0.1	3.0	30.0	30
Ethylbenzene	43	25	0.1	5.0	50.0	50
Xylene	200	45	0.1	5.0	50.0	50
Total Volatile Hydrocarbons	1800*	1600*	100	150	800	NS

*Head space
+ 10,000* *900*

NOTES

- All values in ug/g.
- NS - Not Specified
- CCME Comm/Ind - Canadian Council of Ministers of the Environment, Commercial/Industrial criteria
- * - total volatile hydrocarbons measured as gasoline

LEVEL I HIGH SENSITIVITY SITE

LEVEL II MODERATE SENSITIVITY SITE

LEVEL III LOW SENSITIVITY SITE

GEOKWAN ENVIRONMENTAL LTD.

MANTOBA ENVIRONMENT



REMEDICATION OF PETROLEUM STORAGE SITES IN MANTOBA

Table 1

Remediation Criteria for Soil

(all concentrations are in mg/kg)

<u>Parameter</u>	<u>Level I</u>	<u>Level II</u>	<u>Level III</u>
Benzene	0.05	0.5	5.0
Toluene	0.1	3.0	30.0
Ethylbenzene	0.1	5.0	50.0
Xylene	0.1	5.0	50.0
Total Semi-Volatile Hydrocarbons	500	2000	2000
Total Volatile Hydrocarbons	100	150	800
Mineral Oil and Grease	1000	5000	5000
Lead	375	500	1000

LEVEL I HIGH SENSITIVITY SITE

LEVEL II MODERATE SENSITIVITY SITE

LEVEL III LOW SENSITIVITY SITE

**Geokwan
Environmental Ltd**

TITLE

July, 1993 **GUIDELINE**

CCME

Canadian Council of Ministers of the Environment / Le Conseil canadien des ministres de l'environnement

Interim Canadian Environmental Quality Criteria for Contaminated Sites

Table 2
Interim Remediation Criteria For Soil

(all values in ug/g dry weight)

<u>Parameter</u>	<u>Agricultural</u>	<u>Residential/ Parkland</u>	<u>Commercial/ Industrial</u>
Benzene	0.05	0.5	5
Toluene	0.1	3.0	30
Ethylbenzene	0.1	5.0	50
Xylene	0.1	5.0	50
PCBS	0.5	5.0	50
TCE (Trichloroethylene)	0.1	5.0	50
TCA (Trichloroethane)	0.1	5.0	50
PCP (Pentachlorophenol)	0.05	0.5	5
<u>PAHS</u>			
Benzo(a)anthracene	0.1	1	10
Benzo(a)pyrene	0.1	1	10
Naphthalene	0.1	5	50
Phenanthrene	0.1	5	50
Pyrene	0.1	10	100
<u>Heavy Metals</u>			
Chromium, Cr	750	250	800
Lead, Pb	375	500	1000
Mercury, Hg	0.8	2	10
Zinc, Zn	600	500	1500
Cadmium, Cd	3	5	20

**Geokwan
Environmental Ltd**

TITLE:

Report CCME EPC-CS34
September 1991

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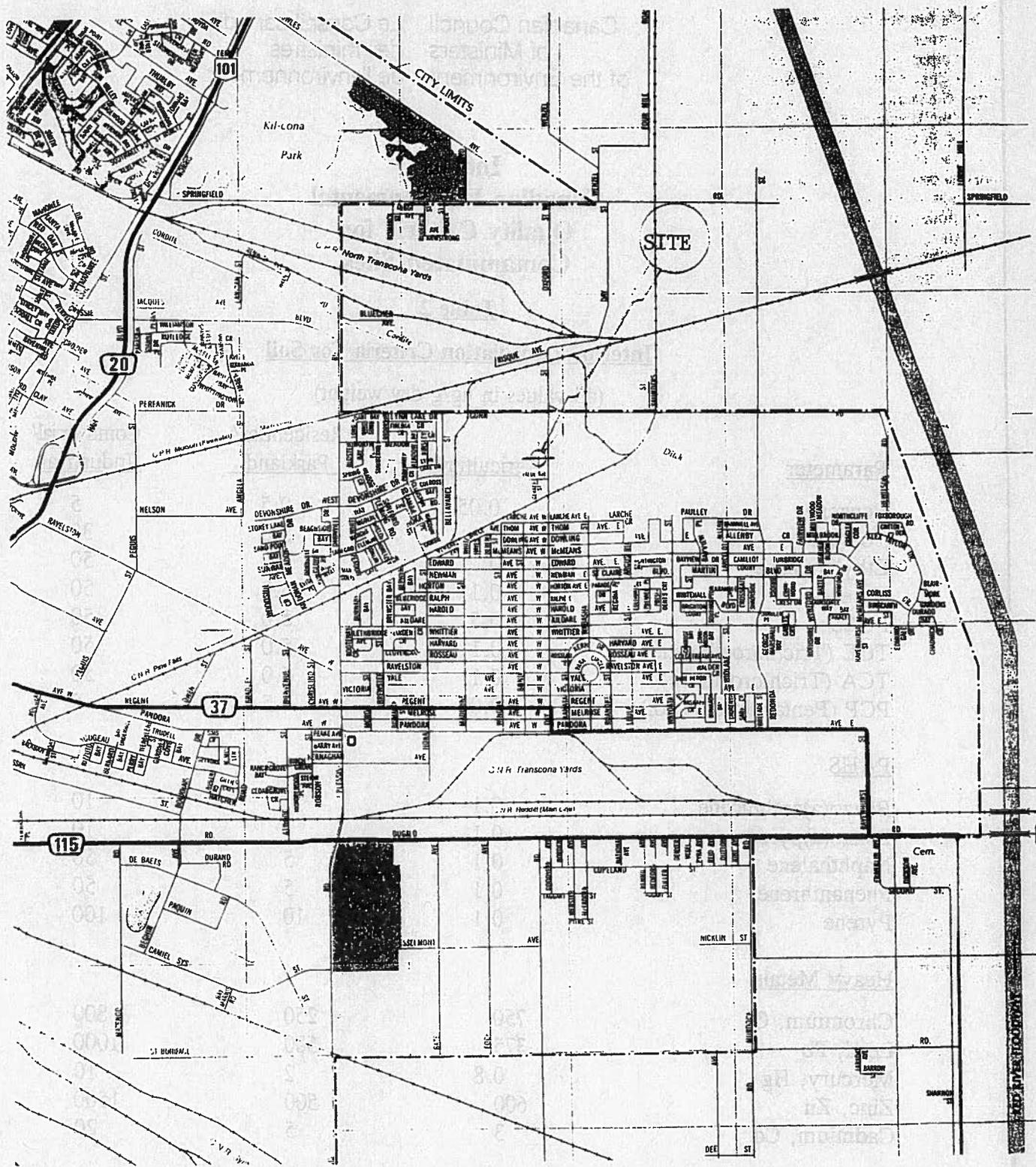
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CHKD.:

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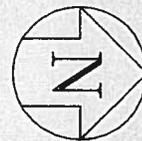
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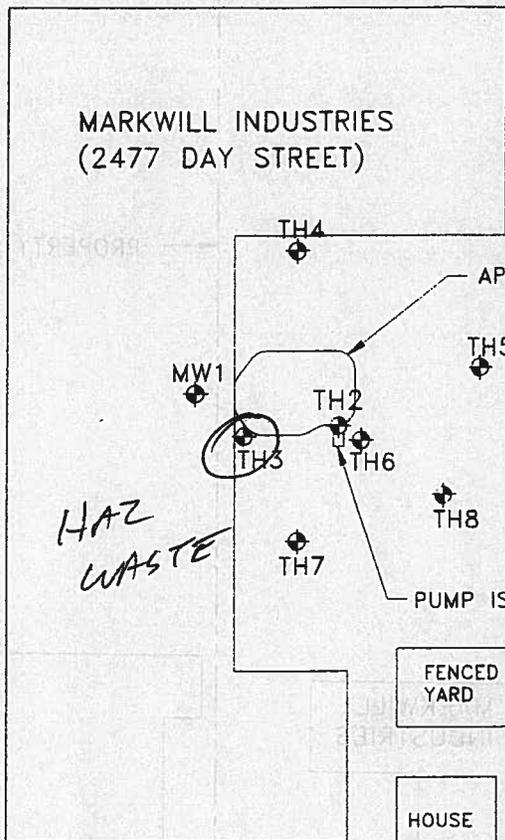
Geokwan Environmental Ltd
WINNIPEG, MANITOBA

TITLE: GENERAL SITE LOCATION
MARKWILL INDUSTRIES
2477 DAY STREET, WPG, MB

SCALE: NTS	DATE: 94/10/07	MADE: MP	CHKD: WK	JOB: E308	PLATE: 1A
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985.2'



PROPERTY LINE
DAY STREET

Geokwan Environmental Ltd
WINNIPEG, MANITOBA

TITLE: TESTHOLE LOCATION PLAN
MARKWILL INDUSTRIES
2477 DAY STREET, WPG, MB

SCALE: 1"=50'

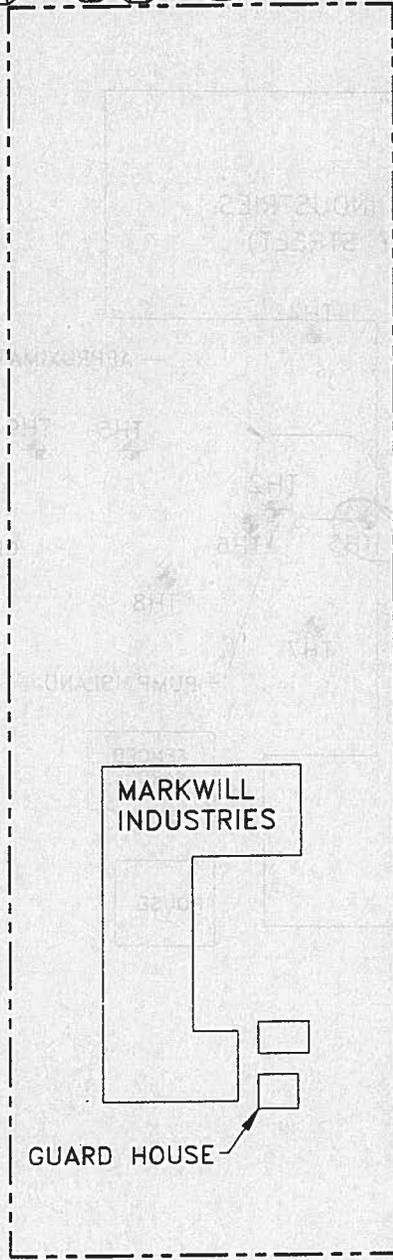
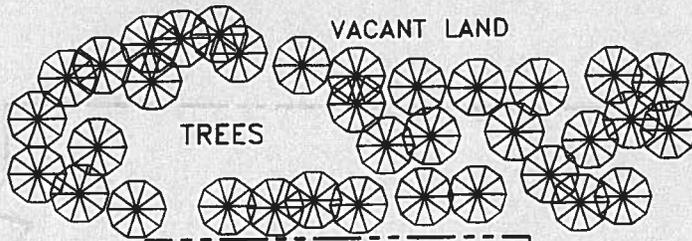
DATE: 94/10/07

MADE: MP

CHKD: WK

JOB: E308

PLATE: 1B



PROPERTY LINE

LIGHT INDUSTRIAL

MARKWILL INDUSTRIES

AEROFOAM

GUARD HOUSE

DAY STREET

OPEN FIELD (BASEBALL DIAMOND)

GRIFFIN STEEL

Geokwan Environmental Ltd
WINNIPEG, MANITOBA

TITLE: PRESENT LAND USE MAP
MARKWILL INDUSTRIES
2477 DAY STREET, WPG, MB

SCALE: 1" = 125'

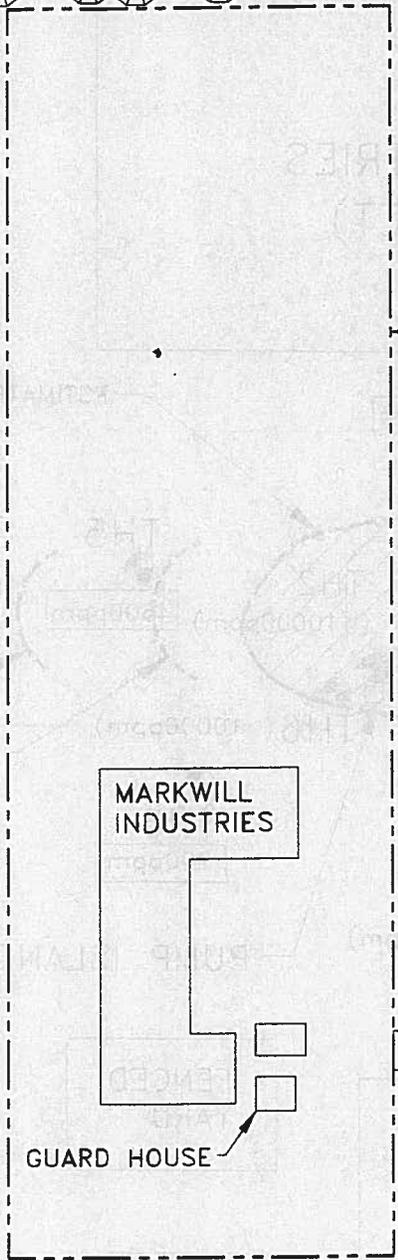
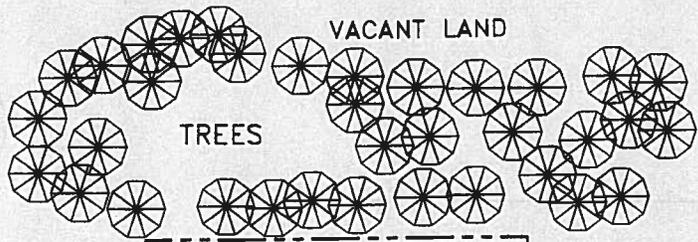
DATE: 94/10/07

MADE: MP

CHKD: WK

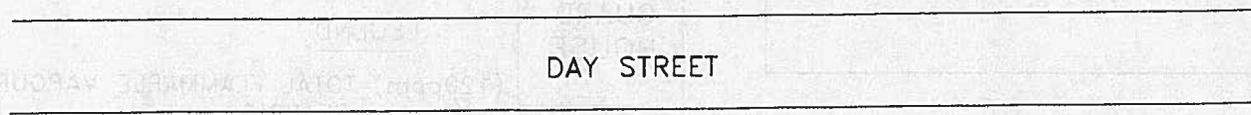
JOB: E308

PLATE: 1C



LIGHT INDUSTRIAL

AEROFOAM



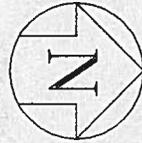
OPEN FIELD (BASEBALL DIAMOND)

GRIFFIN STEEL

Geokwan Environmental Ltd
WINNIPEG, MANITOBA

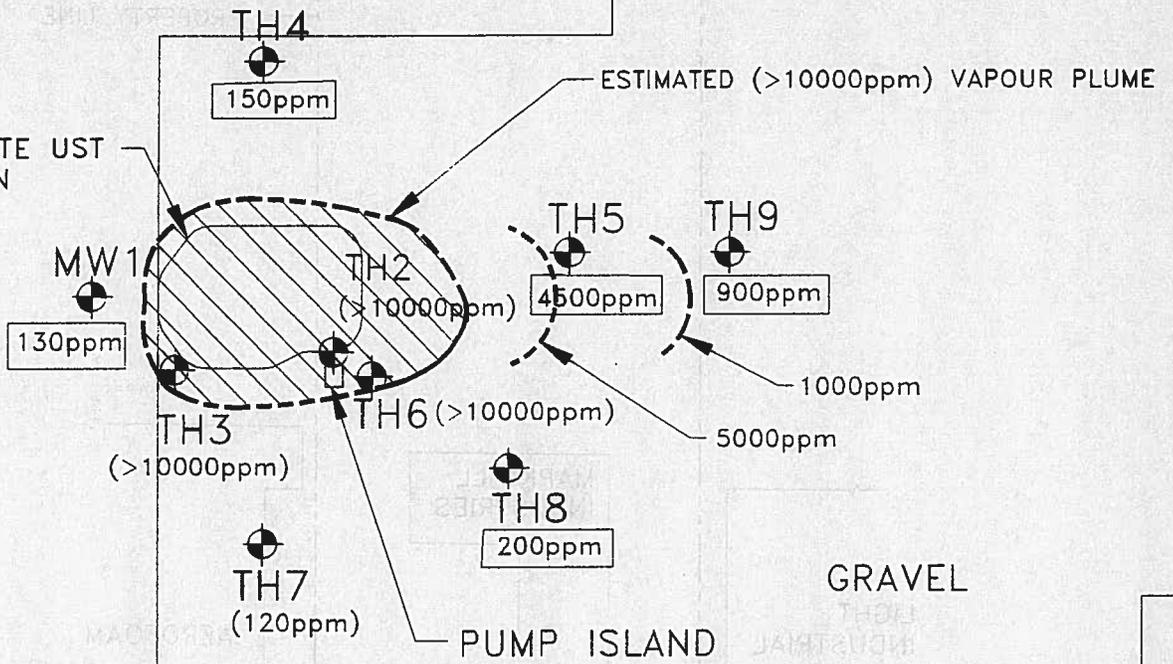
TITLE: PRESENT LAND USE MAP
MARKWILL INDUSTRIES
2477 DAY STREET, WPG, MB

SCALE: 1"=125'	DATE: 94/10/07	MADE: MP	CHKD: WK	JOB: E308	PLATE: 1C
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MARKWILL INDUSTRIES (2477 DAY STREET)

APPROXIMATE UST
EXCAVATION



LEGEND

- (120ppm) TOTAL FLAMMABLE VAPOUR READING
- 900ppm MAX. SOIL (HEADSPACE) VAPOUR READING

NOTE: THIS DRAWING IS REPRESENTATIONAL ONLY.

Geokwan Environmental Ltd
WINNIPEG, MANITOBA

TITLE: AERIAL SOIL VAPOUR
DISTRIBUTION AS OF 94/10/07
2477 DAY STREET, WPG, MB

SCALE: 1"=30'

DATE: 94/10/07

MADE: MP

CHKD: WK

JOB: E308

PLATE: 1D

Monitoring Well No.1

0 - 6.5" CONCRETE
6.5 - 10" FILL - gravelly sand, some cobbles
10 - 2.5' CLAY - black, stiff, fissured, organic
2.5 - 3' SILT - tan, saturated, very soft
3 - 8.5' CLAY - brown, stiff, silt inclusions

Notes:

- 1) Monitoring well installed to 8.38' below grade.
- 2) Water table at 1.98' below grade upon completion of drilling.

Testhole No.2

0 - 1.5' FILL - gravelly sand
1.5 - 7' CLAY - grey, stiff, fissured
- black stains, strong hydrocarbon odor to 6.5'
- brown with silt and gypsum inclusions below 6.5'

End testhole at 7' below grade.

Testhole No.3

0 - 2' FILL - black clay, some sand and gravel
2 - 4.5' CLAY - grey, stiff, fissured
4.5 - 5' CLAY - brown, stiff fissured, silt inclusions
- black stains, strong hydrocarbon odor
5 - 7' SILT - tan, saturated, black stains
- strong hydrocarbon odor
7 - 12.5' CLAY - grey brown, stiff
- moderate hydrocarbon odor to 10'

Notes:

- 1) End testhole at 12.5' below grade.
- 2) Soil caving and water seepage to 5' below grade upon completion of drilling.

Testhole No.4

- 0 - 1' FILL - gravelly sand, some cobbles
- 1 - 1.5' FILL - black clay, some sand and gravel
- 1.5 - 15' CLAY - brown, fissured, stiff
- silt pockets from 6.5' to 7'
- firm below 11'

End testhole at 15' below grade.

Testhole No.5

- 0 - 8" FILL - gravelly sand, some cobbles
- 8 - 3.5' CLAY - black, stiff, fissured, organic
- 3.5 - 5' SILT - tan, saturated, very soft
- moderate hydrocarbon odor
- 5 - 12.5' CLAY - brown, stiff, fissured
- moderate hydrocarbon odor to 11' below grade

End testhole at 12.5' below grade.

Testhole No.6

- 0 - 4" FILL - gravelly sand, some cobbles
- 4 - 1.5' FILL - grey clay, some sand and gravel
- black stains, strong hydrocarbon odor
- 1.5 - 10' CLAY - grey, stiff, fissured
- black stains, strong hydrocarbon odor to 7'
- brown with silt and gypsum inclusions below 7'

End testhole at 10' below grade.

Testhole No.7

- 0 - 3" TOPSOIL
- 3 - 1.75' FILL - black clay, some sand and gravel
- 1.75 - 15' CLAY - grey black, stiff, fissured
- brown below 4'
- silt pockets from 5' to 7'

End testhole at 15' below grade.

Testhole No.8

- 0 - 6" FILL - gravelly sand, some cobbles
- 6 - 1.5' FILL - black clay, some sand and gravel
- 1.5 - 2.5' CLAY - silty, tan, soft
- 2.5 - 12.5' CLAY - brown, stiff, fissured
- silt and gypsum inclusions

End testhole at 12.5' below grade.

Testhole No.9

- 0 - 8" FILL - gravelly sand, some cobbles
- 8 - 2' FILL - black clay, some sand and gravel
- 2 - 12.5' CLAY - brown, stiff, fissured
- silt pockets from 2.5' to 5'
- silt and gypsum inclusions below 5'

End testhole at 12.5' below grade.

*** SUBGROUP 1 is samples 19015 to 19016

ANALYST *PB/pmr*
CHECKED *mf*

Geokwan Environmental Ltd.

1962 PHONED IN.....
SAMPLE PROC.....

Attention: Walter Kwan
Special Instructions: FAX/OCT 17/94
Date Received: 11-Oct-94

P.O. PROJ#E308

dry basis

***** No Other Analytes *****

Sample Client Description
19015 TH 3-6.5' (100) *SOIL*
19016 TH 9-11.5' (9) *SOIL*

ANALYTE	UNITS	ESQUA#	19015	19016
GLC				
Benzene	ug/s	no-val	16	5.9
Ethylbenzene	ug/s	no-val	43	2.5
Gasoline	ug/s	no-val	1800	1600
Toluene	ug/s	no-val	130	27
Xylene	ug/s	no-val	200	45

Post-It Fax Note 7871		Date <i>Oct 17/94</i>	# of pages <i>1</i>
To <i>W. Kwan</i>	From <i>PAT MOSEK</i>		
Co./Dept. <i>Geokwan Env.</i>	Co. <i>SLC</i>		
Phone #	Phone # <i>306 933-5203</i>		
Fax #	Fax # <i>306 933-7922</i>		

Plate 5
Project E308