EXECUTIVE SUMMARY

A Phase II Environmental Assessment was conducted of a transformer oil storage area at an industrial property located at 1995 Logan Avenue, in Winnipeg, Manitoba. This assessment was conducted to determine the extent of possible soil and ground water contamination by transformer oil, and to investigate mitigative measures. In order to derive background information on the site, the findings of a Phase I Audit conducted by ENSIS were reviewed, and historic air photographs were assessed. Further, a tour of the facility was undertaken. Potentially applicable environmental legislation was also reviewed. Borehole drilling, and soil and ground water sampling were conducted at selected locations, to determine whether the soils and shallow ground water have been impacted by transformer oil, and if any potential contaminant concentrations are in compliance with the applicable environmental regulations.

The subject property consists of a main plant/office building on the north side of Logan Avenue, with a parking lot area located immediately west of the plant. The transformer oil storage tank compound is situated at the west side of the plant and comprises four aboveground tanks: two with capacities of 10,000 gallons (45 000 L); one with a capacity of 25,000 gallons (112 000 L); and one with a capacity of 20,000 gallons (90 000 L).

A total of eight boreholes were drilled to depths ranging from 2.1 m to 4.4 m at strategic locations across the site. Four boreholes were drilled inside the oil storage tank compound area and four outside, in the parking lot area.

The drilling program determined that clay fill was found to cover the ground surface to depths of 1 or 2 m, and that the native soils comprise silty clay to a depth of more than 4.4 m below grade.

Soil samples were collected at regular intervals from each of the boreholes and subjected to Petroleum Hydrocarbon vapour analyses. This testing found Petroleum Hydrocarbon vapour concentrations produced by the soils to range from a low of 10 ppm at a depth of 3 m to a maximum of 1000 ppm at a depth of 1 m, at the southeast corner of the tank compound.

Nine soil samples were selected for laboratory analyses of Mineral Oil and Grease (transformer oil) content. The laboratory analyses revealed concentrations of up to 9930 mg/kg or parts per million (ppm) in the soils sampled from the southeast corner of the tank compound. The Manitoba Environment Criterion for maximum allowable Oil and Grease concentrations on industrial property is 5000 ppm.

All boreholes were completed as ground water and hydrocarbon vapour monitoring wells. Subsequent monitoring of these wells found hydrocarbon vapour concentrations of up to 1875 ppm, in the well installed at the southeast corner of the tank farm. Concentrations in excess of 200 ppm are generally indicative of soils contaminated by Petroleum Hydrocarbons.

Perched ground water was found in five wells. Ground water samples were collected from these monitoring wells and submitted for Mineral Oil and Grease content analyses. The laboratory analyses revealed concentrations ranging from nondetectable to 13 ppm, with the highest concentrations being found in the well located in the southeast corner of the tank compound. Manitoba Environment does not have a guideline for maximum allowable Oil and Grease concentrations in ground water. However, Environment Quebec uses a 5 ppm guideline concentration for industrial properties.

Based on the above results, it appears that the southeast portion of the tank compound will require remediation. Further, it is very likely that the contaminated soil and ground water extend east beneath the building.

Remediation of the site would likely require removal of the soil in the southeast portion of the tank compound and treatment of these soils at the Manitoba Hazardous Waste Corporation facility near St. Jean Baptiste, Manitoba. Any ground water pooling in the resulting excavation will also require removal and disposal as a hazardous waste.

In order to properly remediate the site, it would be necessary to remove and rebuild part or all of the storage tank system.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The Wardrop Engineering Study Team acknowledges with appreciation, the contributions of the individuals consulted during the course of this Assessment, particularly:

- Mr. Rod Kakowchyk, Carte International Inc.
- Mr. Harold Bilokrely, Carte International Inc.

We further wish to acknowledge the services of Manitoba Natural Resources, Surveys and Mapping Branch for undertaking the aerial photograph search, Enviro-Test Labs for the analytical work, and Maple Leaf Enterprises for the borehole drilling and monitoring well installations.

STUDY TEAM

The following key personnel were directly involved in this investigation:

- Mr. E.A. Wolowich, P.Eng., Principal, Project Manager
- Mr. J.H. Wong, P.Eng., Project Engineer
- Mr. P.A. Michalchuk, C.E.T, Drilling Technician
- Mr. P.C. Finnbogason, AutoCAD Drafter
- Ms. P.J. Peters, Secretary

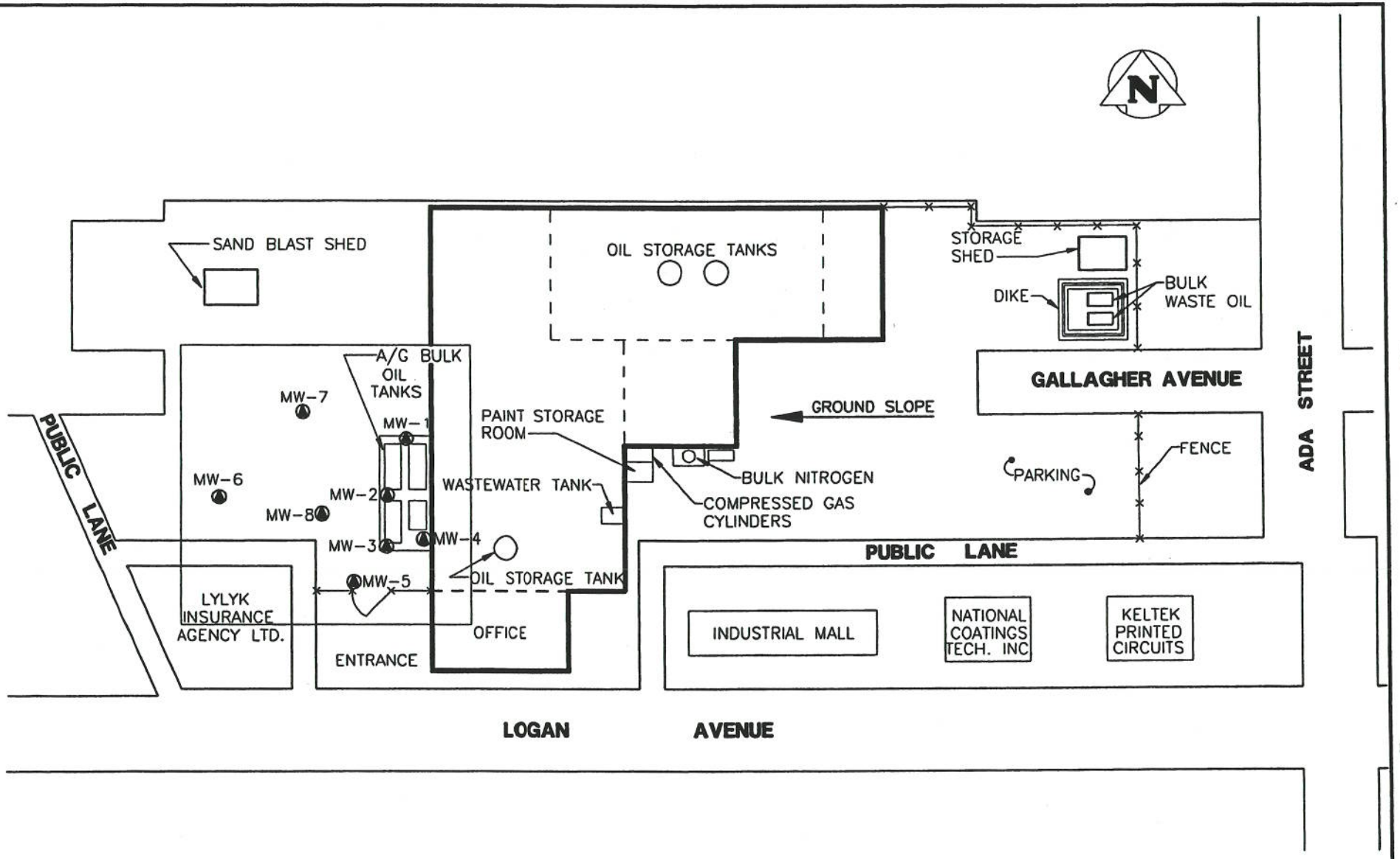
This Wardrop Engineering report has been prepared for Carte International Inc., and its use is governed by the attached Third Party Disclaimer.

1.0 INTRODUCTION

Wardrop Engineering was retained by Carte International Inc. to conduct a Phase II Environmental Assessment of a transformer oil storage tank area at 1995 Logan Avenue, Winnipeg. These investigations were undertaken to determine if there are any environmental concerns regarding the site that would require remedial action, under the applicable Provincial Legislation.

Prior to undertaking the field work, a review of historical records and a site inspection were conducted. The Phase I Audit conducted by ENSIS Corporation Inc. (dated June 1995) was reviewed. This was followed by borehole drilling, soil and ground water sampling, and laboratory and engineering analyses.

Background information, the investigative methodology, and the findings of this assessment are detailed in the following report. A Glossary of Terms is provided as Appendix A.



CARTE-1

CLIENT CARTE INTERNATIONAL INC.

LEGEND

MW-1 ▲ MONITORING WELL

WARDROP ENGINEERING INC. WINNIPEG TORONTO THUNDER BAY

DWG. DESCRIPTION

ENVIRONMENTAL ASSESSMENT
1995 LOGAN AVENUE - WINNIPEG, MANITOBA
SITE PLAN

DESIGNED BY: P.A.M.	DRAWN BY: P.C.F.	DWG. NO.
CHECKED BY: D.B.T.	DATE: 95/10/12	951292-01-00

FIG.1

2.0 BACKGROUND

2.1 PHYSICAL SETTING

The subject property is located at 1995 Logan Avenue, Winnipeg, Manitoba. The property comprises a 87,900 ft^2 (8169 m^2) building (including storage sheds) with a parking area located on the west side. Transformer oil is stored in four aboveground tanks (refitted rail cars) positioned on concrete supports in a gravel-covered, concrete-diked compound. Two tanks have capacities of 10,000 gallons (45 000 L), one of 25,000 gallons (112 500 L), and one of 20,000 gallons (90 000 L).

The property, located on the north side of Logan Avenue, a half block east of Route 90, is surrounded by other commercial/industrial developments. The property is zoned for commercial/industrial use.

A site plan is provided as Figure 1. Colour copies of photographs taken at the site are provided, following the text.

2.2 GEOLOGICAL SETTING

The regional soil stratigraphy of the Winnipeg area generally comprises lake bottom clays and silts above glacial till. The overburden is deposited on predominantly limestone and dolomite bedrock.

Generally, the clays are of low permeability and contain some degree of fracturing. The more permeable silts can contain perched ground water. The glacial till may contain outwash deposits of sand and gravel, which can be water-bearing. The carbonate bedrock is usually fractured and water-bearing. This fractured rock aquifer constitutes the major potable water aquifer in the area; however, this aquifer is used mainly for industrial purposes within the City.

In this area of Winnipeg the clays and minor silts are generally greater than 18 m thick and will contain limited amounts of ground water. The ground water that is contained within these surficial deposits at the transformer oil storage area will likely flow toward subsurface utility corridors or underneath the shop building, which is adjacent to the east side of the transformer oil storage area.

2.3 DATA REVIEW

Since a Phase I Audit of the 1995 Logan Avenue property was conducted by ENSIS in June of 1995, the Phase I Audit activities were not repeated during this investigation. The ENSIS report, however, was obtained from Carte and reviewed to obtain relevant information to assist in the placement of boreholes and monitoring wells.

A site visit was also conducted and historic aerial photographs were reviewed to better understand the areas of concern and potential migration paths for spilled oil.

2.3.1 Spill History

From the site visit and review of the ENSIS report, it was noted that in 1987, a significant spill of about 10,000 gallons (45 000 L) of non-PCB-containing transformer oil occurred. The loss was caused by the end of the northwest tank failing during filling of the tank. The spilled oil was noted to pool in the tank compound. Some of the oil was recovered with sorbet material; however, some oil escaped to a catchbasin in the parking lot immediately west of the tank compound.

Two smaller spills took place on May 8, 1989 (80 L) and August 18, 1989 (25 L). A further spill of 341 L of non-PCB-containing transformer oil was reported to have occurred on December 22, 1993, resulting when a transformer was mishandled during unloading at the main receiving area. The spilled oil was recovered with sorbet material.

The ENSIS report also suggests that oil spills within the plant may have permeated the concrete wall and floor at the west side of the building adjacent to the tank farm, and may have contaminated the subsurface at that location.

2.3.2 Review of Aerial Photographs

Historic aerial photographs were reviewed to identify any areas of excavation and fill or depressions on the property that may locally influence the shallow ground water flow regimen. Aerial photographs as early as circa 1950 were reviewed. This review found no areas of excavation or depressions on the property. However, it appears that the plant and parking lot area were built-up with fill prior to construction.

3.0 PHASE II ASSESSMENT

The Phase II Assessment was undertaken to ultimately determine whether the soils and ground water in the vicinity of the transformer oil storage area have been impacted by non-PCB-containing transformer oil (mineral oil), and if any concentrations present exceed the existing Provincial Department of Environment Guidelines. The Phase II Assessment comprised the following activities:

- sensitivity classification of the subject property;
- borehole drilling and soil sampling;
- combustible soil-gas measurements;
- ground water monitoring well installation and ground water sampling;
- hydrocarbon vapour monitoring; and
- soil and ground water sample analyses.

3.1 SITE SENSITIVITY CLASSIFICATION

In July 1993, Manitoba Environment published "A Guideline for the Environmental Investigation and Remediation of Petroleum Hydrocarbon Storage Sites in Manitoba." This Guideline based remediation requirements on the sensitivity or environmental risk of a given site. This classification system takes into account current and future site use, current and future use of surrounding properties, and the susceptibility of the natural environment to contaminant migration and impact. With this information, a flow chart is used to determine the applicable site remediation criteria.

Manitoba Environment has established three sets of maximum allowable contaminant concentrations in soil. These are identified as Level I, Level II and Level III. Level I is the most stringent (lowest allowable concentrations), while Level III is the least stringent (highest allowable concentrations). The subject site was classified according to this Guideline, to determine the allowable concentrations of Petroleum Hydrocarbons, as well as to determine the appropriate level of site remediation (if excessive contaminant concentrations are present).

The Guideline concentrations are listed below:

Constituent	Soil Criteria (mg/kg)		
	High Risk (Level I)	Medium Risk (Level II)	Low Risk (Level III)
BTEX:			
Benzene	0.05	0.5	**5.0**
Toluene	0.1	3.0	**30.0**
Ethylbenzene	0.1	5.0	**50.0**
Xylenes	0.1	5.0	**50.0**
Total Purgeable Organics (TPO)	100	150	**800**
Total Extractable Hydrocarbons (TEH)	500	2000	**2000**
Mineral Oil and Grease	1000	5000	**5000**
Lead	375	500	**1000**

Based on the Guideline, the "Low Risk, Level III" values would apply to the subject site, since there are no apparent sensitive receptors (e.g., rivers, residences, etc.) in the immediate area. The pertinent criteria are highlighted in the above table in **BOLD** text. Transformer oil would be classified as Mineral Oil and Grease; the 5000 mg/kg guideline would apply. The Manitoba Environment Site Sensitivity Classification Criteria documents are provided in Appendix B.

The Canadian Council of Ministers of the Environment (CCME) have also established a more extensive set of contaminant remediation criteria. These criteria are based mainly on current and proposed site use. Site use has been divided into Agricultural, Residential/Parkland, and Commercial/Industrial. These criteria are provided in the CCME "National Guidelines for Decommissioning Industrial Sites." In the absence of Manitoba Environment criteria for acceptable concentrations of non-Petroleum Hydrocarbon contamination, the CCME criteria are employed. This site would be subject to the commercial/industrial guideline limits.

3.2 BOREHOLE DRILLING PROGRAM AND MONITORING WELL INSTALLATION

A borehole drilling program was designed to assess the presence, severity and extent (if any) of transformer oil introduced into the subsurface soil in the transformer oil storage area. Ground water monitoring wells were installed in each borehole in order to determine the extent (if any) of ground water contamination. The wells also enable monitoring of Petroleum Hydrocarbon vapours emitted by impacted soil or ground water.

Boreholes were strategically positioned at the following locations, as shown on Figure 1:

- Four boreholes within the transformer oil storage compound.
- Four boreholes in the parking lot area adjacent to the oil storage compound.

A total of eight boreholes were drilled to depths ranging from 2.1 m to 4.4 m below grade, on September 18 and 19, 1995. The borehole drilling program was completed by Maple Leaf Enterprises Limited of Winnipeg, using backhoe and truck-mounted drill rigs for monitoring wells installed inside and outside of the oil storage tank compound, respectively. The drill rigs were equipped with 127 mm diameter solid stem, and 400 mm diameter hollow stem auger flights.

All boreholes were completed as ground water and hydrocarbon vapour monitoring wells. The borehole logs are contained in Appendix C.

Each of the monitoring wells was completed with 51 mm diameter PVC casing and screen. A 1.2 m to 2.9 m long slotted section was installed to 0.9 m below grade in all monitoring wells, and the wells extended to the surface with solid casing risers. A clean silica sand pack was placed around the screen section within 0.9 m of grade. A 0.9 m thick bentonite plug was placed above the sand pack around the solid casing risers, to prevent any surface water or contamination from entering the well. Each well was capped with a screw on cap and a protective steel casing was placed around the well, at grade.

TABLE 1

Hydrocarbon Vapour and Water Level Monitoring
Carte International Inc.
1995 Logan Avenue, Winnipeg, Manitoba

Borehole No.	Borehole Elevations	Hydrocarbon Vapour Concentration (ppm)	Free Product Thickness	Water Level (m below top of casing)		Water Elevation (m above datum)	
		Sept. 20/95	Sept. 20/95	Sept. 20/95	Sept. 21/95	Sept. 20/95	Sept. 21/95
BH-1	99.45	405	Nil	1.000	1.048	98.450	98.402
BH-2	99.50	275	Nil	0.958	0.985	98.542	98.515
BH-3	99.49	370	Nil	0.929	0.978	98.561	98.512
BH-4	99.49	1875	Nil	0.908	0.943	98.582	98.547
BH-5	99.31	80	Nil	1.731	0.540	97.579	98.770
BH-6	99.13	905	Nil	Dry	Dry	N.A.	N.A.
BH-7	99.35	405	Nil	Dry	Dry	N.A.	N.A.
BH-8	99.13	380	Nil	Dry	Dry	N.A.	N.A.

Note: ppm = parts per million

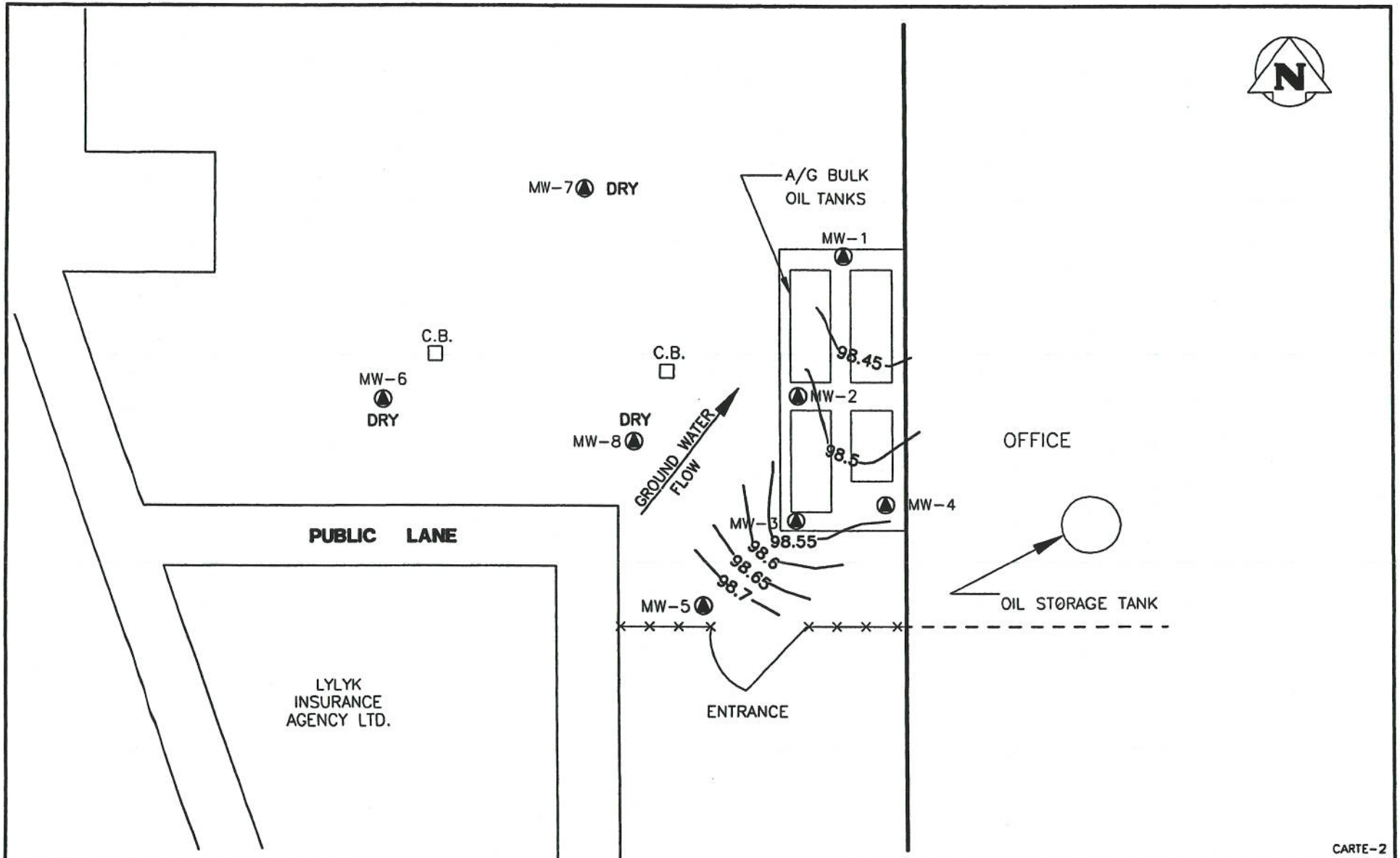
The elevations of the monitoring well casings were determined by surveying with reference to an arbitrary datum. This was completed in order to determine a ground water flow direction. Five of the monitoring wells (BH-1, BH-2, BH-3, BH-4 and BH-5) contained sufficient amounts of water for sampling purposes, and the other three monitoring wells (BH-6, BH-7, and BH-8) did not contain any or sufficient water. The ground water levels were measured on September 20 and September 21, 1995, and the elevations calculated. The ground water elevation data for both dates are presented on Table 1. The September 21 data set was contoured on a site plan presented as Figure 2. It is believed that the water levels had insufficient time to equilibrate when measured on September 20. Ground water appears to be flowing from the tank compound towards and beneath the building.

3.3 COMBUSTIBLE SOIL-GAS MONITORING

In order to obtain a preliminary indication of the presence, severity, and extent of Petroleum Hydrocarbon contamination in the subsurface soils, soil samples were collected for head-space (the air surrounding the soil) combustible vapour concentration measurements. These concentrations were measured using a portable, combustible gas indicator (GMI Gasurveyor IV) calibrated to Hexane (a reference standard used for Petroleum Hydrocarbon detection).

Soils contaminated by hydrocarbon-based compounds may emit combustible vapours. Given the transformer oil spill of eight years ago, Mineral Oil and Grease were expected to be the main potential contaminants in the soil. Mineral Oil is not very volatile and rather low head-space hydrocarbon vapours were expected. Generally, soils are considered contaminated if the head-space combustible vapour concentration produced is greater than 200 ppm for Mineral Oil or diesel fuel. Combustible vapour concentrations below 50 ppm are considered to be "background levels" and can be attributed to hydrogen in water vapour, as well as natural organic soil gases. However, laboratory analyses should be undertaken to confirm any suspected contamination.

If the vapour concentration exceeds 1000 ppm, then the combustible vapour concentration is measured as a percentage of the Lower Explosive Limit (LEL). One percent (1%) LEL is equal to 125 ppm for Hexane. One hundred percent (100%) LEL or 12 500 ppm is the concentration at which Hexane vapours could ignite when exposed to a spark or flame.



LEGEND

MW-1 ▲ MONITORING WELL

C.B. □ CATCHBASIN (LOCATION APPROX.)

-98.65- GROUND WATER ELEVATION (m ABOVE DATUM)

0 8 16
METRES

WARDROP ENGINEERING INC.
WINNIPEG TORONTO THUNDER BAY

CLIENT
CARTE International Inc. CARTE INTERNATIONAL INC.

DWG. DESCRIPTION
ENVIRONMENTAL ASSESSMENT
1995 LOGAN AVENUE - WINNIPEG, MANITOBA
PARTIAL SITE PLAN SHOWING GROUND WATER ELEVATIONS - SEPTEMBER 21, 1995

DESIGNED BY:	P.A.M.	DRAWN BY:	P.C.F.	DWG. NO.	FIG.2
CHECKED BY:	D.B.T.	DATE:	95/10/12	951292-01-00	

Head-space combustible vapour concentrations were measured by sampling the air space around each soil sample contained in a plastic sampling bag. Once the soil sample was placed in the bag, the bag was sealed and the sample set aside until it reached ambient temperature. Prior to taking each measurement, the soil sample was disturbed, which allows for movement of the air from within the soil pore spaces into the bag. The combustible gas indicator probe was then inserted into the bag to sample the air and measure the concentration.

Hydrocarbon vapour concentrations were measured in soil samples from all of the eight boreholes at the site. Samples were collected at a depth of 0.75 m below grade, and periodically (about every 0.75 m) until the bottom of each borehole. The results of the combustible soil-gas measurements are presented is Section 4.2 and contained with the graphical borehole logs in Appendix C.

3.4 HYDROCARBON VAPOUR MONITORING

Hydrocarbon vapour concentrations were also measured in each completed monitoring well on September 20, 1995. The hydrocarbon vapour monitoring was carried out by inserting the sampling probe of the combustible gas indicator into the monitoring well. The results of the hydrocarbon vapour monitoring are presented in Section 4.3.

3.5 SOIL SAMPLING

During the drilling of the eight boreholes, the soils encountered were logged according to the Unified Soil Classification (USC) system. Abnormalous odours and appearances, sample depth, and combustible gas concentrations were also documented. Soil samples were obtained by using the split-spoon sampler or removed from the base of the auger flights at intervals ranging from 0.15 to 0.75 m, at stratigraphic boundaries, and at any apparent zones of contamination. The samples were trimmed with a stainless steel blade to remove any soil that may have been in contact with the borehole walls or the auger flights. The soils were placed in laboratory supplied sampling jars and placed in a cooler. Duplicate samples were placed in sterilized sampling bags, for head-space combustible vapour concentration measurements. All samples were handled with clean, disposable, PVC gloves, to avoid cross-contamination.

Selected soil samples, based on the visual staining and head-space vapour concentrations, were submitted to Enviro-Test Labs in Edmonton, for laboratory analyses. The additional soil samples collected in glass jars and not submitted to the laboratory, were placed in freezer storage for possible future analyses.

The soil samples were analyzed for Mineral Oil and Grease by solvent extraction and Infrared Spectroscopy method.

The results of the laboratory analyses are presented and discussed in Section 4.4.

3.6 GROUND WATER SAMPLING

Ground water samples were collected from Monitoring Wells BH-1, BH-2, BH-3, BH-4, and BH-5 on September 21, 1995, three days after the installation of the wells. The remaining wells were dry or did not contain sufficient water for sampling purposes.

Prior to sampling, the monitoring wells were bailed dry and allowed to recharge for 24 hours prior to sample collection, to ensure that the samples were representative of the ground water in the water-bearing zone. The dewatering and sample collection was performed using precleaned, dedicated bailers. As with the soil samples, the ground water samples collected from BH-1, BH-2, BH-3, BH-4, and BH-5 were submitted to Enviro-Test Labs for Mineral Oil and Grease analyses.

The results of the ground water analyses are presented in Section 4.5.

4.0 PHASE II RESULTS

4.1 DRILLING OBSERVATIONS

During the drilling program, the soil samples collected were observed for any abnormalities in odour, staining, and composition. The following observations were noted.

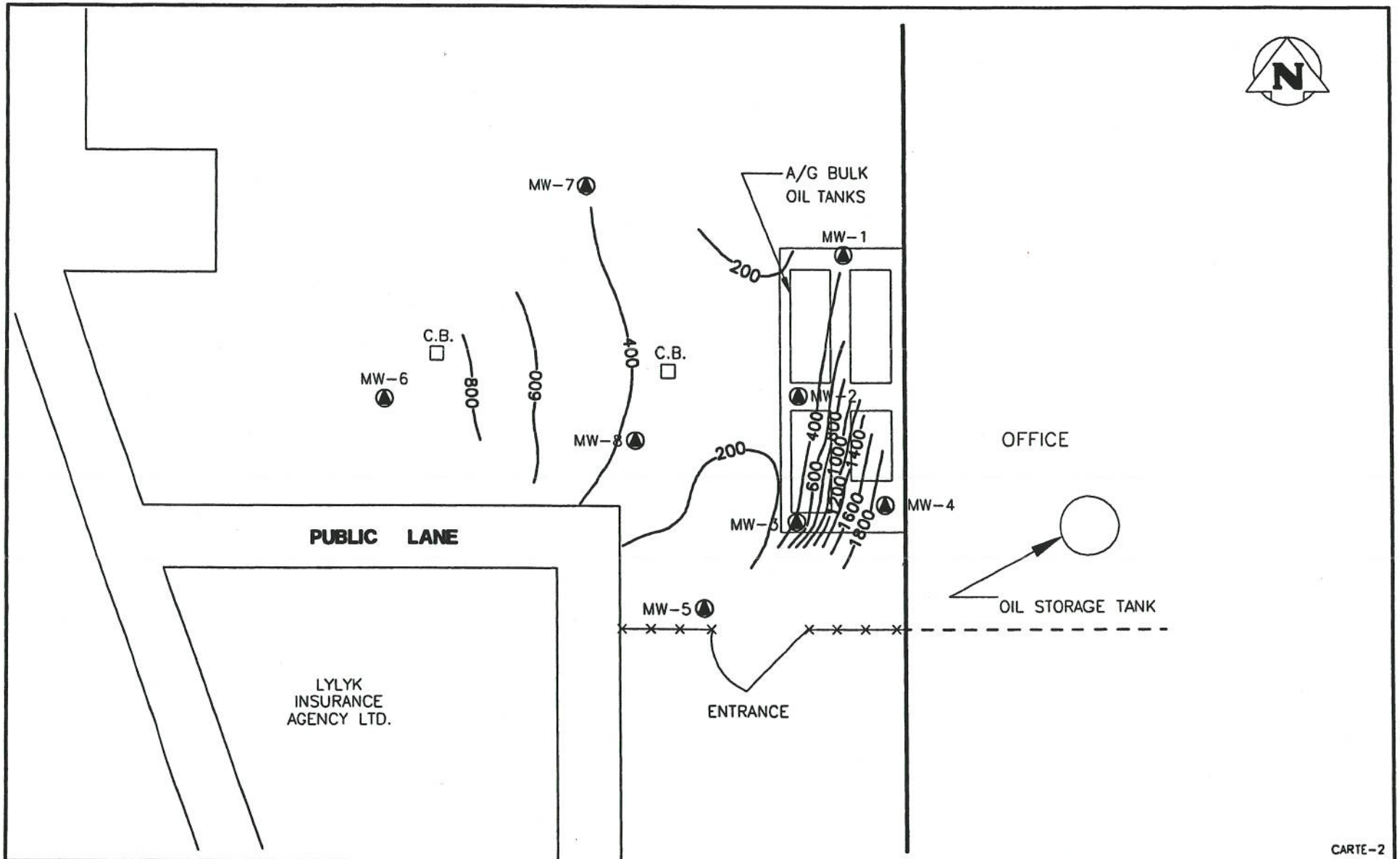
- BH-1: Oil stained from grade to 0.2 m, petroleum odour from 0.2 to 2.1 m, strongest at 0.8 to 0.9 m.
- BH-2: Oil stained from grade to 0.2 m, petroleum odour from 0.2 to 0.9 m and 2.3 to 3.7 m.
- BH-3: Oil stained from grade to 0.2 m, petroleum odour from 0.2 to 1.8 m.
- BH-4: Oil stained from grade to 0.2 m, petroleum odour from 0.2 to 2.3 m.
- BH-5: Petroleum odour from 0.3 to 0.9 m.

The borehole logs are presented as Appendix C.

4.2 COMBUSTIBLE SOIL-GAS CONCENTRATIONS

Hydrocarbon vapour concentrations were measured in the soil samples retrieved from the eight boreholes. The hydrocarbon vapour concentrations emitted by the soil samples ranged from less than 10 ppm to 1000 ppm, with the highest concentrations found in the soil sampled form BH-4, located in the southeast corner of the tank compound at a depth of 1 m.

These results are presented graphically with the Borehole Logs, contained in Appendix C.


N
MW-7
A/G BULK
OIL TANKS
MW-1
200
C.B.
C.B.
MW-6
800
600
400
MW-2
MW-8
200
400
600
800
1000
1200
1400
1600
1800
OFFICE
MW-4
MW-3
PUBLIC LANE
MW-5
OIL STORAGE TANK
LYLYK
INSURANCE
AGENCY LTD.
ENTRANCE
CARTE-2
LEGEND
MW-1
MONITORING WELL
C.B.
CATCHBASIN (LOCATION APPROX.)
600
HYDROCARBON VAPOUR
CONCENTRATION (ppm)
ppm = PARTS PER MILLION
0
8
16
METRES
WARDROP ENGINEERING INC.
WINNIPEG TORONTO THUNDER BAY
CLIENT
CARTE International Inc.
CARTE INTERNATIONAL INC.
DWG. DESCRIPTION
ENVIRONMENTAL ASSESSMENT
1995 LOGAN AVENUE - WINNIPEG, MANITOBA
PARTIAL SITE PLAN SHOWING HYDROCARBON VAPOUR
CONCENTRATIONS (ppm) - SEPTEMBER 20, 1995
DESIGNED BY: P.A.M.
DRAWN BY: P.C.F.
CHECKED BY: D.B.T.
DATE: 95/10/12
DWG. NO.
951292-01-00
FIG.3

4.3 HYDROCARBON VAPOUR MONITORING

Hydrocarbon vapour concentrations measured in the eight monitoring wells produced concentrations of 80 to 1875 ppm, with the highest concentrations found in the monitoring well installed in BH-4. The hydrocarbon vapour concentrations detected on September 20, 1995, are presented in Table 1. The higher concentrations are likely due to the presence of Mineral Oil and Grease in the soil within the transformer oil storage tank area. The concentrations are contoured on a site plan, presented as Figure 3.

4.4 SOIL SAMPLE ANALYSES

The soil sample analytical results for Mineral Oil and Grease are compared to the applicable Manitoba Environment Guideline in Table 2. The concentrations have been contoured on a site plan presented as Figure 4. The laboratory's reports, which include the quality control data, are provided in Appendix D.

The results of these soil sample analyses disclosed Mineral Oil and Grease concentrations of up to 9930 mg/kg, with the highest concentration detected in a soil sample collected from borehole BH-4, located in the southeast portion of the tank compound.

The concentrations present in the soil samples from BH-4 are in excess of the applicable Manitoba Environment Level III Remediation Criteria. The remaining soil samples in all of the other boreholes produced Mineral Oil and Grease concentrations below the Guideline limit of 5000 mg/kg.

4.5 GROUND WATER ANALYSES

The ground water sample results for Mineral Oil and Grease are presented in Table 3. There are no applicable guidelines for Mineral Oil and Grease in ground water in Manitoba. However, for comparison, Quebec stipulates a maximum concentration of 5 mg/L for industrial property.

TABLE 2

Soil Sample Analyses
Carte International Inc.
1995 Logan Avenue, Winnipeg, Manitoba

Parameter	Soil Sample Concentration (mg/kg)								Manitoba Environment Low Risk (Level III)[1]
	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	
Mineral Oil & Grease	1500	1720	556	8340/9930[2]	<100	1320	950	719	5000

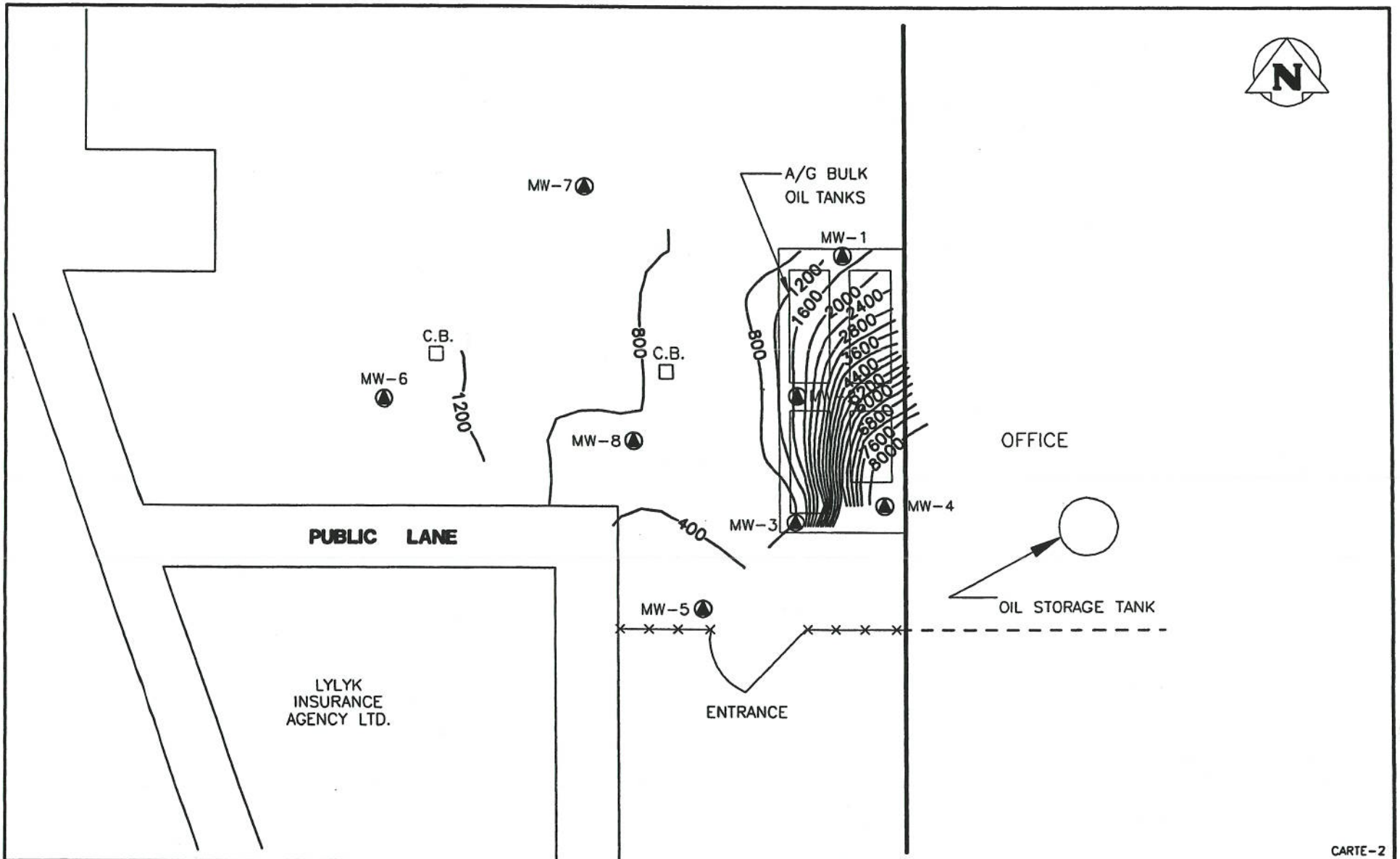
Note: [1]Manitoba Environment "A Guideline for the Environmental Investigation and Remediation of Petroleum Hydrocarbon Storage Sites in Manitoba," July 1993.
[2]Duplicate sample taken.

TABLE 3

Ground Water Sample Analyses
Carte International Inc.
1995 Logan Avenue, Winnipeg, Manitoba

Parameter	Ground Water Sample Concentration (mg/L)								Field Blank	Quebec[1] Criteria (mg/L)
	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8		
Mineral Oil & Grease	3	<1	<1	13/8[2]	<1	Not Sampled	Not Sampled	Not Sampled	<1	5

Note: [1]Environment Quebec Contaminated Site Rehabilitation Policy, February 1980, Level C
[2]Duplicate sample
< = less than



LEGEND

MW-1 ▲ MONITORING WELL

C.B. □ CATCHBASIN (LOCATION APPROX.)

—800— OIL AND GREASE CONCENTRATION IN SOIL (ppm)

ppm = PARTS PER MILLION

0 8 16
METRES

WARDROP ENGINEERING INC.
WINNIPEG TORONTO THUNDER BAY

CLIENT: CARTE International Inc. — CARTE INTERNATIONAL INC.

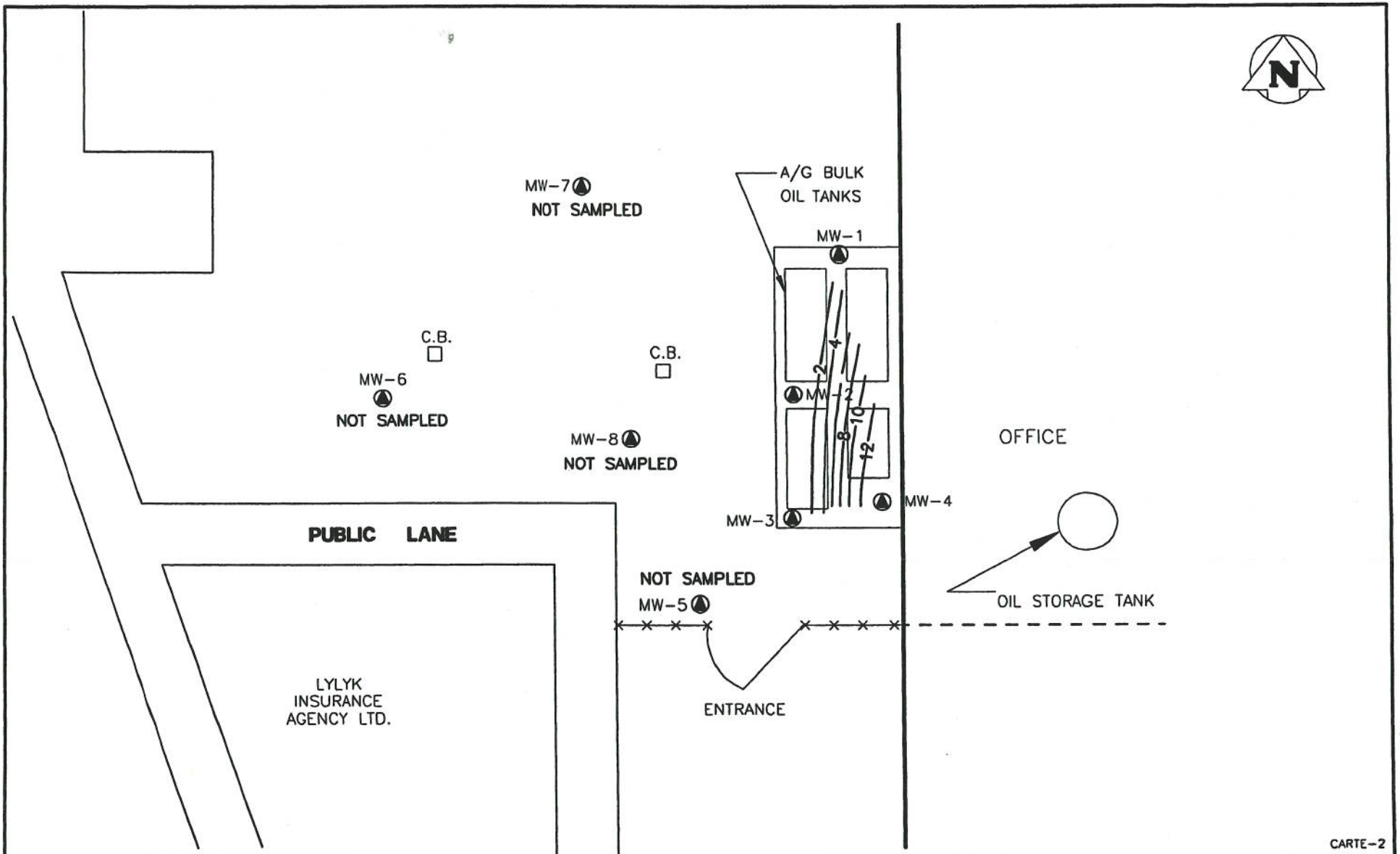
DWG. DESCRIPTION

ENVIRONMENTAL ASSESSMENT
1995 LOGAN AVENUE - WINNIPEG, MANITOBA
OIL AND GREASE CONCENTRATIONS IN SOIL (ppm)

DESIGNED BY:	P.A.M.	DRAWN BY:	P.C.F.	DWG. NO.	FIG. 4
CHECKED BY:	D.B.T.	DATE:	95/10/12	951292-01-00	

The results of these analyses disclosed concentrations ranging from nondetectable in the parking lot area to 13 mg/L in the southeast corner of the transformer oil storage tank area (i.e., in the sample collected from BH-4). The concentrations are contoured on a site plan presented as Figure 5.

The laboratory's report, which include the quality control data, are provided in Appendix D.



CARTE-2

LEGEND

MW-1 ▲ MONITORING WELL

C.B. □ CATCHBASIN (LOCATION APPROX.)

-10- OIL AND GREASE CONCENTRATION IN WATER (ppm)

ppm = PARTS PER MILLION

0 8 16

METRES

WARDROP ENGINEERING INC.
WINNIPEG TORONTO THUNDER BAY

CLIENT

CARTE International Inc. CARTE INTERNATIONAL INC.

DWG. DESCRIPTION

ENVIRONMENTAL ASSESSMENT
1995 LOGAN AVENUE - WINNIPEG, MANITOBA
OIL AND GREASE CONCENTRATIONS IN GROUND WATER (ppm)

DESIGNED BY:	P.A.M.	DRAWN BY:	P.C.F.	DWG. NO.	FIG. 5
CHECKED BY:	D.B.T.	DATE:	95/10/12	951292-01-00	

5.0 DISCUSSIONS

The results of the Phase II Assessment indicate that the southeast corner of the tank compound has been adversely impacted by Mineral Oil and Grease. The elevated Mineral Oil and Grease concentrations is likely the result of the 1993 spill of 45 000 L, that occurred within the tank compound. The oil likely pooled in the southeast corner of the compound where it infiltrated the soil and impacted the shallow ground water.

The Mineral Oil and Grease concentrations within the southeast corner of the compound are in the order of twice the acceptable concentration of 5000 mg/kg, as dictated by Manitoba Environment. Elevated concentrations exist throughout the remainder of the compound, but the concentrations are generally between 1000 and 2000 mg/kg, well below the Manitoba Environment Criteria. The parking lot area produced soils that do not appear to have been significantly impacted by the transformer oil, with the exception of an elevated concentration of 1320 mg/kg in a soil sample collected from BH-6, 26.5 m west of the tank compound. This location is down gradient from the compound and near the catchbasin, which apparently some of the oil entered.

The ground water within the tank compound produced maximum Mineral Oil and Grease concentrations of 13 mg/L which compares to the Quebec maximum acceptable concentration of 5 mg/L for commercial/industrial property. The highest concentrations are again located in the ground water beneath the southeast corner of the tank compound. Concentrations north and west of that area dissipate sharply. However, elevated concentrations may be present beneath the building.

The ground water flow regime would suggest that the contaminant was carried eastward beneath the building. Further investigations are required to determine the concentrations beneath the building and the resulting impact on the environment.

According to the Manitoba Environment Guideline, the soils within the southeast corner of the tank compound will require remediation. Since Mineral Oil and Grease is not very volatile, the most effective means of remediating the site would be the removal (i.e., excavation) of the impacted soils. The soils can be treated at the Manitoba Hazardous Waste facility near St. Jean Baptiste, Manitoba. Once the impacted soils have been removed, contaminated ground water may drain into the excavation from the remainder of the compound and from beneath the building. This should be accommodated by allowing the excavation to remain open for a few days. The accumulated water could then be removed by suction truck and properly disposed of. The excavated area should then be lined to prevent further migration of any contaminants, then backfilled.

In order to properly remediate the affected soils, consideration should be given to dismantling and rebuilding part or all of the oil storage tank system. In particular, Tank 1 and its accompanying foundation should be removed, the soils beneath it excavated and backfilled, and then the same tank (or a new tank) reinstalled on a liner.

6.0 CONCLUSIONS

- Based on the Manitoba Environment Site Sensitivity Classification Criteria, the "Level III Low Risk" Guideline Criteria would apply for maximum acceptable Petroleum Hydrocarbon concentrations in the soil at the subject property.

- The soil sample analytical results revealed concentrations of Mineral Oil and Grease above the applicable remediation criteria, in the southeast corner of the tank compound.

- Based on the Quebec Guideline, the analytical results for the ground water disclosed concentrations of Mineral Oil and Grease that may pose an environmental concern if allowed to migrate off-site.

- The extent of the contaminated soil and ground water appear to include an area beneath the building, directly east of the transformer oil storage area.

- According to the applicable Manitoba Environment Guideline, soil remediation will be required, comprising removal of the affected soils in the southeast corner of the tank area.

7.0 RECOMMENDATIONS

- The impacted soils should be removed by excavating and shipped to the Manitoba Hazardous Waste Treatment facility located near St. Jean Baptiste.

- Part or all of the transformer oil storage compound should be dismantled and properly reconstructed to facilitate excavation of the contaminated soils.

- The potential of contamination beneath the building adjacent to the storage tank area should be further investigated, by drilling through the floor slab and sampling the soils beneath.

- Manitoba Environment should be made aware of these findings, and remediation requirements discussed with them, prior to conducting any further work including remediation.

8.0 LIMITATIONS

The scope of this assessment is limited to the matters expressly covered and is intended solely for the client to whom it is addressed. Wardrop makes no warranties, expressed or implied, including without limitation, as to the marketability of the site, or fitness for a particular use. The assessment was conducted using standard engineering and scientific judgement, principles and practices. Except as provided, Wardrop has made no independent investigations to verify the accuracy or completeness of the information obtained from secondary sources or personal interviews. This assessment is based on a limited amount of data (e.g., the number of boreholes drilled and the number of soil samples submitted for laboratory analyses), and actual site conditions (e.g., the type, level, and extent of any subsurface contamination) on the property may vary from that described in this report. Any findings regarding site conditions different from those described in this report, upon which our conclusions and recommendations are based, will consequently change our conclusions and recommendations.

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Manitoba Environment, Dangerous Goods Handling and Transportation Act (R.S.M. 1987, c. D12).

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PHOTOGRAPHS

Photo 1 - View of tank compound lookinh northeast. MW-1 is located at south end of Tank 2. MW-4 is located at southeast corner of compound, at right of photograph.

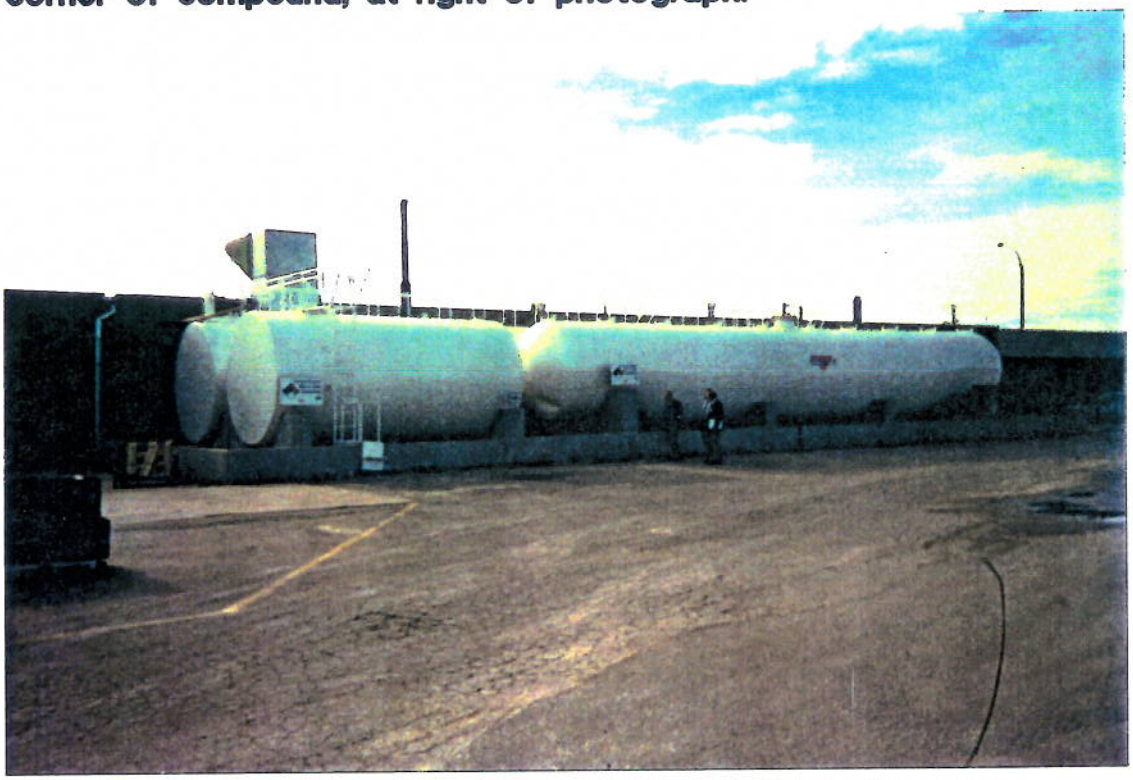

Photo 2 - View of tank compound looking east-southeast. Failure of small tank in foreground (left) occurred in December, 1987.

Photo 3 - View of tank compound and parking lot to the west of tank compound, looking southeast.

Photo 4 - View of tank compound and parking lot area looking south. Note location of catchbasin (pooling water) in centre of photo between tanks and cars.

Photo 5 - View of southeast corner of tank compound looking north. MW-4 is located at bottom right corner of photo, at base of Tank 1. Note oil-stained gravel.

APPENDICES