TYPE A CLOSURE REPORT
FOR AN UNDERGROUND STORAGE TANK WASTE OIL RELEASE
ANN ARBOR CITY GARAGE
721 NORTH MAIN STREET
ANN ARBOR, MICHIGAN 48104

April 7, 1992

Submitted to:

Michigan Department of Natural Resources
Environmental Response Division
Jackson District Office
301 East Louis Glick Highway
Jackson, MI 49201

Prepared for:

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1.0 INTRODUCTION

The following report summarizes the tank removal project activities conducted at the City of Ann Arbor City Garage, including details regarding the tank removal, excavation of impacted soil, and analytical results of soil samples. The report also includes the results of a background metals investigation conducted at the site. The report contains documentation including the tank disposal receipt, soil boring logs, analytical laboratory reports and manifests for soil disposal. The site is located at 721 North Main Street in Ann Arbor and is used as a base for the City of Ann Arbor's street maintenance and solid waste departments.

The 20-day report detailing initial abatement actions, prepared by The Traverse Group, Inc. (TGI), was submitted to the Michigan Department of Natural Resources (MDNR) Jackson District office on November 6, 1991. The 45-day report including the *Site Characterization Report and Site Investigation Work Plan* was submitted to the MDNR Jackson District office on December 5, 1991. Based on the results of the activities performed to date at this site, TGI, on behalf of the City of Ann Arbor, is applying for type A closure per Rule 707 of the Michigan Environmental Response Act (MERA, 1982 PA307, as amended), where the target contaminant levels are based on method detection limits promulgated by the MDNR.

2.0 CHRONOLOGICAL ORDER OF CLOSURE ACTIVITIES

The following sections summarize abatement actions and remedial activities leading to this request for closure, and are presented in a chronological order.

2.1 <u>October 15, 1991 - Removal of Waste Oil Tank</u>

On October 15, 1991, a 500 gallon bare steel waste oil underground storage tank (UST) was removed from the ground at the City Garage site by Carlo Environmental Technologies, Incorporated (CET) of Mt. Clemens, Michigan, and supervised by TGI. Prior to removal, the tank was pumped dry of contents. A large hole was cut into the tank to render it useless. The tank interior was then cleaned with a pressurized water system and all rinseate and tank sludge were containerized for proper disposal. After cleaning, a hole measuring approximately 2-inches long by 0.5-inches wide was found in the side of the tank.

This hole was not apparent prior to pressure cleaning the tank's interior with water. Pressure cleaning may have caused the hole or enlarged a smaller hole. Soils in the tank pit did not exhibit any visual or olfactory signs of being impacted by a release of waste oil.

The cleaned tank was flattened by mechanical means and transferred to a local metals recycling center. The tank disposal receipt is included as Appendix A, page A-1.

2.2 October 15, 1991 - Collection of Site Assessment Soil Samples

Soil samples were collected from the floor of the excavation beneath each end of the tank. One soil sample was also collected beneath the underground piping connected to the tank. Prior to collection of soil samples to be submitted to the analytical laboratory, separate soil samples from the same locations were collected and field screened with an organic vapor meter (OVM) equipped with a photo ionization detector (PID). The field screening process as well as olfactory and visual observations did not indicate that a release had occurred. Samples were collected in sterile sample jars supplied by the analytical laboratory. Immediately upon collection, samples were placed on ice in a cooler. Soil samples were submitted for polynuclear aromatics (PNAs) analysis to Environmental Quality Laboratories in Sterling Heights, Michigan. Proper chain of custody procedures were followed.

Results of analysis showed that the samples collected from the east floor and west floor of the excavation contained elevated levels of PNAs. Analytical reports are found in Appendix C, pages C-1 through C-4. Results of the initial sampling and analytical results are summarized in the following table:

Table 1.
Initial Sampling Field Screening and Analytical Results

Sample Description	Depth Below Grade (feet)	OVM Reading	Total PNA Concentration
CG101 East Floor	5.5	0.0 ppm	1.45 ppm
CG102 West Floor	5.5	0.0 ppm	0.45 ppm
CG103 Piping	2.0	0.0 ppm	Non-detect

ppm: parts per million
note: Non-detect for PNAs is <0.30 parts per million

2.3 October 24, 1991 - Soil Excavation and Disposal

Twenty-eight (28) cubic yards of hydrocarbon impacted soil were excavated, transported and properly disposed of at the City of Ann Arbor Sanitary Landfill by CET and supervised by TGI. Soil disposal receipts have been included in Appendix B, page B-1. After the excavation, the pit measured approximately 10 feet (north/south) by 16 feet (east/west) by 6 feet (depth).

At the conclusion of the excavation operation, samples from the walls and floor of the excavation were field screened with an OVM. Field screening, as well as visual and olfactory observations did not show any signs of waste oil-impacted soil. Verification samples were collected from the east and west floor, and north, south, east and west walls. The samples were placed in sterile sample jars supplied by the analytical laboratory. The samples were stored on ice following collection and during transportation. Standard chain-of-custody procedures were followed. The samples were submitted to Environmental Quality Laboratories for analysis of benzene, toluene, ethylbenzene and xylenes (BTEX) and PNAs. These analyses were performed by methods outlined in the MDNR draft document "*Recommended Parameters, Analytical Methods, and Detection Levels at Lust Sites*" dated April, 1991. Specifically, soil samples were analyzed for BTEX by EPA methods 8020/5030. Soil samples were analyzed for PNAs using EPA Method 8310.

Analytical results of soil samples collected on October 24, 1991 indicated that elevated levels of PNAs above the MDNR recommended detection limit of 330 parts per billion (ppb) existed along the west floor, and the east and north walls of the excavation pit. Based on the results of the verification samples, it was determined that additional excavation of hydrocarbon impacted soils at the site would be necessary to fully remediate the residual hydrocarbon impacted soil. Analytical results from the excavation are contained in Appendix C, pages C-5 thru C-17 of this report. The results of the October 24, 1991 field screening and analytical results are summarized in the following table:

Table 2.
Field Screening and Analytical Results
from October 24, 1991 Sampling Event

Sample Description	OVM Reading (parts per million)	Total PNA Concentration (parts per million)	Total BTEX Concentration (parts per million)
CG 201 East Floor	0.0	Non-detect	Non-detect
CG 202 West Floor	0.0	2.07	Non-detect
CG 203 East Wall	0.0	14.08	Non-detect
CG 204 West Wall	0.0	Non-detect	Non-detect
CG 205 North Wall	0.0	2.89	Non-detect
CG 206 South Wall	0.0	Non-detect	Non-detect

note: Non-detect for PNAs is <0.30 parts per million
Non-detect for BTEX is <0.01 parts per million

2.4 November 6, 1991 - Additional Analytical Data

A request for polychlorinated biphenyls (PCBs) and cadmium, chromium, and lead analysis for the east floor, and west and south wall samples that were collected on October 24, 1991 was made to Environmental Quality Laboratories to comply with the MDNR soil sampling guidelines regarding a confirmed release from a waste oil UST system. Analytical results of these samples reveal that PCB levels are below the MDNR recommended detection limit of 0.033 parts per million. Detectable levels of cadmium, chromium, and lead were reported in all three (3) samples submitted for analyses. Analytical reports can be found in Appendix C, pages C-18 thru C-24. Analytical results are summarized below:

Table 3.
October 24, 1991 Sampling Event
Analytical Data for Cadmium, Chromium, Lead and PCBs

Location	Cadmium (parts per million)	Chromium (parts per million)	Lead (parts per million)	PCBs (parts per million)
East Floor CG-201	0.33	6.6	45.2	ND
West Wall CG-204	0.054	6.5	3.6	ND
South Wall CG-206	0.052	6.6	6.2	ND

note: Non-detect for PCBs is <0.033 parts per million

2.5 November 8, 1991 - Soil Excavation and Disposal

Additional hydrocarbon impacted soil was excavated, transported and disposed of in the City of Ann Arbor Sanitary Landfill by CET under TGI's supervision. A total of 45 cubic yards of soil was removed from the excavation pit from the areas that the previous verification samples indicated as containing residual hydrocarbons. As of November 8, 1991, 73 cubic yards of soil had been removed from the waste oil tank area.

At the conclusion of the excavation operation, verification samples were collected from the west floor, and north and east walls. The samples were placed in sterile sample

jars supplied by the analytical laboratory. The samples were stored on ice upon collection and during transportation. Standard chain of custody procedures were followed. The samples were submitted to Environmental Quality Laboratories for BTEX, PNA, cadmium, chromium, and total lead analyses. These analyses were performed by methods outlined in the MDNR draft document "Recommended Parameters, Analytical Methods, and Detection Levels at Lust Sites" dated April, 1991.

Analytical results of the verification samples collected on November 8, 1991 indicate that the west floor and east wall had been remediated with respect to BTEX and PNAs. The north wall contained one (1) PNA compound (flouranthene at 0.39 ppm) that exceeded the MDNR recommended detection limit of 0.330 ppm. In addition, detectable levels of cadmium, chromium and lead were reported for all three (3) samples submitted. Analytical reports are contained in Appendix C, pages C-25 through C-31. Based on the results of the verification samples, it was determined that additional excavation of hydrocarbon impacted soils along the north wall of the excavation pit would be necessary to fully remediate the residual hydrocarbon impacted soil. The following table summarizes analytical reports from the November 8, 1991 sampling event.

Table 4.
Soil Sample Analytical Results
from the November 8, 1991 Sampling Event

SAMPLE LOCATION	PNA (ppm)	BTEX (ppm)	CADMIUM (ppm)	CHROMIUM (ppm)	LEAD (ppm)
West Floor #9033	ND	ND	0.036	3.0	13.2
East Wall #9031	ND	ND	0.042	4.4	6.6
North Wall #9032	0.39	ND	0.042	5.1	14.2

note:
ppm = parts per million
Non-detect for PNAs is <0.30 parts per million
Non-detect for BTEX is <0.01 parts per million

2.6 November 27, 1991 - Soil Excavation and Disposal

Additional hydrocarbon impacted soil was excavated, transported and disposed of in the City of Ann Arbor Sanitary Landfill by CET. Seven cubic yards of soil were removed from the north wall of the excavation on November 27, 1991. The total quantity of soil removed from the excavation, as of November 27, 1991, was 80 cubic yards.

At the conclusion of the excavation operation, verification samples were collected from the north wall. The samples were containerized in sterile sample jars supplied by the analytical laboratory and stored on ice during transportation. Standard chain of custody procedures were followed. The samples were submitted to Environmental Quality Laboratories (EQL) on December 2, 1991 for BTEX, PNA, cadmium, chromium, and total lead analyses. The analytical reports are in Appendix C, pages C-32 thru C-34. The analytical results are summarized below:

Table 5.
North Wall Analytical Results
from November 27, 1991 Sampling Event

SAMPLE NO.	BTEX	PNAs	Cadmium	Chromium	Lead
North Wall CG 405	ND	ND	0.108	3.6	6.0

note: All results in parts per million
ND = Non-detect
Non-detect for PNAs is <0.30 parts per million
Non-detect for BTEX is <0.01 parts per million

2.7 December 10, 1991 - Additional Analytical Data

A request for PCBs for west floor, east wall (collected November 8, 1991) and north wall (collected November 27, 1991) was made to EQL. Analytical results for PCBs analysis of the November 27, 1991 samples were received on December 12, 1991. Analytical reports show that PCBs were not detected above the detection limit of 0.033 parts per million. Analytical reports are included in Appendix C, pages C-36 thru C-39. A summary of the PCB data is presented below.

Table 6.
PCB Analytical Results Received December 12, 1992

Location	Date Sample Collected	PCBs (parts per million)
West Floor #9033	Nov. 8, 1991	Non-detect (<0.033)
East Wall #9031	Nov. 8, 1991	Non-detect (<0.033)
North Wall #CG405	Nov. 27, 1991	Non-detect (<0.033)

2.8 Final Soil Sample Analytical Results

Locations of final soil verification samples, including depth below grade, can be found in *Figure 1. Soil Sample Location Sketch.* The final excavation measured approximately 22 feet (east/west) by 13 feet (north/south) by 7.5 feet deep. The following table summarizes final verification sample analytical results at the site:

Table 7.
FINAL SOIL SAMPLE ANALYTICAL RESULTS

SAMPLE LOCATION	PNA (ppm)	BTEX (ppm)	CADMIUM (ppm)	CHROMIUM (ppm)	LEAD (ppm)	PCBs (ppm)
East Floor CG201	ND	ND	0.33	6.6	45.2	ND
West Floor #9033	ND	ND	0.036	3.0	13.2	ND
East Wall #9031	ND	ND	0.042	4.4	6.6	ND
West Wall CG204	ND	ND	0.054	6.5	3.6	ND
North Wall CG405	ND	ND	0.108	3.6	6.0	ND
South Wall CG206	ND	ND	0.052	6.6	6.2	ND

note:
ppm = parts per million
Non-detect for PNAs is <0.30 parts per million
Non-detect for BTEX is <0.01 parts per million
Non-detect for PCBs is <0.033 parts per million

3.0 BACKGROUND LEAD, CADMIUM AND CHROMIUM LEVELS

3.1 Fill Material Encountered in the Tank Excavation

The tank pull and excavation revealed fill material throughout the pit. Fill material included bottles, cans, ash and assorted garbage. Photographs of the excavation have been included as *Figure 2* of this report and can be found on pages 10 to 13. These photographs demonstrate some of the fill material encountered during the excavation. TGI believes that the fluctuating lead levels are due to the high amount of fill material found at the site. The highest lead level found in the tank excavation was 45.2 parts per million. Soil borings to determine background metal limits were conducted at the site as specified in the *Site Investigation Work Plan* in the 45-day report dated December 5, 1991.

3.2 Background Metals Soil Borings Investigation

On February 10, 1992, six soil borings were conducted at the site, upgradient and cross-gradient of the source area. Location of soil borings and ground water flow direction are illustrated in *Figure 3.* Ground water flow direction is based on static water levels observed in existing monitoring wells on July 6, 1990. The soil borings were performed by CET and supervised by TGI. Soil boring logs have been included as Appendix D, pages D-1 through D-6. Split spoon soil samples were collected from all soil strata encountered in the waste oil tank excavation. The soil borings were conducted using a drill rig equipped with hollow stem augers. Augers and sampling equipment were steam cleaned prior to each use to prevent cross contamination.

Three major soil strata were encountered in the excavation: (1) sand and gravel, (2) sandy clay/clayey sand and (3) silty sand. These three soil types all exhibited at least some extent of fill material, as described in Section 3.1.

Four samples from each soil strata were analyzed for lead, cadmium, and chromium. Analytical reports are included as Appendix E, pages E-1 through E-6. Analytical results of soil boring samples depict a wide range of data points for lead values. Lead values range from 1.4 to 23.8 ppm for sand and gravel, 3.3 to 69.6 ppm for the sand/clay strata, and 2.8 to 10.8 ppm for the silty sand. This wide range of data from the soil borings, along with the variety of fill material encountered throughout the excavation and borings, further supports that a background metals investigation is not applicable to the site. The entire site contains fill material of various types, so that comparing analytical data from separate fill types is not practical and no correlation be drawn between discrete areas of the site for overall site comparison of lead levels. Table 8 summarizes cadmium, chromium and lead analytical results from the background metal soil borings.

The site is located in an urban area and contains large quantities of fill material. The fluctuating metals concentrations are believed to be a result of these two factors. In a telephone conversation on February 27, 1992 with MDNR toxicologist Chris Flaga, Ms. Flaga stated that the lead levels observed at the site are lower than most historical urban sites.

TABLE 8. BACKGROUND METALS ANALYTICAL RESULTS

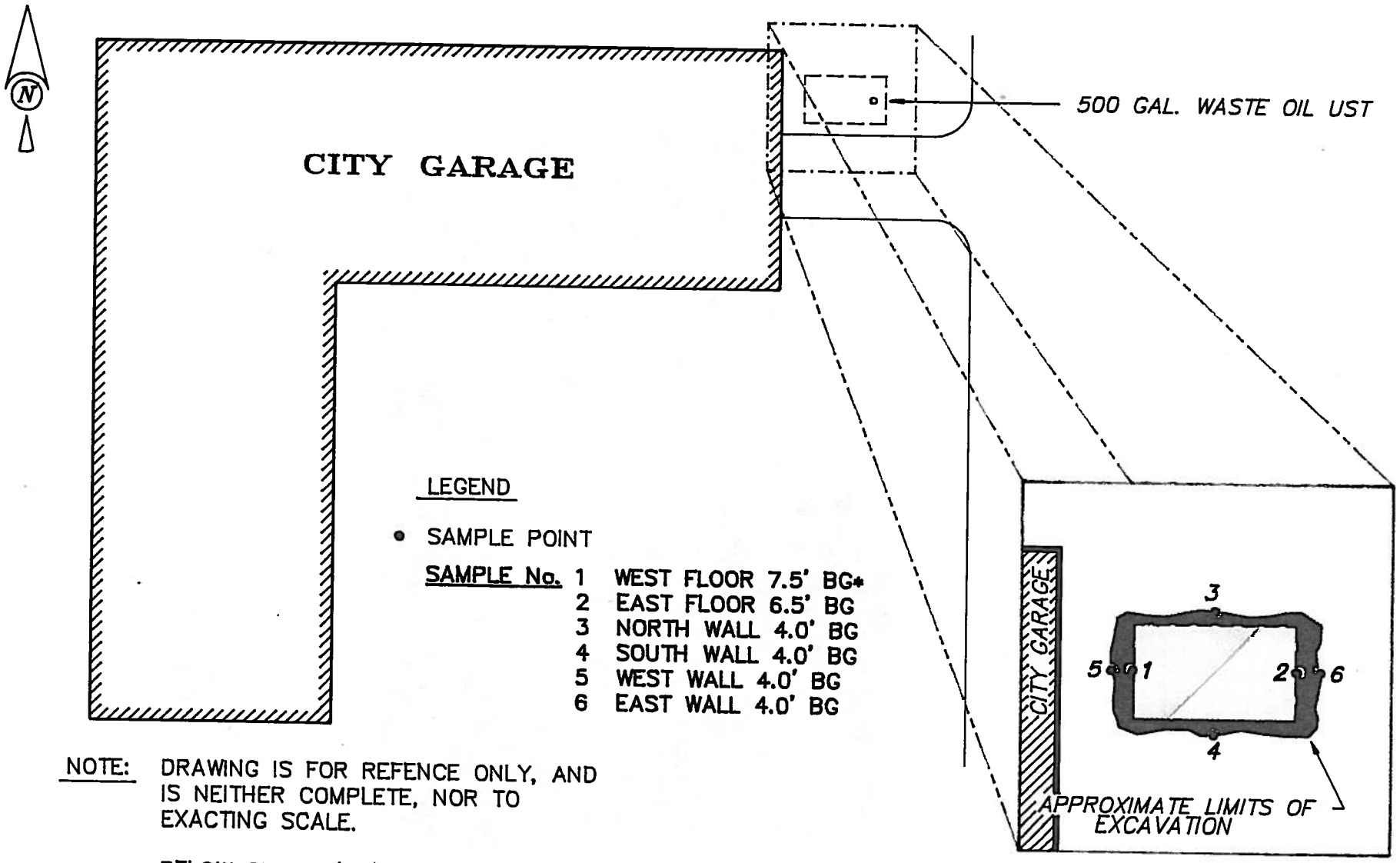
Sample No.: Ft. Below Grade		Total Lead (ppm)	Total Cadmium (ppm)	Total Chromium (ppm)
SAND AND GRAVEL STRATA:				
SB2:	2-3	1.4	2.0	4.5
SB1:	3-4	6.2	2.0	5.0
SB1:	3.5-4	23.8	1.5	10.4
SB5:	3-3.5	20.2	1.1	9.6
SANDY CLAY/CLAYEY SAND STRATA:				
SB1:	5-6	13.3	0.85	15.8
SB2:	5-6	69.6	0.73	18.8
SB4:	3-4	26.2	0.88	9.2
SB6:	3-4	3.3	0.7	10.7
SILTY SAND:				
SB1:	8-9	2.8	<0.050	4.6
SB3:	9.5-10	3.6	<0.050	3.2
SB3:	7-8	7.3	0.28	5.9
SB4:	5.5-6.5	10.8	0.68	6.5

PPM = parts per million

4.0 SUMMARY

A total of 80 cubic yards of soil was removed from these site, transported, and properly disposed of at the City of Ann Arbor Sanitary Landfill. Analytical results demonstrate that the sidewall and floor samples at the site meet with MDNR cleanup criteria as outlined in *MDNR MERA Operational Memorandum #6 dated October 1, 1991: Analytical Detection Guidance for Environmental Contamination Response Activities under Act 307 Rules, Tables 1 and 2a* with the exception of the detectable levels of cadmium, chromium, and lead. Laboratory reports prove that hydrocarbons in the soil have been removed. The remaining metals cannot be compared with background levels, as the soil and fill strata at the site are discontinuous and are not native.

Given the abatement actions taken to date, TGI believes that all necessary steps in remediating the release at this site have been completed. The source of contamination has been removed and the impacted soil has been properly disposed of. On behalf of the City of Ann Arbor, TGI requests type A closure for the site, and that the MDNR indicate the approval of this type closure this in writing.



NOTE: DRAWING IS FOR REFENCE ONLY, AND IS NEITHER COMPLETE, NOR TO EXACTING SCALE.

* BELOW GRADE (BG)

CLIENT: CITY OF ANN ARBOR	The Traverse Group, Inc. 3772 Plaza Drive, Suite 5 Airport Plaza Park Ann Arbor, Michigan 48108	TITLE: FIGURE 1 SOIL SAMPLE LOCATION SKETCH
SITE: CITY GARAGE		DATE 4-2-92 / ENGINEER PW
LOCATION: 721 N. MAIN STREET ANN ARBOR, MICHIGAN		PROJECT 569 / DWG CAA92064
		SCALE 1"=40' / DRAFTED BY: MSM

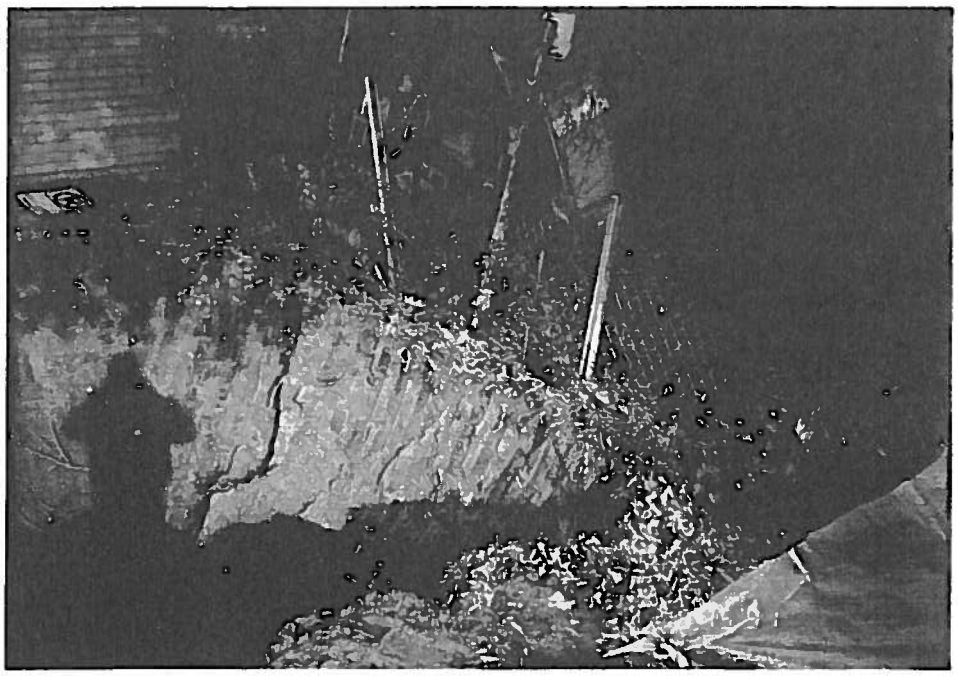
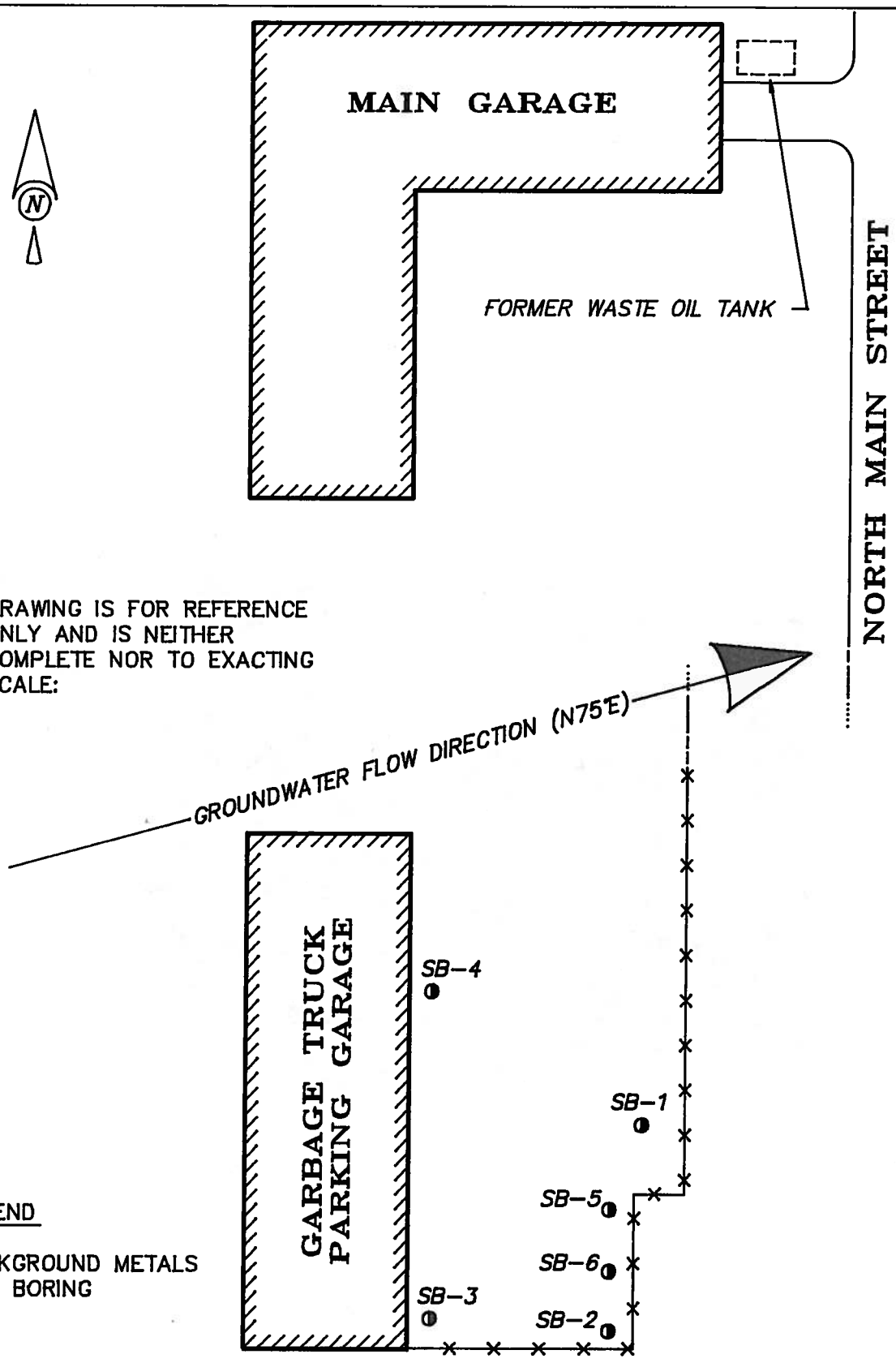


Figure 2(A). Waste Oil Tank Excavation
North Wall, Northwest Corner
October 15, 1991

Figure 2(B). Waste Oil Tank Excavation
North Wall, Northwest Corner
October 24, 1991

Figure 2(C). Waste Oil Tank Excavation
North Wall
October 24, 1991

Figure 2(D). Waste Oil Tank Excavation
North Wall, Northeast Corner
October 24, 1991



CLIENT: CITY OF ANN ARBOR	The Traverse Group, Inc. 3772 Plaza Drive, Suite 5 Airport Plaza Park Ann Arbor, Michigan 48108	TITLE: FIGURE 3 SOIL BORING LOCATION PLAN	
SITE: CITY GARAGE		DATE 4-2-92	ENGINEER PW
LOCATION: 721 N.MAIN STREET ANN ARBOR, MICHIGAN		PROJECT 569	DWG CAA92063
		SCALE 1"=60'	DRAFTED BY MSM

45 DAY REPORT
FOR

A UST RELEASE AT
THE ANN ARBOR CITY GARAGE
721 NORTH MAIN STREET
ANN ARBOR, MICHIGAN 48104

December 5, 1991

SUBMITTED TO:

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
JACKSON DISTRICT OFFICE
301 LOUIS GLICK HIGHWAY
JACKSON, MICHIGAN 49201

PROVIDED BY:

THE TRAVERSE GROUP, INC.
3772 PLAZA DRIVE
SUITE 5
ANN ARBOR, MICHIGAN 48108

45 DAY REPORT
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THE ANN ARBOR CITY GARAGE
721 NORTH MAIN STREET
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45 DAY REPORT
FOR A UST RELEASE AT
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1.0 SITE CHARACTERIZATION REPORT

1.1 Site Description

The City of Ann Arbor Maintenance Garage is located on the west side of North Main Street between Felch Street and Summit Street, approximately 1 mile north of downtown Ann Arbor. The property measures approximately 600 feet north/south by 220 feet east/west.

Three buildings exist on the site. The main building is an L-shaped garage located on the north half of the property. The city garage structure is used primarily as a vehicle maintenance center. The former underground tank was located in the northeast section of the property, adjacent to the east wall of the northern wing of the garage which faces North Main Street. A Site Location Map and Site Sketch can be found in Appendix A and B, respectively. (Please note that the Site Sketch located on page B-1 has been revised as the directional symbol was reversed in the 20-Day Report submitted on November 6, 1991.)

1.2 Nature and Estimated Quantity of the Release

1.2.1 Nature of the Release

A confirmed release was reported to the Michigan State Police/State Fire Marshall Division by The Traverse Group, Inc. (TGI) on October 23, 1991 based upon receipt of the analytical report from analyses of site assessment samples collected during activities to permanently close the UST system. This 45-Day Report is based on a release of the 500 gallon waste oil UST system at the above mentioned site.

1.2.2 Quantity of the Release

Estimating the quantity of the release at this time is not feasible as the release may have occurred over an extended period of time. There were no visible signs of free product.

1.3 Available Sources and Site Investigation Data

1.3.1 Surrounding Population

The 721 North Main Street site is located in Section 20, of Ann Arbor Township, City of Ann Arbor, Washtenaw County. The 1990 census indicated that the population of the City of Ann Arbor is approximately 109,592. The site is bordered by The Ann Arbor Community Center and North Main Street to the east, to the west by railroad tracks, and farther to the west by The Daily Ground Flour Mill which was formerly a Standard Oil facility. Felch Street forms the southern border, while Summit Street, including some residential properties forms the northern border.

1.3.2 Water Quality

Information was gathered to determine aquifer vulnerability, potable and non-potable water sources, surface water impact, and is outlined below.

1.3.2.1 Well Logs

The Washtenaw County Environmental Health Bureau was contacted for the purpose of locating wells within a one mile radius of the site. The following is a summary of the well logs. If further information is required, please refer to the attached well logs in Appendix C.

Township/Range/Section	# of Wells	Average Well Depth	Use
2S/5E/19	1	307 feet	1 domestic well
2S/6W/28	1	96 feet	1 research well
2S/6E/28	1	193 feet	1 research well
2N/6E/29	1	112 feet	1 domestic well

1.3.2.2 Surface Water

The nearest surface water body is the Huron River, located approximately 1/4 mile northeast of the site.

1.3.3 Use and Locations of Potentially Affected Wells

The City of Ann Arbor is serviced by a water and sewer system. Water for the City of Ann Arbor is supplied by water from the Huron River and municipal well fields located within the City of Ann Arbor. Two (2) of the wells within one mile of the site are used for domestic water sources. The remaining two (2) wells are owned by the University of Michigan and are used for research purposes.

1.3.4 Subsurface Soil Conditions

The geology of the immediate tank area can be summarized from information obtained during the UST removal: surface - 1 foot below grade (bg), brown sand and gravel; 1 - 4 feet bg, fine to medium grained brown sand; 4 - 6 feet bg, brown clayey sand, 6 - 7.5 feet bg (bottom of hole), moist to wet silty brown and gray sand. The immediate tank area appeared to consist of backfill material including household refuse such as bottles, cans, and ashes, particularly the north wall of the excavation which is adjacent to the northern property boundary.

Three monitor wells were installed on the site in June 1990 by TGI as part of a site investigation related to a release from an abandoned gasoline underground storage tank. Well logs for these three wells indicated ground water at a depth of 3 - 4 feet below grade in a perched aquifer. A boring log showing a dry hole to a depth of 11 feet below grade supports that this perched aquifer is not continuous. These four logs have been included in Appendix C of this report.

Auger hole boring logs from a previous subsurface investigation at the site conducted in June 1990 indicated ground water has been encountered between 7 and 11 feet below grade at the site. This report revealed alternating layers of clay, sand and gravel from the surface to a confining clay layer encountered between 10 and 27 feet below grade. This information, including details about auger hole and monitor well placement, is found in a report entitled "Site Investigation at the Ann Arbor City Garage", dated October 30, 1990, submitted by TGI to The City of Ann Arbor Risk Management Department.

A previous subsurface investigation was performed by Environmental Control Technology Corporation (ENCOTEC) of Ann Arbor, Michigan. This report entitled "Environmental Property Assessment", dated february 26, 1990, included a description subsurface soil conditions. This report was submitted to The City of Ann Arbor Parks and Recreation Department.

Well logs obtained from The Washtenaw County Environmental Health Bureau indicated that the soil strata in the area within a mile of the site consists of layers of sand, clay, and gravel to depth in excess of 300 feet below grade. Of the four (4) wells located within one mile of the site, one (1) was dry, while the other three encountered water between 63 and 112 feet below grade.

1.3.5 Locations of Subsurface Utility Lines and Sewers

Water and sewer maps obtained from the City of Ann Arbor Engineering Department indicated two (2) 16-inch and one (1) 6-inch water mains along Summit Street north of the site, and a 14-inch water main along Main Street east of the site. In addition, an 8-inch sanitary sewer is located along Hiscock Street west of the site, an 8-inch sanitary and a 16-inch storm sewer are located along Summit Street north of the site, and an 8-inch sanitary sewer is located along Main Street east of the site. Several additional storm and sanitary sewers are located in the vicinity of the City Garage, see Appendix D for copies of maps depicting water and sewer lines.

The Allen Drain storm sewer runs underneath the City Garage property. This sewer has a cross section of 8.5 feet by 14 feet and flows from southwest to northeast underneath the middle of the site. The Allen Drain is within 50 to the southeast of the former waste oil tank location.

1.3.6 Climatological Conditions

Climatological conditions are typical of those found in southeast Michigan.

1.3.7 Land Use

The Ann Arbor City Garage Site is used by the City of Ann Arbor as a center for city maintenance activities, including, but not limited to, vehicle and street maintenance. The site has two (2) above ground fuel tanks with one dispenser island. One 100 gallon underground waste oil tank will be installed to replace the 500 gallon waste oil tank that was removed.

1.4 Results of Site Characterization

The following information has been used to characterize the site: the initial abatement measures taken on-site prior to and following confirmation of the release and the information provided in Section 1.1 through 1.3 of this report.

The following conclusions are made based on the site characterization: the City of Ann Arbor is serviced by a municipal water and sewer system, therefore, there exists no risk to the public.

1.5 Results of Free Product Investigation

The source of the release was confirmed based on the analytical results of site assessment samples collected during the UST removal. Free product was not visible during the UST removal.

2.0 SITE INVESTIGATION WORK PLAN

2.1 Abatement Measures

Abatement measures to date at the site, as stated in the 20-Day Report, include emptying and disposing of the UST and its contents. The UST disposal receipt may be found in Appendix E of this report. The following sections are a summary of abatement actions conducted at the site since the filing of the 20-Day Report.

2.1.1 October 24, 1991.

Twenty-eight (28) cubic yards of hydrocarbon impacted soil were excavated, transported and properly disposed of at the City of Ann Arbor Sanitary Landfill by Carlo Environmental Technologies, Incorporated (CET), and supervised by TGI. All soil disposal receipts have been included in Appendix F of this report.

At the conclusion of the excavation operation, verification samples were collected from the east and west floor, and north, south, east and west walls. The samples were containerized in sterile sample jars supplied by the analytical laboratory. The samples were stored on ice during transportation and standard chain-of-custody procedures were followed. The samples were submitted to Environmental Quality Laboratories for analysis of Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) and Polynuclear Aromatics (PNAs). These analyses were performed by methods outlined in the MDNR draft document "Recommended Parameters, Analytical Methods, and Detection Levels at Lust Sites" dated April, 1991.

Analytical results of soil samples collected on October 24, 1991 indicated that elevated levels of PNAs above the MDNR recommended detection limit of 330 parts per billion (ppb) existed along the west floor, and the east and north walls of the excavation pit. Based on the results of the verification samples it was determined that additional excavation of hydrocarbon impacted soils at the site would be necessary to fully remediated the residual hydrocarbon impacted soil. All analytical results are contained in Appendix G of this report.

2.1.2 November 6, 1991

A request for PCB and Cd, Cr, and Pb analysis for the east floor, and west and south wall samples that were collected on October 24, 1991 was made to Environmental Quality Laboratories as part of the MDNR guidelines regarding a confirmed release from a UST system. Analytical results of these samples indicate PCB levels below the MDNR recommended detection limit of 33 parts per billion (ppb). Detectable levels of cadmium, chromium, and lead were reported in all three (3) samples submitted for analyses.

2.1.3 November 8, 1991

Additional hydrocarbon impacted soil was excavated, transported and disposed of in the City of Ann Arbor Sanitary Landfill by CET. A total of 45 cubic yards of soil was removed from the excavation pit from the areas that the previous verification samples indicated as containing residual hydrocarbon impacted soil.

At the conclusion of the excavation operation, verification samples were collected from the west floor, and north and east walls. The samples were containerized in sterile sample jars supplied by the analytical laboratory. The samples were stored on ice during transportation and standard chain of custody procedures were followed. The samples were submitted to Environmental Quality Laboratories for BTEX, PNA, cadmium, chromium, and total lead analyses. These analyses were performed by methods outlined in the MDNR draft document "Recommended Parameters, Analytical Methods, and Detection Levels at Lust Sites" dated April, 1991.

Analytical results of the verification samples collected on November 8, 1991 indicate that the west floor and east wall that contained residual hydrocarbon impacted soil had been remediated with respect to BTEX and PNAs. The north wall contained one (1) PNA that exceeded the MDNR recommended detection limit of 330 parts per billion (ppb). In addition, detectable levels of cadmium, chromium and lead were reported for all three (3) samples submitted. Based on the results of the verification samples it was determined that additional excavation of hydrocarbon impacted soils along the north was would be necessary to fully remediated the residual hydrocarbon impacted soil. A background metals investigation may be needed to determine background metals concentrations at the site. An

alternative to a background metals investigation would be to utilize existing metal concentration data from previous subsurface investigations performed at the site to determine background metals levels at the site.

2.1.4 November 25, 1991

A request for Cd, Cr, and Pb analysis for the west floor and east wall samples that were submitted on October 25, 1991 was made to Environmental Quality Laboratories. Analytical results of these samples were not received within the scope of this report, but will be forwarded to the MDNR upon receipt.

2.1.5 November 27, 1991

Additional hydrocarbon impacted soil was excavated, transported and disposed of in the City of Ann Arbor Sanitary Landfill by CET. A total of 7 cubic yards of soil was removed from the north wall of the excavation pit.

At the conclusion of the excavation operation, verification samples were collected from the north wall. The samples were containerized in sterile sample jars supplied by the analytical laboratory and stored on ice during transportation with standard chain of custody procedures were followed. The samples were submitted to Environmental Quality Laboratories on December 2, 1991 for BTEX, PNA, cadmium, chromium, and total lead analyses. Analytical results of the November 27, 1991 samples collected were not received within the scope of this report, but will be forwarded to the MDNR upon receipt.

2.2 Additional Investigation

The following sections are an outline of the work proposed to define the background levels of metals in the soil at the site. The resulting analytical data from the background metals investigation will be used to determine if the previously collected soil samples are within the calculated background limits. As previously mentioned (Section 2.1.3), an alternative to a background metals investigation may be to utilize existing data from previous investigations to determine background limits of Cd, Cr, and Pb in soil at the site. A map indicating the location of background metal investigation soil borings can be found in Appendix H of this report.

2.2.1 Soil Borings

This work plan will be implemented by conducting four soil borings at the site. The borings will be placed at locations specified by TGI.

The soil borings will be conducted using a drill rig equipped with seven-inch outside diameter hollow stem augers. Augers and sampling equipment will be steam cleaned prior to each use to prevent cross contamination.

2.2.2 Soil Sampling and Analyses

During each soil boring, split spoon soil samples will be collected from each soil strata encountered. The samples will be submitted to an analytical laboratory for analyses of Cd, Cr and total lead content. These analyses will be performed by methods outlined in the MDNR draft document "Recommended Parameters, Analytical Methods, and Detection Levels at Lust Sites" dated April 1, 1991.

Sterile sample jars supplied by the analytical lab will be used to containerize the sampled soil. Samples will be stored on ice in a cooler for transportation to an analytical laboratory. All sampling equipment will be thoroughly cleaned between sampling intervals. Standard chain of custody procedures will be followed.

Upon review of the resulting data, background limits will be calculated for each type of strata using the statistical method outlined in the MDNR Draft document "Verification of Soil Remediation", dated October 25, 1990. The metal concentrations present in the soil samples collected from the former UST excavation will be compared with the calculated background limits to determine if these levels are within the established background range.

In lieu of performing a background metals investigation at the site, existing metal concentration data will be used to calculate background limits for each type of soil strata using the statistical method outlined in the MDNR Draft document "Verification of Soil Remediation", dated October 25, 1990. The metal concentrations present in the soil samples collected from the former UST excavation will be compared to the calculated limits as determined from the existing data to ascertain if these levels are within the established background range.

2.2.3 Project Schedule

The following is a week by week schedule for work to be performed as described in this work plan. This schedule will commence within two weeks of obtaining written approval of the work plan by the MDNR.

This schedule is based on reasonable weather conditions within the period of performance. Adverse weather conditions may force a delay in the completion of any of the individual tasks presented herein.

WEEK	TASK
Week One	Schedule drill rig Call Miss Dig
Week Three	Conduct soil borings
Week Five	Analytical results received and reviewed
Week Six	Determination of background levels
Week Seven	Report summarizing results initiated
Week Eight	Report reviewed
Week Nine	Report completed and sent to the client and MDNR

APPENDIX A

SITE LOCATION MAP

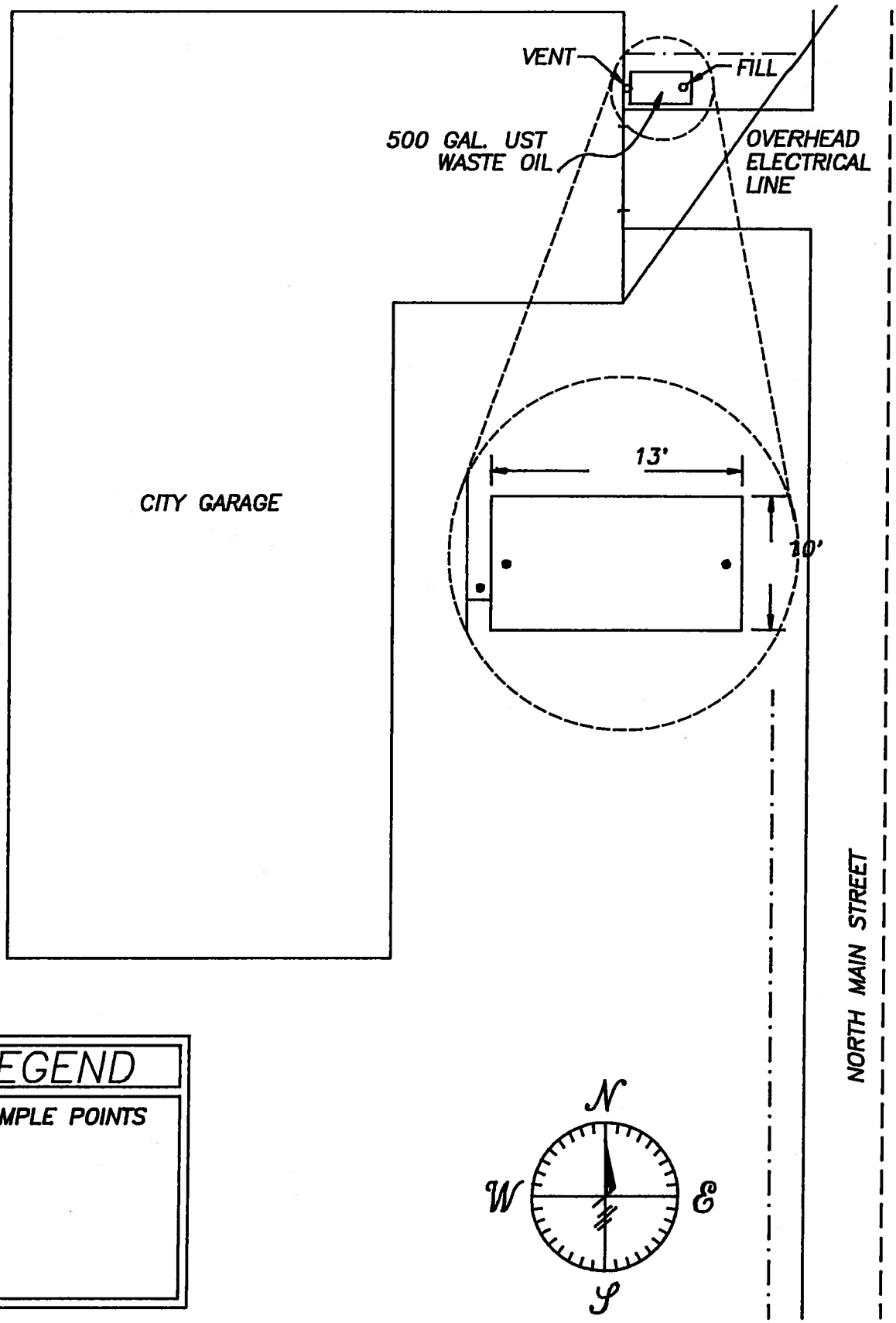
Cheryl English - 45 Day Report
City of Ann Arbor
City Garage

SITE LOCATION MAP

Source: Rand McNally Map of Washtenaw County

APPENDIX B

SITE SKETCH



LEGEND

- SAMPLE POINTS

CLIENT: CITY OF ANN ARBOR	The Traverse Group, Inc. 3772 Plaza Drive, Suite 5 Airport Plaza Park Ann Arbor, Michigan 48108	TITLE: SITE SKETCH
SITE: CITY GARAGE		DATE: 10-30-91 / ENGINEER:
LOCATION: 721 N. MAIN ST. ANN ARBOR, MICHIGAN		PROJECT: 569 / DWG: CAA91158 SCALE: NONE / DRAFTED BY: DEE

GASOLINE TANK
SUPPLEMENTAL SITE INVESTIGATION REPORT
FOR AN UNDERGROUND STORAGE TANK RELEASE
ANN ARBOR CITY GARAGE
721 N. MAIN STREET
ANN ARBOR, MICHIGAN

June 21, 1993

Submitted to:

Michigan Department of Natural Resources
Environmental Response Division
Jackson District Office
301 East Louis Glick Highway
Jackson, Michigan 49201

Prepared for:

City of Ann Arbor
100 N. Fifth Avenue
P.O. Box 8607
Ann Arbor, MI 48104-8607

Prepared by:

The Traverse Group, Inc.
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Ann Arbor, Michigan 48108

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1.0 INTRODUCTION

The City of Ann Arbor, owner/operator of the former underground storage tank (UST) system at City Garage, 721 N. Main Street, Ann Arbor, Michigan, has retained the Traverse Group, Inc. (TGI) to prepare a Gasoline Tank Supplemental Site Investigation Report for the confirmed release from the UST system.

This report summarizes the hydrogeological and soil boring investigations which were outlined in the *Gasoline Tank Supplemental Site Investigation Work Plan* which TGI submitted to the Michigan Department of Natural Resources (MDNR) on February 23, 1993. The work plan was approved by Terry Hiske of the MDNR on March 5, 1993, via telephone contact with TGI. Written approval was received from the MDNR on March 10, 1993. This report addresses the technological approach and results of the supplemental site investigation work conducted at City Garage.

2.0 SITE DESCRIPTION

City Garage is located south of Summit Street at 721 N. Main Street in the City of Ann Arbor, Michigan. The Conrail Railroad is adjacent to the site on the west side. *Figure 1, Site Location Map*, page 26, shows the site with respect to topographic features, roads, railroads and surface water bodies. The structures currently on the site are the various buildings and garage facilities used by the City of Ann Arbor.

Figure 2, Site Sketch, page 27, shows the site with respect to topographic features, a road, and railroads and also illustrates the location of the former gasoline UST. The 2,000-gallon gasoline UST was located nearly 5 feet west of the existing garage building. The Allen's Creek Drain which runs across the site was added to the Act 307 Michigan Sites of Environmental Contamination List in October, 1989.

3.0 SITE HISTORY

The 2,000-gallon gasoline UST was removed from the site on December 14, 1989. Ground water was encountered at approximately 8 feet below grade (BG) at the time of excavation. The UST exhibited surface rust but appeared to be in good condition. Visual and olfactory evidence of a hydrocarbon release was noted during the removal operation. Initial abatement activities at the site included the removal, transportation and proper disposal of 45 cubic yards of soil. The hydrocarbon-affected soil was properly disposed of at the Ann Arbor landfill in Ann Arbor, Michigan, by Youngs Environmental Cleanup, Inc. (YECI) of Flint, Michigan on January 2 and 3, 1990. One post-

excavation soil sample was collected from the east side of the tank and screened with an HNu type organic vapor meter (OVM). A reading of 110 parts per million (ppm) was obtained on the HNu meter. Soil and ground water samples were collected and submitted to an analytical laboratory for benzene, toluene, ethylbenzene, xylenes (BTEX) analysis. Results of the analysis are summarized below.

Sample Location	Total BTEX (ppm)	Date Collected
North end tank soil-8 feet BG	<0.01	12-14-89
South end tank soil-8 feet BG	1.02	12-14-89
Pit water	1.32	12-14-89

After reviewing the laboratory analyses of samples collected on December 14, 1989, it was determined that BTEX concentrations from the south end of the pit and in the pit water exceeded the Michigan Department of Natural Resources (MDNR) suggested clean-up guidelines. TGI proposed a Site Investigation Work Plan as part of the 45-Day Report submitted on January 29, 1990. The plan outlined a hydrogeological and soil boring investigation.

On June 22, 1990, upon MDNR approval, the investigation was initiated by placing one soil boring designated BO-1 and installing three monitoring wells (MW). The wells were placed to determine ground water flow direction and to serve as future ground water quality monitoring points. Soil and ground water samples were collected for BTEX, polynuclear aromatics (PNAs) and total petroleum hydrocarbons (TPH) analyses. *Table 1*, page 16, contains a summary of analytical laboratory data for the June 22, 1990, sampling event. The wells were sampled a second time on July 6, 1990; and the results are summarized in *Table 1*, page 16.

Seven soil borings designated AH-1 through AH-7 were placed at the site on August 8 and August 9, 1990. The work was conducted as outlined in the April 5, 1990, Site Investigation Work Plan Proposal, submitted to the MDNR via facsimile on August 8, 1990. The soil boring investigation was conducted by TGI, and the results were summarized in a Site Investigation Report dated October 30, 1990. Monitoring well and auger hole location are illustrated in *Figure 2, Site Sketch*, page 27.

Table 1, page 16, summarizes analytical laboratory data for the August 8 and 9, 1990, sampling events.

Of the 28 samples collected on August 8 and 9, 14 exhibited elevated levels of BTEX and TPH. Based on the elevated levels it was determined that the non-detect boundary required further definition. TGI, on behalf of the City of Ann Arbor, proposed to continue with the site investigation as outlined in the *Gasoline Tank Supplemental Site Investigation Work Plan* which TGI submitted to the Michigan Department of Natural Resources (MDNR) on February 23, 1993.

There are three storage tanks that remain in service at the site. Two aboveground tanks are located on the west side of the property. One tank contains diesel fuel, and the other tank contains gasoline. These tanks are linked to the fuel dispenser island via underground piping which runs southwest to northeast. A release from this underground piping occurred about 12 years ago. Details concerning the amount of product released were not recorded. Subsequent remediation included soil removal and installation of purge wells (barrel sample points) constructed of 55-gallon drums. On October 3, 1990, TGI representatives collected a ground water sample from the one remaining barrel sample point and submitted it for BTEX analysis. The sample contained a total BTEX concentration of 29,760 ppb at 7.5 to 12 feet BG. The barrel sample point and aboveground tanks are illustrated in *Figure 2, Site Sketch*, page 27.

The third tank, a UST containing waste oil, has been removed and replaced at the site. This tank was reported to have had a 500-gallon capacity and was located adjacent to the east side of the City Garage, north of the entrance driveway. All of the associated impacted overburden soil has been removed as outlined in the Type A Closure Report submitted to the MDNR on April 7, 1992. The 500-gallon waste oil UST was replaced with a 100-gallon waste oil UST in November 1991.

4.0 GASOLINE TANK SUPPLEMENTAL SITE INVESTIGATION REPORT

The hydrogeological and soil boring investigation methodology was outlined in the *Gasoline Tank Supplemental Site Investigation Work Plan*. It consisted of soil sampling and analysis, monitoring well installation, surveying, and ground water sampling and analysis. The purpose of this investigation was to ascertain the vertical and lateral extent of the hydrocarbon-affected soil and ground water at the site. The following sections describe the methodology used to define the extent of hydrocarbon-affected resources at the site.

4.1 Hydrogeological Investigation - March 8 and 9, 1993

The hydrogeological investigation described below was based on the findings from the previous investigation that indicated the aquifer had been affected. This investigation consisted of the replacement and the proper abandonment of the existing MW-1 and MW-2, the installation of an additional vertical profiling monitoring well near the source area, well surveying, static ground water level measurements, soil sampling and ground water sampling and analysis. The wells were installed at the locations indicated in *Figure 2, Site Sketch*, page 27. Each task is described in detail in the following sections.

4.1.1 Ground Water Monitoring Well Installation (March 8 and 9, 1993)

The work plan was implemented by installing MW-4 and MW-5 to replace MW-1 and MW-2, respectively, in order to confirm ground water flow direction, gradient and quality as well as soil type. MW-1 and MW-2 were damaged beyond repair and were therefore abandoned on March 8, 1993 by pulling the wells and grouting the holes with 3-foot and 2-foot-thick bentonite pellet seal, respectively. In addition to the replacement wells, a vertical profiling cluster monitoring well, MW-6, was installed near MW-4.

The wells were installed using a drill rig equipped with hollow stem augers. During installation of MW-4, split spoon soil samples were not collected. However, during the installation of MW-5 and MW-6, split spoon soil samples were collected. The wells were constructed of a 2-inch-inside-diameter galvanized steel casing with a 5-foot, #7 slot, stainless steel screen. Well screen placement for MW-4 and MW-5 was based on the depth where the ground water table was encountered and set so that at least 1 foot was above the surface of the ground water table. Well screen placement for MW-6 was screened 3 feet below the screen bottom of MW-4. During the installation of MW-4, MW-5 and MW-6, a #7 silica filter sand was placed from the bottom of the well screen to 1 foot above the screen. MW-4 was grouted with a 0.5-foot-thick bentonite pellet seal, and MW-6 was grouted with a 6-foot-thick bentonite powder and cement grout slurry followed by a 2-foot-thick bentonite pellet seal. The remaining annular space in MW-4 and MW-6 was filled with concrete. MW-5 was grouted with a 5-foot-thick bentonite pellet seal to within 1 foot of grade level. The remaining annular space was filled with concrete. MW-4, MW-5, and MW-6 were capped and finished with a flush mount protective steel cover set in concrete. The monitoring wells were installed by Traverse Drilling, Inc., of Traverse City, Michigan. The well construction diagrams are located in Appendix A, pages A-2, A-3 and A-5.

Augers, well construction materials, and sampling equipment were steam cleaned before use to prevent potential cross contamination. The soil cuttings created from the placement of the monitoring wells were collected and stored in 55-gallon barrels, properly labeled, and stored on the site awaiting proper disposal.

After placement, the monitoring wells were developed according to industry standards using a development pump. Approximately 10 gallons of ground water was purged during the development process of MW-4, 20 gallons of ground water from MW-5, and 10 gallons of ground water from MW-6. The purged ground water was collected and stored in 55-gallon barrels, properly labeled and stored on the site awaiting proper disposal.

Upon closure of the site by the MDNR, TGI will abandon the wells by pulling the wells and filling the holes with a bentonite seal or abandoning the wells in place by filling them with concrete.

4.1.2 Site Hydrogeology (MW-4, MW-5, and MW-6)

At the MW-4 location, the soil lithology is summarized as follows:

0 to 1 foot BG - asphalt and gravel fill
1 to 3 feet BG - moist, medium sand, gray
3 to 13 feet BG - wet, fine-medium silty sand, gray (end of boring)

Ground water was encountered at 3 feet BG, and the static water level was at 1.73 feet below top of casing (BTOC).

Based on the continuous subsurface split spoon soil sampling during the installation of MW-5 and MW-6, the subsurface soil conditions are described as follows.

At MW-5 the soil lithology includes:

0 to 4 feet BG - topsoil, black
4 to 8 feet BG - black peat w/ trace silty sand
8 to 23 feet BG - wet, silty sand, brown
23 to 27 feet BG - silty clay, gray
27 to 29 feet BG - stiff silty clay, gray (end of boring)

Ground water was encountered at 8 feet BG, and the static water level was at 1.91 feet BTOC.

At MW-6 the soil lithology includes:

0 to 3 feet BG - asphalt and gravel fill
3 to 4 feet BG - gravel and sand fill
4 to 8 feet BG - topsoil, black
8 to 9.5 feet BG - soft clay, gray-black
9.5 to 12.5 feet BG - wet, silty sand, gray-brown
12.5 to 15 feet BG - soft-stiff clay, gray (end of boring)

Ground water was encountered at 9 feet BG, and the static water level was at 5.64 feet BTOC.

The monitoring well logs (MW-4, MW-5, and MW-6), describing the subsurface soil strata in greater detail, are included in Appendix A, pages A-2, A-3 and A-5.

4.1.3 Monitoring Well Installation Soil Sampling (MW-4, MW-5 and MW-6)

During installation of MW-4 continuous split spoon soil samples were not collected and vertical profiling of the aquifer was not conducted at MW-4, MW-5 and MW-6.

During placement of MW-5 and MW-6, continuous split spoon soil samples were obtained starting from 2 feet BG to the soil/ground water interface. One soil sample from MW-5 and two soil samples from MW-6 were submitted to Traverse Analytical for analyses of BTEX and PNAs using methods outlined in Section 4.2.1. Criteria for choosing the sample from MW-5 for the analytical laboratory included soil strata and depth BG. The soil samples submitted for analyses from MW-6 were the two samples with the highest OVM readings. MW-5 had no elevated OVM readings.

The sampled soil was accumulated in sterile sample jars supplied by the analytical lab. Samples were stored in a cooler for transportation to Traverse Analytical. All sampling equipment was thoroughly steam-cleaned between sampling events. Standard chain of custody procedures were followed.

4.1.4 Monitoring Well Installation Soil Analytical Results (MW-4, MW-5 and MW-6)

Soil sampling data from MW-4, MW-5 and MW-6 are summarized in *Table 1*, page 16. Elevated levels of BTEX and PNAs in the soils and ground water are discussed in Section 5.0. Analytical reports of the soil samples collected, quality control reports and the document chain-of-custodies are included in Appendix B, pages B-1 through B-53.

4.1.5 Monitoring Well Surveying and Sampling (MW-4, MW-5 and MW-6)

MW-4, MW-5, and MW-6 were surveyed by a registered surveyor to determine spatial locations to the nearest 0.1 foot and top of casing elevations correlated with United States Geological Survey (USGS) benchmark datum to the nearest 0.01 foot. Surveyor's results and observed static water level elevations were used to determine ground water flow direction and gradient and are discussed in Section 4.5.

MW-4 and MW-5 were allowed 18 days to stabilize, and MW-6 was allowed 17 days to stabilize prior to sampling on March 26, 1993. Before purging, the wells' static ground water levels were measured to the nearest 0.01 foot BTOC. Following the measurement of static ground water level, 2.5 gallons of ground water was purged from MW-4, 5.0 gallons from MW-5, and MW-6. Ground water samples were collected from the well using a stainless steel hand bailer. The ground water samples were submitted to Traverse Analytical in Traverse City, Michigan, for laboratory analyses of BTEX and PNAs to determine ground water quality. These analyses were performed

using Method 8020 for BTEX and Method 8310 for PNAs as outlined in the document *MDNR MERA Operational Memorandum #6 Revision 1 dated April 22, 1992: Analytical Detection Level Guidance for Environmental Contamination Response Activities under Act 307 Rules, Tables 1 and 2a.*

The ground water samples were accumulated in sterile sample jars supplied by the analytical laboratory and placed on ice in a cooler for transportation to the laboratory. Standard chain of custody procedures were followed. Purged ground water was collected and stored in 55-gallon barrels, properly labeled, and stored on the site awaiting proper disposal.

Section 4.4 outlines and discusses the results of the analyses. Analytical reports of the soil and ground water samples collected from the soil borings, quality control reports and the document chain-of-custodies are included in Appendix B, pages B-1 through B-16.

4.2 Soil Boring Investigation - March 8 through 15, 1993

On March 8 through 15, 1993 soil borings were conducted to determine the extent of the hydrocarbon-affected soil and ground water. The work consisted of conducting seven (7) soil borings at the site and tracking BTEX and PNA concentrations in terms of location, constituents, and concentrations by soil and ground water sampling and analytical testing. The borings were placed at the locations shown in *Figure 2, Site Sketch*, page 27.

4.2.1 Delineation of Hydrocarbon-Affected Resources

The soil boring investigation used a drill rig equipped with hollow stem augers. The collection of continuous split spoon soil samples from 2 feet BG to the soil/ground water interface was attempted using a split spoon sampling device. However, due to various fill materials in the immediate sub-surface at some of the soil boring locations, split spoon soil samples were not obtained from 2 feet BG. Split spoon soil samples were field screened using an OVM equipped with a PID. The soil samples with the highest PID readings from each boring were sent to the analytical laboratory. If all soil samples from a soil boring produced a zero reading on the PID, then the soil sample collected at the capillary zone was submitted for analysis. The soil samples were collected and accumulated in sterile sample jars supplied by the analytical laboratory and stored on ice in a cooler for transportation to the analytical laboratory. Standard chain of custody procedures were followed.

Ground water was sampled using a lead-screened hollow-stem auger advanced into the aquifer 5 feet with vertical profiling continuing in 10-foot intervals. The samples were collected using a stainless steel bailer inserted down the center of the auger flight to the screened sampling interval.

The lead screened, hollow-stem auger is a field-screening tool used to vertically sample potential contaminant pathways in the uppermost aquifer.

Vertical profiling of the aquifer was continued to the confining gray clay layer, approximately 12.5 to 23 feet BG for AH-10, AH-11, MW-5, and MW-8. The remaining borings were vertically profiled to various depths BG based on field observations and previous analytical data which established intervals greater than 12.5 feet BG to be free of hydrocarbons. Before collection of the ground water samples, two auger flight volumes of ground water were purged. The purged ground water was collected and stored in 55-gallon barrels, properly labeled, and stored on the site awaiting proper disposal. The ground water samples were accumulated in sterile sample jars supplied by the analytical laboratory and placed on ice in a cooler for transportation to the analytical laboratory. Standard chain of custody procedures were followed.

Soil and ground water samples were sent to Traverse Analytical for laboratory analyses of BTEX and PNAs as outlined in the document *MDNR MERA Operational Memorandum #6 Revision 1 dated April 22, 1992: Analytical Detection Level Guidance for Environmental Contamination Response Activities under Act 307 Rules, Tables 1 and 2a.*

Boring locations were chosen across and along transects of the hydraulic gradient determined in the hydrogeologic investigation. Additional boring locations were needed to define the hydrocarbon-affected resources along utility lines which acted as a pathway for the migrating hydrocarbons and around the perimeter of the hydrocarbon-affected area to complete the delineation.

The amount of spacing between soil borings along a transect and radial line were based on field screening results. The borings and the soil and ground water sampling continued until the hydrocarbon-affected resources were defined. Boring logs which describe the soil strata are illustrated in Appendix A, pages A-1 through A-15.

4.2.2 Soil/Ground Water Sampling and Analytical Results (March 8 through 15, 1993)

The March 8 through 15, 1993 soil and ground water sampling data from the seven (7) soil borings (AH-8 through AH-13 and HA-1) are summarized in *Table 1*, page 16. Elevated levels of BTEX and PNAs in the soils and ground water are discussed in Section 5.0. Analytical reports of the soil and ground water samples collected from the soil borings, quality control reports and the document chain-of-custodies are included in Appendix B, pages B-1 through B-47.

Following the site investigation summarized above, TGI placed guardian wells to monitor the forward and/or lateral migration of hydrocarbon-affected ground water and an additional vertical profiling cluster monitoring well as outlined in the following section.

4.3 Ground Water Monitoring Investigation - March 9, 11, 12, 15 and 17, 1993

One vertical profiling cluster monitoring well, MW-7; two guardian wells, MW-8B and MW-9/HA-2B; and one temporary monitoring well, HA-1, were installed on March 9, 11, 12, 15, and 17, 1993.

MW-7 was installed near the barrel sample point as a vertical profiling cluster monitoring well to MW-3. MW-8B was installed on the eastern property line of the City Garage site along the property fence line as a long-term monitoring point to monitor the potential lateral plume movement. HA-1 was installed along the northwest side of the Allen's Creek Drain as a temporary well because underground and overhead utilities restricted the use of a drill rig to install a long-term monitoring well. Temporary well HA-1, constructed of 2-inch schedule 40 (polyvinyl chloride) PVC screen and riser, was inserted 2 feet into the aquifer using a hand auger. Due to auger refusal at this point, the well could not be inserted further into the aquifer. The samples at the HA-1 location were collected using a stainless steel bailer inserted down the center of the temporary well to the sampling interval 2 feet into the aquifer. Sample handling procedures and laboratory analytical methodology outlined in Section 4.2.1 were followed. Monitoring well locations are illustrated in *Figure 2, Site Sketch*, page 27.

4.3.1 Ground Water Monitoring Well Installation (March 9, 11, 12, 15 and 17, 1993)

The screen for MW-7 was set 5 feet below the screen bottom of MW-3. During the installation of MW-7, the native fine-medium brown sand and gravel was used as the screen pack from the bottom of the well screen to 6 feet above the screen. MW-7 was grouted with a 3-foot-thick bentonite powder and cement grout slurry followed by a 2.0-foot-thick bentonite pellet seal. The remaining annular space was filled with concrete. A #7 silica filter sand was placed from the bottom of the well screen in MW-8B and MW-9/HA-2B to 4 feet above the screen. MW-8B was grouted with a 1-foot-thick bentonite pellet seal followed by a 3-foot-thick cement and bentonite powder slurry seal to within 1 foot of grade level. The remaining annular space was filled with concrete. MW-9/HA-2B was grouted with a 1-foot-thick bentonite pellet seal followed by a 1-foot-thick cement and bentonite powder slurry seal to 1 foot of grade level. Well screen placement for MW-8B and MW-9/HA-2B was based on the depth where the ground water table was encountered and screened 1 foot above the ground water table. MW-7, MW-8B, and MW-9/HA-2B were capped and finished with flush mount protective steel covers set in concrete.

Augers, well construction materials, and sampling equipment were steam cleaned before use to prevent potential cross contamination. The soil cuttings created from the placement of the monitoring wells were collected and stored in 55-gallon barrels, properly labeled and stored on the site awaiting proper disposal.

After placement, the monitoring wells were developed according to industry standards using a development pump. Approximately 8 gallons of ground water was purged during the development process of MW-7, 8 gallons of ground water from MW-8B, and 15 gallons of ground water from MW-9/HA-2B. The purged ground water was collected and stored in 55-gallon barrels, properly labeled and stored on the site awaiting proper disposal.

Upon obtaining closure of the site by the MDNR, the three wells are abandoned by pulling the wells and filling the holes with a bentonite seal or abandoning the wells in place by filling them with concrete.

4.3.2 Site Hydrogeology (MW-7, MW-8B, HA-1 and MW-9/HA-2B)

Based on the continuous subsurface split spoon soil sampling during the installation of MW-7 and MW-8B as well as observations made during the installation of temporary well HA-1 and MW-9/HA-2B, the subsurface soil conditions are described as follows.

At MW-7 the soil lithology includes:

0 to 4 feet BG - asphalt, fine-medium sand, brown and gravel (fill)
4 to 8 feet BG - silty fine sand, black, trace clay
8 to 10 feet BG - wet, silty fine sand, black
10 to 19 feet BG - wet, fine-medium sand, brown w/ trace gravel (end of boring)

Ground water was encountered at 8 feet BG, and the static water level was at 5.70 feet BTOC and rising (well under pressure).

At MW-8B the soil lithology includes:

0 to 6 feet BG - asphalt, fine-medium sand, brown
6 to 8 feet BG - fine sandy silt w/ trace organics
8 to 11 feet BG - moist, silty clay
11 to 12.5 feet BG - wet, silty sand
12.5 to 17 feet BG - dry, hard clay, gray (end of boring)

Ground water was encountered at 11 feet BG, and the static water level was at 7.98 feet BTOC and rising (well under pressure).

At HA-1 the soil lithology includes:

0 to 0.5 foot BG - grass and topsoil
0.5 to 6 feet BG - fine to medium sand, brown, and small gravel
6 to 7 feet BG - moist, silty clay, black
7 to 10 feet BG - wet, silty clay, gray w/ trace sand (end of boring)

Ground water was encountered at 8 feet BG.

At MW-9/HA-2B the soil lithology includes:

0 to 0.5 foot BG - grass and topsoil
0.5 to 6 feet BG - fine-medium sand, brown and small gravel
6 to 9 feet BG - moist, silty fine sand, gray and small gravel
9 to 14.5 feet BG - wet, fine-coarse silty sand, w/ small gravel
14.5 to 17 feet BG - dry, hard silty clay gray w/ small gravel
17 to 24 feet BG - wet, fine-coarse sand w/ small gravel (end of boring)

Ground water was encountered at 8 feet BG, and the static water level was at 7.45 feet BTOC.

The monitoring well logs, describing the subsurface soil strata in greater detail, are included in Appendix A, pages A-6 and A-13 through A-15.

4.3.3 Monitoring Well Installation Soil/Ground Water Sampling (MW-7, MW-8B, HA-1 and MW-9/HA-2B)

During installation of HA-1 and MW-9/HA-2B grab samples from the hand auger were obtained. Vertical profiling of the aquifer was not conducted at MW-7, MW-8B and HA-1.

During placement of MW-7 and MW-8B, continuous split spoon soil samples were obtained starting from 2 feet BG. Two soil samples from each of the borings were submitted to Traverse Analytical for analyses of BTEX and PNAs using methods outlined in Section 4.2.1. The soil samples submitted for analyses were two samples with elevated OVM readings. Criteria for choosing the two samples for the analytical laboratory also included soil strata and depth BG.

During placement of MW-9, ground water was sampled using a lead screened hollow-stem auger as outlined in Section 4.2.1. Vertical profiling continued to 24 feet BG. One ground water

custody procedures were followed. Purged water was collected and stored in 55-gallon barrels, properly labeled and stored on the site awaiting proper disposal.

Section 4.4 outlines and discusses the results of the analyses.

4.4 Ground Water Monitoring Results - March 26, 1993 and April 29, 1993

On March 26, 1993, ground water samples were collected from MW-3 through MW-9. Ground water sampling data from the wells are summarized in *Table 1*, page 16. Elevated levels of BTEX and PNAs in the ground water are discussed in Section 5.0. Analytical reports of the ground water samples collected, quality control reports and the document chain-of-custodies are included in Appendix B, pages B-54 through B-65.

During the March 26, 1993 sampling event a surface sheen of hydrocarbons was apparent in the many puddles around the flush-mounted monitoring well MW-5. TGI believes that the hydrocarbon sheen and wet ground surface may have caused a cross contamination of the ground water sample. Therefore, on April 29, 1993, MW-5 was resampled for BTEX in the ground water. Analysis showed non-detect levels of BTEX from this sampling event.

4.5 Ground Water Flow Direction and Gradient

Static ground water table data collected during the March 26, 1993 (measured to the nearest 0.01 foot BTOC), along with spatial locations and top of casing elevations from the survey were used to calculate ground water flow direction and gradient. MW-3, MW-4, MW-5 and MW-9 were used to establish the piezometric surfaces, based on their respective screened intervals BG in relation to the ground water table. MW-6 and MW-7 are vertical profiling monitoring wells screened below the water table and were thus not used in the calculation. MW-8B was not used in the calculation as it had a fluctuating static water level (well was under pressure). Ground water flow direction was calculated at south 45 degrees east with a gradient of 2.5 feet per 100 feet as indicated in *Figure 3, Site Sketch with Ground Water Contours (03-26-93)*, page 28. Static ground water levels are summarized in the table on *Figure 3*.

sampling interval (19'-24' BG) was retained and sent to Traverse Analytical for analyses of BTEX and PNAs using methods outlined in Section 4.2.1.

The sampled soil and ground water were accumulated in sterile sample jars supplied by the analytical lab. Samples were stored in a cooler for transportation to Traverse Analytical. All sampling equipment was thoroughly steam-cleaned between sampling events. Standard chain of custody procedures were followed.

4.3.4 Monitoring Well Installation Soil/Ground Water Analytical Results (MW-7, MW-8B, HA-1 and MW-9/HA-2B)

Soil and ground water sampling data from MW-7, MW-8B, HA-1 and MW-9/HA-2B are summarized in *Table 1*, page 16. Elevated levels of BTEX and PNAs in the soils and ground water are discussed in Section 5.0. Analytical reports of the soil and ground water samples collected, quality control reports and the document chain-of-custodies are included in Appendix B, pages B-1 through B-53.

4.3.5 Monitoring Well Surveying and Sampling (MW-7, MW-8B, and MW-9/HA-2B)

MW-7, MW-8B, and MW-9/HA-2B were surveyed by a registered surveyor to determine spacial locations to the nearest 0.1 foot and top of casing elevations correlated with USGS benchmark datum to the nearest 0.01 foot. Surveyor's results and observed static water level elevations were used to determine ground water flow direction and gradient and are discussed in Section 4.5.

MW-7 was allowed 17 days to stabilize, MW-8B was allowed 15 days to stabilize, and MW-9/HA-2B was allowed 9 days to stabilize prior to sampling on March 26, 1993. Before purging, the well's static ground water levels were measured to the nearest 0.01 foot BTOC. Following the measurement of static ground water level, 5.0 gallons of ground water were purged from MW-7, 1.5 gallons from MW-8B, and 1 gallon from MW-9/HA-2B. Ground water samples were collected from the well using a stainless steel hand bailer. The ground water samples were submitted to Traverse Analytical for laboratory analyses of BTEX and PNAs to determine ground water quality. These analyses were performed using Method 8020 for BTEX and Method 8310 for PNAs as outlined in the document *MDNR MERA Operational Memorandum #6 Revision 1 dated April 22, 1992: Analytical Detection Level Guidance for Environmental Contamination Response Activities under Act 307 Rules, Tables 1 and 2a.*

The ground water samples were accumulated in sterile sample jars supplied by the analytical laboratory and placed on ice in a cooler for transportation to the laboratory. Standard chain of

5.0 DISCUSSION OF SITE INVESTIGATION DATA

A non-detect boundary was established both laterally and vertically. Based on the results of the site invetigation, soil and ground water concentration contour maps were developed in conjunction with soil and ground water concentration sketches to illustrate the analytical results.

- *Figure 4*, page 29, *Soil BTEX Concentrations Sketch*, identifies locations of BTEX concentrations in the soil. The sketch illustrates the analytical results presented in *Table 1*, page 16.

- *Figure 5*, page 30, *Soil BTEX Concentration Contours (5'-8' Below Grade)*, illustrates the lateral profile of BTEX concentrations at 5 to 8 feet below grade. Based on the analytical data there appears to be one significant point source relating to BTEX in the soil.

- *Figure 6*, page 31, *Ground Water BTEX Concentrations Sketch*, identifies the locations of BTEX concentrations in the ground water. The sketch illustrates the analytical results presented in *Table 1*, page 16.

- *Figure 7*, page 32, *Ground Water BTEX Concentration Contours (8'-13' Below Grade)*, illustrates the lateral profile of BTEX concentrations in the ground water. The initial ground water monitoring was conducted by using a lead screened hollow stem auger which established both the lateral and vertical extent of the hydrocarbon-affected ground water.

  The Allen's Creek Drain acts as a preferential migration pathway. It appears that the leading edge of the contaminant plume lies somewhere around the northeast corner of the City Garage property along the Allen's Creek Drain. MW-9/HA-2B was placed along the southeast side of the Allen's Creek Drain as a long-term monitoring point to monitor the potential forward migration of the plume. Analytical results have also identified a limited area of BTEX-affected ground water at AH-4 below MDNR Type B criteria.

- *Figure 8*, page 33, *Soil PNA's Concentrations Sketch*, identifies the locations of PNA's concentrations in the soil. The sketch illustrates the analytical results presented in *Table 1*, page 16. All analytical results were non-detect for PNA's in the soil.

- *Figure 9*, page 34, *Ground Water PNA's Concentration Sketch*, identifies the locations of PNA's concentrations in the ground water. The sketch illustrates the analytical results presented in *Table 1*, page 16. Analytical results have identified limited areas of PNA-affected ground water at MW-4 and AH-12.

- *Figures 4 and 6*, pages 29 and 31, *Soil BTEX and Ground Water BTEX Concentrations Sketches*, identifies the locations of BTEX concentrations in the soil and ground water, respectively. The vertical distribution of the BTEX-affected soil and ground water has been established near AH-1 as being limited to 13 feet BG in the soil and 26 feet BG in the ground water. BTEX-affected soil and ground water near the leading edge of the plume has been limited to 8 feet BG in the soil and 10 feet BG in the ground water.

  The vertical distribution of the PNA-affected ground water has been established and limited to areas around MW-4 at 10 feet BG and AH-12 at 13 feet BG.

Based on the hydrogeology of the site, the analytical data, the concentration contours, the history of the site, and the abatement actions taken to date, TGI, on behalf of the City of Ann Arbor, recommends that a corrective measures study (feasibility study) be conducted on potential soil and ground water cleanup technologies. In conclusion, TGI, on behalf of the City of Ann Arbor, requests that the MDNR furnish a written statement confirming that the site investigation is adequate and complete.

Table 1
Soil and Ground Water Sampling Results

Sample ID	Date	Matrix	Depth Below Grade (feet)	Benzene♦ (ppb)	Toluene♦ (ppb)	Ethyl-Benzene♦ (ppb)	Xylenes♦ (ppb)	Total BTEX (ppb)	Total PNAs◂ (ppb)	TPH● (ppb)
BO-01	22-Jun-90	soil	10'	ND	ND	ND	ND	ND	ND◂◂	ND
MW-01	22-Jun-90	soil	01'-03'	ND	ND	ND	ND	ND	ND◂◂	ND
MW-01	22-Jun-90	soil	05' grab	ND	ND	ND	ND	ND	ND◂◂	140,000
MW-01	22-Jun-90	water	05'	ND♣	ND♣	ND♣	ND♣	ND	ND◂◂	ND
MW-01	06-Jul-90	water	02'-07'	ND	ND	ND	1	1	ND◂◂	830,000
MW-02	06-Jul-90	water	03'-08'	ND	ND	ND	ND	ND	ND◂◂	28,000
MW-03	06-Jul-90	water	03'-08'	130	15	ND	ND	145	ND◂◂	89,000

ppb	Parts per billion:	= µ/kg (microgram per kilogram) for soil = µg/L (micrograms per liter) for water
BTEX	Benzene, Toluene, Ethyl-benzene and Xylenes	
PNAs	Polynuclear Aromatics	
TPH	Total Petroleum Hydrocarbons	
NS	Not Sampled	
ND	(Non-Detect) Indicates Results Below Detection Limits	
♠	Sample Broken	

Indicates Results Above Type B Criteria

Detection Limits:			
♦	BTEX (per constituent)	Soil:	< 10.0 ppb
		Water:	< 1.0 ppb
♦♦	Xylenes, total	Soil:	< 30.0 ppb
♣	Benzene	Water:	< 4.0 ppb
	Toluene, Ethyl-benzene, Xylenes	Water:	< 2.0 ppb (each)
◂	PNAs (per constituent)	Soil:	< 330.0 ppb
		Water:	< 5.0 ppb
◂◂	PNAs (per constituent)	Soil:	Varies
		Water:	Varies
●	TPH	Soil:	<50,000 ppb
		Water:	< 1,000 ppb

Table 1

Soil and Ground Water Sampling Results

Sample ID	Date	Matrix	Depth Below Grade (feet)	Benzene♦ (ppb)	Toluene♦ (ppb)	Ethyl-Benzene♦ (ppb)	Xylenes♦ (ppb)	Total BTEX (ppb)	Total PNAs◂ (ppb)	TPH● (ppb)
AH-01	08-Aug-90	soil	05'-07'	90	1,000	2,400	5,700	9,190	NS	ND
AH-01	08-Aug-90	soil	11'-13'	ND	ND	ND	ND	ND	NS	ND
AH-01	08-Aug-90	water	11'-13'	43	27	14	27	111	NS	ND
AH-01	08-Aug-90	water	19'-21'	3	ND	ND	ND	3	NS	ND
AH-01	08-Aug-90	water	24'-26'	2	ND	ND	ND	2	NS	ND
AH-02	08-Aug-90	soil	05'-07'	ND	ND	ND	ND	ND	NS	630,000
AH-02	08-Aug-90	soil	11'-13'	ND	ND	ND	ND	ND	NS	ND

ppb Parts per billion: = µ/kg (microgram per kilogram) for soil
= µg/L (micrograms per liter) for water
BTEX Benzene, Toluene, Ethyl-benzene and Xylenes
PNAs Polynuclear Aromatics
TPH Total Petroleum Hydrocarbons
NS Not Sampled
ND (Non-Detect) Indicates Results Below Detection Limits
♠ Sample Broken

Indicates Results Above Type B Criteria

Detection Limits:

♦	BTEX (per constituent)	Soil:	< 10.0 ppb
		Water:	< 1.0 ppb
♦♦	Xylenes, total	Soil:	< 30.0 ppb
♣	Benzene	Water:	< 4.0 ppb
	Toluene, Ethyl-benzene, Xylenes	Water:	< 2.0 ppb (each)
◂	PNAs (per constituent)	Soil:	< 330.0 ppb
		Water:	< 5.0 ppb
◂◂	PNAs (per constituent)	Soil:	Varies
		Water:	Varies
●	TPH	Soil:	<50,000 ppb
		Water:	< 1,000 ppb

Table 1

Soil and Ground Water Sampling Results

Sample ID	Date	Matrix	Depth Below Grade (feet)	Benzene♦ (ppb)	Toluene♦ (ppb)	Ethyl-Benzene♦ (ppb)	Xylenes♦ (ppb)	Total BTEX (ppb)	Total PNAs◂ (ppb)	TPH● (ppb)
AH-04	09-Aug-90	water	11'-13'	ND	ND	2	5	7	NS	ND
AH-05	09-Aug-90	soil	07' grab	ND	ND	ND	ND	ND	NS	ND
AH-05	09-Aug-90	soil	14'-16'	ND	ND	ND	ND	ND	NS	ND
AH-05	09-Aug-90	water	14'-16'	ND	ND	ND	4	4	NS	ND
AH-05	09-Aug-90	water	23'-25'	ND	ND	ND	ND	ND	NS	ND
AH-05	09-Aug-90	water	27'-29'	ND	ND	ND	ND	ND	NS	ND
AH-06	09-Aug-90	soil	09'-11'	ND	ND	ND	ND	ND	NS	ND
AH-06	09-Aug-90	water	09'-11'	20	7	ND	ND	27	NS	ND

ppb	Parts per billion: = µ/kg (microgram per kilogram) for soil = µg/L (micrograms per liter) for water
BTEX	Benzene, Toluene, Ethyl-benzene and Xylenes
PNAs	Polynuclear Aromatics
TPH	Total Petroleum Hydrocarbons
NS	Not Sampled
ND	(Non-Detect) Indicates Results Below Detection Limits
♠	Sample Broken

Indicates Results Above Type B Criteria

Detection Limits:			
♦	BTEX (per constituent)	Soil:	< 10.0 ppb
		Water:	< 1.0 ppb
♦♦	Xylenes, total	Soil:	< 30.0 ppb
♣	Benzene	Water:	< 4.0 ppb
	Toluene, Ethyl-benzene, Xylenes	Water:	< 2.0 ppb (each)
◂	PNAs (per constituent)	Soil:	< 330.0 ppb
		Water:	< 5.0 ppb
◂◂	PNAs (per constituent)	Soil:	Varies
		Water:	Varies
●	TPH	Soil:	<50,000 ppb
		Water:	< 1,000 ppb

The Traverse Group, Inc.

Table 1

Soil and Ground Water Sampling Results

Sample ID	Date	Matrix	Depth Below Grade (feet)	Benzene♦ (ppb)	Toluene♦ (ppb)	Ethyl-Benzene♦ (ppb)	Xylenes♦ (ppb)	Total BTEX (ppb)	Total PNAs◂ (ppb)	TPH● (ppb)
AH-06	09-Aug-90	water	17'-20'	8	2	ND	ND	10	NS	ND
AH-07	09-Aug-90	soil	05'-07'	ND	ND	ND	ND	ND	NS	ND
AH-07	09-Aug-90	soil	13'-15'	ND	ND	ND	ND	ND	NS	ND
AH-07	09-Aug-90	water	09'-11'	ND	ND	2	5	7	NS	ND
AH-07	09-Aug-90	water	20'-22'	ND	ND	1	3	4	NS	ND
Purge Well	04-Oct-90	water	07.5'-12'	8,120	10,300	1,050	10,290	29,760	NS	NS
AH-08	08-Mar-93	soil	12'-14'	ND	ND	ND	ND♦,♦♦	ND	ND	NS

ppb Parts per billion: = µ/kg (microgram per kilogram) for soil
= µg/L (micrograms per liter) for water
BTEX Benzene, Toluene, Ethyl-benzene and Xylenes
PNAs Polynuclear Aromatics
TPH Total Petroleum Hydrocarbons
NS Not Sampled
ND (Non-Detect) Indicates Results Below Detection Limits
♠ Sample Broken

Indicates Results Above Type B Criteria

Detection Limits:

♦	BTEX (per constituent)	Soil: < 10.0 ppb Water: < 1.0 ppb
♦♦	Xylenes, total	Soil: < 30.0 ppb
♣	Benzene	Water: < 4.0 ppb
	Toluene, Ethyl-benzene, Xylenes	Water: < 2.0 ppb (each)
◂	PNAs (per constituent)	Soil: < 330.0 ppb Water: < 5.0 ppb
◂◂	PNAs (per constituent)	Soil: Varies Water: Varies
●	TPH	Soil: <50,000 ppb Water: < 1,000 ppb

Table 1

Soil and Ground Water Sampling Results

Sample ID	Date	Matrix	Depth Below Grade (feet)	Benzene♦ (ppb)	Toluene♦ (ppb)	Ethyl-Benzene♦ (ppb)	Xylenes♦ (ppb)	Total BTEX (ppb)	Total PNAs◂ (ppb)	TPH● (ppb)
MW-05	08-Mar-93	soil	06'-08'	ND	ND	ND	ND♦♦	ND	ND	NS
AH-09	09-Mar-93	soil	06'-08'	ND	ND	ND	ND♦♦	ND	ND	NS
AH-09	09-Mar-93	soil	10'-12'	ND	ND	ND	ND♦♦	ND	ND	NS
AH-09	09-Mar-93	water	12'-17'	ND	ND	ND	ND	ND	ND	NS
AH-09	09-Mar-93	water	22'-27'	ND	ND	ND	ND	ND	♠	NS
MW-06	09-Mar-93	soil	04'-06'	ND	ND	ND	ND♦♦	ND	ND	NS
MW-06	09-Mar-93	soil	06'-08'	ND	ND	ND	ND♦♦	ND	ND	NS
MW-07	09-Mar-93	soil	06'-08'	21	ND	28	220♦♦	269	ND	NS

ppb Parts per billion: = µ/kg (microgram per kilogram) for soil
= µg/L (micrograms per liter) for water
BTEX Benzene, Toluene, Ethyl-benzene and Xylenes
PNAs Polynuclear Aromatics
TPH Total Petroleum Hydrocarbons
NS Not Sampled
ND (Non-Detect) Indicates Results Below Detection Limits
♠ Sample Broken

Indicates Results Above Type B Criteria

Detection Limits:

♦	BTEX (per constituent)	Soil:	< 10.0 ppb
		Water:	< 1.0 ppb
♦♦	Xylenes, total	Soil:	< 30.0 ppb
♣	Benzene	Water:	< 4.0 ppb
	Toluene, Ethyl-benzene, Xylenes	Water:	< 2.0 ppb (each)
◂	PNAs (per constituent)	Soil:	< 330.0 ppb
		Water:	< 5.0 ppb
◂◂	PNAs (per constituent)	Soil:	Varies
		Water:	Varies
●	TPH	Soil:	<50,000 ppb
		Water:	< 1,000 ppb

Table 1

Soil and Ground Water Sampling Results

Sample ID	Date	Matrix	Depth Below Grade (feet)	Benzene♦ (ppb)	Toluene♦ (ppb)	Ethyl-Benzene♦ (ppb)	Xylenes♦ (ppb)	Total BTEX (ppb)	Total PNAs◂ (ppb)	TPH● (ppb)
MW-07	09-Mar-93	soil	08'-10'	45	ND	ND	33♦♦	78	ND	NS
AH-10	10-Mar-93	soil	06'-08'	ND	ND	ND	ND♦♦	ND	ND	NS
AH-10	10-Mar-93	water	08'-13'	ND	ND	ND	ND	ND	ND	NS
AH-12	11-Mar-93	soil	06'-08'	14	14	21	49♦♦	98	ND	NS
AH-12	11-Mar-93	water	08'-13'	320	98	45	110	573	155	NS
AH-13B	11-Mar-93	soil	08'-10'	ND	ND	ND	ND♦♦	ND	ND	NS
AH-13B	11-Mar-93	water	08'-13'	ND	ND	ND	ND	ND	ND	NS

ppb Parts per billion: = μ/kg (microgram per kilogram) for soil
= μg/L (micrograms per liter) for water
BTEX Benzene, Toluene, Ethyl-benzene and Xylenes
PNAs Polynuclear Aromatics
TPH Total Petroleum Hydrocarbons
NS Not Sampled
ND (Non-Detect) Indicates Results Below Detection Limits
♠ Sample Broken

Indicates Results Above Type B Criteria

Detection Limits:

♦	BTEX (per constituent)	Soil: < 10.0 ppb Water: < 1.0 ppb
♦♦	Xylenes, total	Soil: < 30.0 ppb
♣	Benzene	Water: < 4.0 ppb
	Toluene, Ethyl-benzene, Xylenes	Water: < 2.0 ppb (each)
◂	PNAs (per constituent)	Soil: < 330.0 ppb Water: < 5.0 ppb
◂◂	PNAs (per constituent)	Soil: Varies Water: Varies
●	TPH	Soil: <50,000 ppb Water: < 1,000 ppb

Table 1

Soil and Ground Water Sampling Results

Sample ID	Date	Matrix	Depth Below Grade (feet)	Benzene♦ (ppb)	Toluene♦ (ppb)	Ethyl-Benzene♦ (ppb)	Xylenes♦ (ppb)	Total BTEX (ppb)	Total PNAs◂ (ppb)	TPH● (ppb)
AH-13B	11-Mar-93	water	12'-17'	ND	ND	ND	ND	ND	ND	NS
MW-08B	11-Mar-93	soil	06'-08'	ND	ND	ND	ND♦♦	ND	ND	NS
MW-08B	11-Mar-93	soil	12'-14'	ND	ND	ND	ND♦♦	ND	ND	NS
MW-08B	11-Mar-93	water	11'-12.5'	ND	ND	ND	ND	ND	ND	NS
HA-01	12-Mar-93	soil	03.5'-04'	ND	ND	ND	ND	ND	ND	NS
HA-01	12-Mar-93	soil	06.5'-07'	ND	ND	ND	ND	ND	ND	NS
HA-01	12-Mar-93	water	08'-10'	2	ND	ND	ND	2	ND	NS

ppb Parts per billion: = µ/kg (microgram per kilogram) for soil
= µg/L (micrograms per liter) for water
BTEX Benzene, Toluene, Ethyl-benzene and Xylenes
PNAs Polynuclear Aromatics
TPH Total Petroleum Hydrocarbons
NS Not Sampled
ND (Non-Detect) Indicates Results Below Detection Limits
♠ Sample Broken

Indicates Results Above Type B Criteria

Detection Limits:

♦	BTEX (per constituent)	Soil:	< 10.0 ppb
		Water:	< 1.0 ppb
♦♦	Xylenes, total	Soil:	< 30.0 ppb
♣	Benzene	Water:	< 4.0 ppb
	Toluene, Ethyl-benzene, Xylenes	Water:	< 2.0 ppb (each)
◂	PNAs (per constituent)	Soil:	< 330.0 ppb
		Water:	< 5.0 ppb
◂◂	PNAs (per constituent)	Soil:	Varies
		Water:	Varies
●	TPH	Soil:	<50,000 ppb
		Water:	< 1,000 ppb

Table 1

Soil and Ground Water Sampling Results

Sample ID	Date	Matrix	Depth Below Grade (feet)	Benzene♦ (ppb)	Toluene♦ (ppb)	Ethyl-Benzene♦ (ppb)	Xylenes♦ (ppb)	Total BTEX (ppb)	Total PNAs◂ (ppb)	TPH● (ppb)
AH-02B	15-Mar-93	soil	07.5'-08'	ND	ND	ND	ND	ND	ND	NS
MW-09	17-Mar-93	soil	09'-11'	ND	ND	ND	ND	ND	ND	NS
MW-09	17-Mar-93	soil	15'-17'	ND	ND	ND	ND	ND	ND	NS
MW-09	17-Mar-93	water	19'-24'	ND	ND	ND	ND	ND	ND	NS
MW-03	26-Mar-93	water	03'-08'	60	180	ND	19	259	ND	NS
MW-04	26-Mar-93	water	02'-07'	ND	23	ND	44	67	115	NS
MW-05	26-Mar-93	water	07'-12'	51	6	1	20	78	ND	NS

ppb Parts per billion: = µl/kg (microgram per kilogram) for soil
= µg/L (micrograms per liter) for water
BTEX Benzene, Toluene, Ethyl-benzene and Xylenes
PNAs Polynuclear Aromatics
TPH Total Petroleum Hydrocarbons
NS Not Sampled
ND (Non-Detect) Indicates Results Below Detection Limits
♠ Sample Broken

Indicates Results Above Type B Criteria

Detection Limits:

♦	BTEX (per constituent)	Soil:	< 10.0 ppb
		Water:	< 1.0 ppb
♦♦	Xylenes, total	Soil:	< 30.0 ppb
♣	Benzene	Water:	< 4.0 ppb
	Toluene, Ethyl-benzene, Xylenes	Water:	< 2.0 ppb (each)
◂	PNAs (per constituent)	Soil:	< 330.0 ppb
		Water:	< 5.0 ppb
◂◂	PNAs (per constituent)	Soil:	Varies
		Water:	Varies
●	TPH	Soil:	<50,000 ppb
		Water:	< 1,000 ppb

Table 1

Soil and Ground Water Sampling Results

Sample ID	Date	Matrix	Depth Below Grade (feet)	Benzene♦ (ppb)	Toluene♦ (ppb)	Ethyl-Benzene♦ (ppb)	Xylenes♦ (ppb)	Total BTEX (ppb)	Total PNAs◂ (ppb)	TPH● (ppb)
MW-06	26-Mar-93	water	10'-15'	ND	ND	ND	ND	ND	ND	NS
MW-07	26-Mar-93	water	13'-18'	ND	ND	ND	ND	ND	ND	NS
MW-08B	26-Mar-93	water	09'-14'	ND	ND	ND	ND	ND	ND	NS
MW-09	26-Mar-93	water	07'-12'	ND	ND	ND	ND	ND	ND	NS
MW-5	29-Apr-93	water	07'-12'	ND	ND	ND	ND	ND	NS	NS

ppb	Parts per billion: = µ/kg (microgram per kilogram) for soil = µg/L (micrograms per liter) for water
BTEX	Benzene, Toluene, Ethyl-benzene and Xylenes
PNAs	Polynuclear Aromatics
TPH	Total Petroleum Hydrocarbons
NS	Not Sampled
ND	(Non-Detect) Indicates Results Below Detection Limits
♠	Sample Broken

Indicates Results Above Type B Criteria

Detection Limits:			
	♦	BTEX (per constituent)	Soil: < 10.0 ppb Water: < 1.0 ppb
	♦♦	Xylenes, total	Soil: < 30.0 ppb
	♣	Benzene	Water: < 4.0 ppb
		Toluene, Ethyl-benzene, Xylenes	Water: < 2.0 ppb (each)
	◂	PNAs (per constituent)	Soil: < 330.0 ppb Water: < 5.0 ppb
	◂◂	PNAs (per constituent)	Soil: Varies Water: Varies
	●	TPH	Soil: <50,000 ppb Water: < 1,000 ppb

The Traverse Group, Inc.

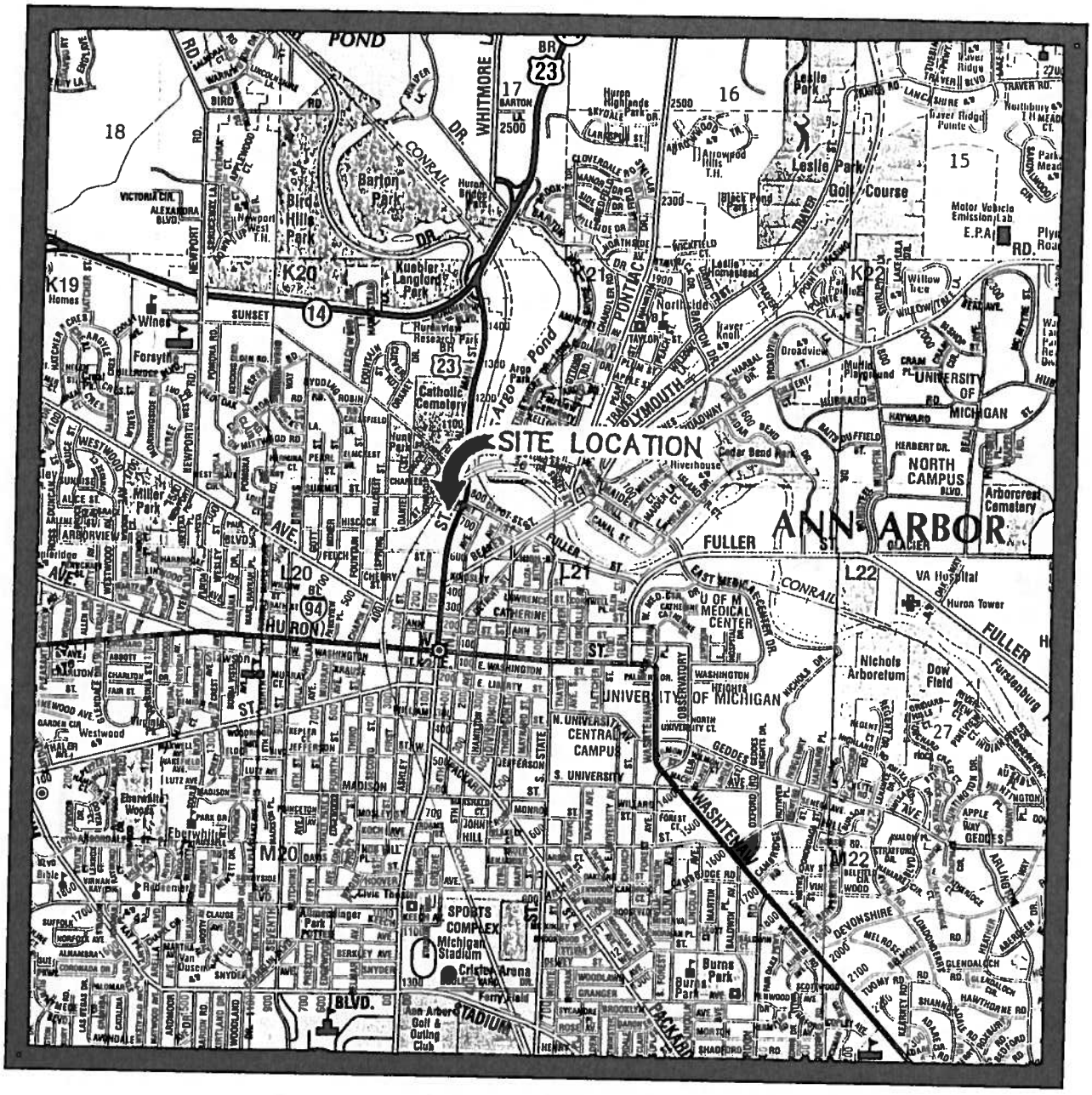

Figure 1.
SITE LOCATION MAP

Ann Arbor City Garage
721 N. Main Street
Ann Arbor, Michigan

The Traverse Group, Inc.