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ENVIRONMENTAL MANAGEMENT CONSULTANTS

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Doc-56

STATUS REPORT
SOIL AND GROUNDWATER REMEDIATION
TANK FARM 37

Advanced Environmental, Inc., Project Number 3114IE
February 17, 1994

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EXECUTIVE SUMMARY

ANALYSIS OF IMPACTED AREA - SOURCE AREAS

1. Review of the WWES report indicates that the east sidewall in particular, as well as areas of the excavation floor continue to be source areas for impacting the soil and groundwater.

2. The east sidewall soil in the TB-5 area (near the former location of Tank Nos. 3, 4, and 5) remains a "hot spot" and should be removed (which will entail removal and replacement of a portion of the concrete access road). Four PNAHs in soil samples collected from this area exceed the Generic Industrial Type C cleanup criteria.

3. The excavation floor in the TB-7 area exceeded the Type B cleanup criteria. This may be due to the remaining presence of benzene in the soil of the excavation floor. Soil samples collected from the excavation sidewalls and floor indicated the presence of benzene and PNAHs above the Type B cleanup criteria. Re-excavation of this area would be impractical.

4. Three other boring locations (benzene at MW-5; benzo(a)anthracene and chrysene at MW-9; and, benz(o)anthracene, benzo(a)pyrene, benzo(b)fluoroanthene, and chrysene at MW-7) exceed the Type B soil cleanup criteria, but not the Generic Industrial Type C cleanup criteria.

5. Type B groundwater cleanup levels for benzene and lead are slightly exceeded only at MW-5, which is close to the TB-5 "hot spot" area.

6. The initial abatement system consisting of an infiltration trench and recovery well was effective in removing free product. Because the area in the vicinity of the recovery well is bowl-shaped, oil may have migrated from the trench and recovery well in the former Tank Farm area into the fill between the former Tank Farm and New Tank Farm and then into the foundation drain tile around the new Tank Farm.

7. Oil build-up due to leakage from the former Tank Farm may be the source of free product found in the monitoring well designated as Section 2/MW-3. This is suspected due to the proximity of the monitoring well to the former Tank Farm; however, the source of free product in this well has not been positively identified.

SELECTION OF CLEANUP CRITERIA

1. The Generic Industrial Type C cleanup criteria is recommended for this site. The Generic Industrial Type C is recommended since:

   - the excavation floor and sidewalls may be continuing sources and the impracticability of re-excavating this area;
   - there are four areas that exceed the Type B soil cleanup criteria, but not the Generic Industrial Type C cleanup criteria; and,
   - only the "hot spot" area of TB-5 has four PNAHs which exceed the Generic Industrial Type C cleanup criteria.

2. The Generic Industrial Type C closure, however, would still require the treatment or removal of the TB-5 "hot spot" area (east sidewall in the vicinity of TB-5).

3. Because of the limited area of the TB-5 "hot spot," excavation and disposal would be the preferred alternative contingent upon disposal of the soil at a local landfill;

4. Floating free product should be recovered from Section 2/MW-3 by bailing. Floating free product in Manhole 2 south of the new Tank Farm 37 should be recovered by adjusting the pumping schedule so that the nearly flat drain tile remains effective or install an oil-water separator or divider in the manhole.

5. It must be emphasized that the Generic Industrial Type C closure for the site also means satisfying the other Type C requirements such as deed restrictions, monitoring, financial responsibility, installing a marker on the site, and other applicable, appropriate and relevant requirements (possibly RCRA capping requirements).

REPORTS

1. Submit the WWES report entitled *Remedial Subsurface Investigation for Former Tank Farm 37* to the Michigan Department of Natural Resources (MDNR) with a cover letter explaining that WWES has been replaced by another consulting firm and that this report should be considered a final report.

2. Submit a corrective action plan for MDNR approval requesting that Generic Industrial Type C cleanup criteria be used and that the TB-5 "hot spot" area be remediated using excavation and disposal. An oil/water separator should be installed in a manhole just south of the new Tank Farm 37 and a new monitoring well installed south of the old tank farm to evaluate the performance of the preferred remedial alternative in the TB-5 source area.

PROPOSED SCHEDULE FOR IMPLEMENTATION

The following proposed schedule reflects the expected duration of the remediation based on existing information:

TASK	TIME LINE
Respond to MDNR comments and modify Corrective Action Plan (CAP)	Two weeks after receipt of MDNR letter
Complete bid package for CAP for excavation, concrete removal, backfill, and concrete replacement	Two months after approval of CAP
Complete bid package for hauling and transport of contaminated soil from "hot spot" area	Two months after approval of CAP
Complete bid package for installation of oil/water separator in manhole south of new Tank Farm 37	Two months after approval of CAP
Complete bid package for installation of additional monitoring well, pump schedule for recovery well, water level measurements for monitoring wells before and after pumping of recovery wells, quarterly monitoring of wells, including well with free product (Section 2/MW-3), progress reports to the MDNR, laboratory analysis of groundwater samples	Three months after approval of CAP
Issue Notice to Proceed	Four months after approval of CAP
Confirmatory sampling of excavation floor and sidewalls	Four months after approval of CAP
Laboratory Analysis of soil and groundwater samples and data interpretation	Five months after approval of CAP
Projected optimistic completion date for "hot spot" removal and replacement of fill and concrete road	Twelve months after approval of CAP
Quarterly monitoring of wells	Five years, or reaching an agreed-upon asymptote

1.0 INTRODUCTION/PURPOSE

The purpose of this report is to detail the progress made in meeting the following Scope of Work contained in Advanced Environmental, Inc. (Advanced), proposal to General Motors:

(1) review existing data and reports prepared by the former consultant, WW Engineering & Science (WWES);

(2) attempt to determine from the previous reports whether the BTEX recovered at well TF-37 has originated from the three tanks that were east of former Building 37; the engine plant tank farms across Stewart Street; or unknown sources under the parking lot west of well TF-37; additional sampling may be recommended if necessary;

(3) determine if the WWES draft report entitled *Remedial Subsurface Investigation for Former Tank Farm No. 37*, dated October 19, 1992, can be finalized into an official report suitable for submission to the Michigan Department of Natural Resources (MDNR); and,

(4) based on existing data, select either a closure request or prepare a tentative interim response plan.

2.0 BACKGROUND

Tank Farm 37 is located near the north end of the BOC-Flint facility as shown in Figure 1. The Tank Farm consisted of 17 underground storage tanks (UST) numbered 3 through 19 (Figure 2) which were installed in 1950. A site diagram is included as Figure 3. Tanks No. 1 and No. 2 were formerly located on the north and south sides of Building 38. These two tanks were removed and closed in 1988, and are not related to Tank Farm 37.

The majority of the tanks, each with a capacity of 12,000 gallons, contained motor oil, hydraulic oil, and mineral seal (Table 1). Two of the tanks (Nos. 4 and 5) held gasoline and one tank (No. 3) contained thinner. A release was suspected during sampling of 11 monitoring wells in the tank farm area during December, 1989. The tanks were subsequently removed during April through August, 1991. Tank No. 4, containing gasoline, and Tank No. 10, containing motor oil, were found to be perforated at the ends of the tanks. Specifically, Tank

TABLE 1

CONTENTS/CAPACITIES OF UNDERGROUND STORAGE TANKS
AT TANK FARM 37

Tank Number	Capacity (gallon)	Composition	Contents	Removal Date	Condition of Tank Upon Removal
3	12,000	Steel	Thinner	4/19/91	Good Condition
4	12,000	Steel	Regular Gasoline	4/19/91	Two 1/2" and 1/4" diameter holes on east end; 12" above the bottom on the north seam
5	12,000	Steel	Regular Gasoline	4/18/91	Good Condition
6	12,000	Steel	Hydraulic Oil	5/10/91	Good Condition
7	12,000	Steel	Hydraulic Oil	5/9/91	Good Condition
8	12,000	Steel	Motor Oil	5/8/91	Good Condition
9	12,000	Steel	Motor Oil	5/7/91	Good Condition
10	12,000	Steel	Motor Oil	5/3/91	1/2" diameter hole at bottom edge of the west end
11	12,000	Steel	Motor Oil	5/2/91	Good Condition
12	12,000	Steel	Motor Oil	5/1/91	Good Condition
13	12,000	Steel	Minearl Seal	5/22/91	Good Condition
14	12,000	Steel	Minearl Seal	5/21/91	Good Condition
15	12,000	Steel	P47 Way Oil	5/20/91	Good Condition
16	12,000	Steel	Soluble	5/17/91	Good Condition
17	12,000	Steel	Sol (Elray)	5/16/91	Good Condition
18	12,000	Steel	Motor Oil	5/15/91	Good Condition
19	12,000	Steel	A-50 Lube	5/14/91	Good Condition

No. 4 had two adjacent holes (1/4" and 1/2" in diameter, 12 inches above the bottom of the north seam) on the end of the tank that faced east in the former Tank Farm. Tank No. 10 had a one-half inch diameter hole along the seam approximately 12 inches from the bottom of the tank on the end that faced west in the former Tank Farm. The tanks were partially submerged in the groundwater at the time of the excavation.

WWES stated in the report entitled *Underground Storage Tank Removal Report for Tank Farm 37*, that the two concrete slabs that formerly supported the saddles for Tank Nos. 6 - 19 were not removed but that the concrete pad and saddles supporting Tank Nos. 3 - 5 were removed. It should be noted that the boring log for TB-5 (Attachment 2) in the vicinity of Tanks Nos. 3 - 5 shows that concrete was encountered 13.5 to 15.0 feet below grade. A concrete tunnel located between the two rows of tanks which acted as a structural support for one end of each tank and provided access for product piping connections from each tank, was demolished and the rubble removed. A daily field report (7/12/91) indicated that the fill around the concrete tunnel was stained.

Groundwater at the time the tanks were removed was encountered at approximately 10 feet below ground surface. An oil sheen was observed on the surface of the groundwater within the excavated area. The groundwater was pumped from the excavation several times during the tank excavation and discharged to the BOC Process Waste Treatment Plant. A water sample collected from the center of the former location of Tank No. 4 indicated the presence of significant concentrations of BTEX and naphthalene which exceeded the then-current Type B cleanup criteria.

It should be noted that the excavation floor was approximately 10 feet below grade, at the approximate depth that groundwater was encountered, indicating that the bottoms of the tanks were likely in water.

With respect to soil samples in the excavated area of Tanks Nos. 3 - 5, the highest concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) were found in a soil sample collected from the east sidewall at the former location of Tank No. 4, the tank that had two holes on the east end of the tank. Benzene concentrations exceeding Type B cleanup criteria were also found in samples collected from the north sidewall and the floor, while ethylbenzene concentrations exceeding Type B cleanup criteria were found on all three sidewalls and the floor. Toluene and xylenes concentrations exceeding Type B cleanup criteria were found in samples collected from the east and west sidewalls. Four polynuclear aromatic hydrocarbons (PNAHs) exceeding Type B cleanup criteria were found in samples collected from the east wall.

With respect to the excavated area for Tank Nos. 6 - 19, benzene concentrations exceeding Type B cleanup criteria were found in three floor samples and xylenes in one floor sample. Some PNAH concentrations exceeding Type B cleanup criteria were found in two floor samples on the west side of the excavation in the vicinity of Tank No. 10, which had a hole facing the west sidewall.

While the excavation was open, an abatement system consisting of a sump and a collection trench along the down-gradient sides of the excavation was sloped toward a 30-inch recovery well acting as a sump. It should be noted that this recovery well was moved to its current location from just south of Tank No. 6. The trenches are on the east and south sides of the excavated area and are three feet wide filled with gravel from approximately two feet below grade to 14 feet below grade. The system was intended to intercept local groundwater upgradient of the trench to a depth of approximately 14 feet below grade. The free product removal report states that the 30-inch recovery well was installed to a depth of 11 feet below grade, with a submersible groundwater depression pump. However, a figure attached to the report shows that the recovery well was installed to a depth of 13 feet with the well screened from six to 13 feet below grade. The 30-inch recovery well influenced groundwater flow and was effective in capturing free product.

A trunk of the storm sewer system that discharges into Outfall 002 runs along the southwestern edge of the Tank Farm. Upon the construction of the new Tank Farm to the south of the former tank farm, a foundation drain pipe was installed to remove the groundwater around the foundation. The collected groundwater discharged into the storm sewer. However, after a period of time, oils were found entering the storm sewer from the foundation drain. The connection to the storm sewer was plugged and the collected groundwater is now discharged into a sump that is pumped to the process waste treatment facility.

Free product was found in Section 2/MW-3 during July, 1992, and appears to have originated from the same source as the free-phase product found in the 30-inch recovery well. The likely source of this oil is leakage from Tank No. 10 and other tanks such as Nos. 8, 9, 11, 12, 13, 16, and 19 which contained motor oil or other petroleum products. However, it is also possible that the oil build-up over time from leaking tanks may have reached the area around Section 2/MW-3.

3.0 FINDINGS FROM REVIEW OF PREVIOUS REPORTS

Advanced reviewed the WWES reports entitled *Underground Storage Tank Removal and Site Assessment Report for Tank Farm 37,* dated December, 1991; *Preliminary Subsurface Investigation for Former Tank Farm 37,* dated February, 1992; and, *Remedial Subsurface Investigation for Former Tank Farm 37,* dated October 19, 1992.

3.1 Soil

Based on a review of these previous reports for Tank Farm 37, the following observations can be made:

(1) Tank No. 4 (holding gasoline) and Tank No. 10 (holding motor oil) had visual evidence of holes;

(2) Daily field logs of the tank excavation and photographs indicated stained soil around the following Tank Nos: 4, 6, 8, 9, 10, 11, 12, 13, 16, and 19;

(3) Daily field logs indicated that the fill surrounding a concrete tunnel between the two rows of tanks was stained;

(4) No written field observations of the demolition of Building 37 (located just north of the two rows of tanks) which tied into the tank farm are available; fill around the foundation of former Building 37 and foundation drains may be potential sources if not removed; also pipes from the tanks to the former building may not have been drained prior to demolition;

(5) Other contributory sources may exist such as piping associated with the tanks or the present pipe trench, fill associated with storm sewer in the adjacent west parking lot, or sewers or tanks associated with Building 36, or piping and foundation drains associated with the demolished Building 37, or the bottom and sidewalls of the excavation;

(6) Laboratory analysis of soil samples collected (Attachment 1) during the tank excavation (May and August, 1991) and during the remedial investigation (July, 1992) indicated that the soil around TB-5 including the east wall of the former excavation remains a source and/or "hot spot" area;

(7) Laboratory analysis of bottom soil samples collected during the tank excavation indicated that concentrations of benzene and some PNAHs exceeded the then-current Michigan Act 307 Type B cleanup criteria and so it is possible that the bottom of the excavation remains a source; for example,the soil sample collected between 14 -16 feet below grade at TB-7 during the remedial investigation (July, 1992) indicated the presence of benzene above Type B cleanup criteria -- this was also shown to be the case in the sample collected from the floor of the excavation approximately 10.5 feet below grade in August, 1991, in the vicinity of Tank No. 10 (near the TB-7 location) that leaked motor oil;

(8) Therefore, while the TB-5 area is identified as a source area, contributory sources at other areas of the former Tank Farm have not been positively identified;

(9) The presence of trichloroethane, vinyl chloride, and cis-1,2-dichloroethane on the extreme west side of the site will not be considered as part of this study as these do not appear related to the Tank Farm.

Laboratory analysis of soil samples collected during the remedial investigation indicated five locations with concentrations of constituents above the current Type B cleanup criteria as shown in Attachment 3 (WWES Figure 5) and summarized in the following table (Table 2).

TABLE 2

TANK FARM 37

SOIL SAMPLING RESULTS

Location	TB-5 11' - 13'	MW-5 14' - 16'	TB-7 14' - 16'	MW-7 8.5' - 10.5'	MW-9 8.5' - 10.5'	Type B Cleanup Criteria	Industrial Type C Cleanup Criteria
Water Level	16'	10.5'	14'	10.3	10'		
Benzene	31,000	32	76			24	85,000
Ethylbenzene	190,000					1,500	14,000
Toluene	260,000					16,000	33,000,000
Xylenes	680,000					5,600	270,000,000
Benzo(a)anthracene	2,500			350	830	180(A=330)	2,100
Benzo(a)pyrene	2,600			400		180(A=330)	2,100
Benzo(b)fluoranthene	2,100			340		180(A=330)	2,100
Chrysene	2,900			400	1,100	180(A=330)	2,100
Dibenzo(a,h)anthracene	380					180(A=330)	2,100
Indeno(1,2,3-CD)pyrene	1,500					180(A=330)	2,100
Naphthalene	6,400					580	32,000,000
Pyrene	4,300					–	67,000,000

Notes:

- All results reported in µg/kg.
- A=330 indicates that the Type A cleanup criterion is 330 µg/kg.

The TB-5 location is a hot spot area that exceeds Type B cleanup criteria. Elevated hnu® readings were found from eight to 13 feet below grade at this location. When comparing the sampling results with the new Industrial Type C cleanup criteria, only four PNAHs slightly exceed the Type C level.

There are a few possible explanations for the presence of benzene below the water table at the MW-5 and TB-7 locations. For the MW-5 and TB-7 locations, it could be that (1) soil had been contaminated below the excavation floor; or (2) the groundwater level fluctuated causing benzene to adsorb to the soil particles. In addition, groundwater flowing toward the recovery well may have caused benzene to adsorb to soil particles in the zone of groundwater fluctuation. However, groundwater should have preferentially flowed toward the infiltration trench, except when the recovery well was being pumped.

The results of a soil sample collected from boring location MW-9, downgradient of the former tank farm, indicates impacted soil above Type B criteria. It is possible that oil from the drainage tile around the new tank farm may have migrated in the direction of groundwater flow.

It is difficult to explain the presence of PNAHs at boring location MW-7, as this area is upgradient of the Tank Farm.

In summary, the TB-5 location should be excavated as it remains a source area. However, achieving a Type B cleanup may be difficult as contributory sources have not been positively identified.

3.2 Groundwater

Static water levels are approximately 10 to 11 feet below ground surface. According to the groundwater contour map (Attachment 4, WWES Figure 4), groundwater flow appears to be influenced by the area in between the new and the old Tank Farms. This area contains a sump pit, a recovery well, a collection trench as part of the initial abatement system, and drainage tiles around the foundation of the new Tank Farm.

Floating free product has been found in the 30-inch recovery well and in Section 2/MW-3. Infrared spectrometry indicated that the free product in both wells was indistinguishable.

In-situ hydraulic conductivity testing indicated that the silt underlying the uppermost sand layer has hydraulic conductivity ranging from 0.65 ft/day to 0.38 ft/day at MW-4D and MW-10D, respectively. However, it would have also been useful to obtain vertical and horizontal hydraulic conductivities for the sand layer as well.

Review of the laboratory results of groundwater samples collected in the Tank Farm area indicate that only MW-5 has concentrations of benzene and lead slightly above the Type B cleanup criteria as shown in the following table. The concentrations of these constituents, however, readily pass the Industrial Type C cleanup criteria.

TABLE 3
TANK FARM 37
GROUNDWATER SAMPLE RESULTS

Location	MW-5	Type B Cleanup Criteria	Industrial Type C Criteria
Benzene	1.5	1.2	12
Lead	4.9	4.0	--

Notes: All results reported in µg/L

One possible explanation for the relatively unimpacted groundwater quality in the MW-5 area is that free product was recovered several times from the open excavation over a four-month period and the 30-inch recovery well was also capturing oil as well as the drainage tile around the foundation of the new Tank Farm. The presence of free product in Section 2/MW-3 may be explained by the fact that there was no pumping of free product in this area and leakage from the underground tanks may have accumulated over time.

It should be noted that MW-7 has three constituents (trichloroethane, vinyl chloride, and dissolved lead) which exceed the Type B cleanup criteria. MW-8 has only one constituent, cis-1,2-dichloroethane, that exceeds the Type B cleanup criteria. However, these constituents are unrelated to the Tank Farm and will not be considered further in this report.

4.0 PROPOSED REMEDIATION PLAN FOR SOIL AND GROUNDWATER

4.1 Groundwater Remediation

With regard to groundwater, the Section 2/MW-3 monitoring well and the 30-inch recovery well, if needed, should be regularly purged of free product, sampled quarterly, and water levels measured. The daily field reports should also note the weather for three days prior to sampling and on the day of sampling. With regard to the recovery well, pumping of the recovery well should be continued and water levels of the monitoring wells recorded before and after pumping of the recovery well. Volume of oil and water removed should also be recorded.

There are two options for recovering the free product along the nearly flat drainage tile surrounding the foundation for the new Tank Farm: 1) pass the entire flow through an oil/water separator, or 2) intercept the entire flow and truck it to the industrial wastewater pretreatment facility (IWPF).

The option of using an oil/water separator may provide an effluent that meets the discharge standards of the current NPDES permit. The oil/water separator would have to be located at the surface which would require pumping from the manhole where flow is currently blocked. The bottom few feet of the manhole could be divided to provide a sump for the pump.

The option of intercepting the flow and trucking would also require a sump being fitted into the manhole. An above ground storage tank could be used to minimize the number of trips made from Tank Farm 37 to the IWPF.

4.2 Soil Remediation

With regard to impacted soil, it is recommended that the TB-5 hot spot area should be excavated to a depth of at least 13 feet, even if that entails removal of a portion of the access road. This remedial action should ensure lowering PNAH concentrations below the Industrial Type C cleanup criteria. Because there may be other contributory sources which are not identified, a Type C closure request is a realistic alternative to consider for this tank farm.

The concentration of BTEX and PNAH constituents can be decreased via the following remedial alternatives:

(1) excavation and disposal
(2) soil-vapor extraction
(3) on-site thermal extraction
(4) in-situ bioremediation

An evaluation of each alternative is presented in Attachment 5. Excavation and disposal of soils in the TB-5 area is the preferred remedial alternative due to the fact that it can be implemented readily and there are no post-excavation monitoring costs.

For the purpose of providing a cost estimate, it is assumed that the impacted area in the vicinity of TB-5 is 35 feet in radius. This assumption is based on the fact that constituent concentrations at MW-5 (approximately 20 to 25 feet from TB-5) fall to non-detect with one exception (benzene at 32 μg/kg at 14 to 16 feet below grade). It is assumed that the TB-5 area will be excavated to a depth of 16 feet. Based on these assumptions, the volume of soil to be removed is 2,280 cubic yards. It may be that the top five feet of material may be clean fill and will be stockpiled rather than disposed of at a landfill. However, this cannot be confirmed until the excavation occurs.

Other assumptions include:

(1) The impact area is assumed to exist under the existing roadway along the eastern edge of the excavation area.

(2) Pumping of the groundwater recovery well has not created an extensive smear zone extending from TB-5 to the recovery well.

(3) The excavated soil will be transported to a disposal facility in Wyoming.

4.3 Excavation and Disposal Costs

Sawcut Concrete (mesh-reinforced)

170 feet @ $1.75/foot =	$ 300.00

Concrete Removal

1,700 feet^2 x 1 foot = 63 cubic yards @ $220/cubic yard	13,860.00

Excavation and Site Transport

2,280 cubic yards @ $7/cubic yard =	15,960.00
2,280 cubic yards @ $20/cubic yard	45,600.00

Disposal Fee at USPCI facility in Wyoming

2,280 cubic yards @ $84.50/cubic yard	192,660.00

Backfill from Off-Site

2,280 cubic yards @ $15/cubic yard	34,200.00

Compaction (vibrating plate, 12" lifts, 2 passes)

2,280 cubic yards @ $0.50/cubic yard	1,140.00

Repave with concrete slab on grade 1 foot thick reinforced heavy industrial

1,700 feet^2 (1 ft^2/9 ft^2) @ $75/yard^2	14,166.00
SUBTOTAL	$317,886.00

4.3.1 Confirmatory Sampling:

Excavation floor and sidewall samples:

Laboratory Analysis of Samples:

13 BTEX and lead samples @ $162/sample:	$2,106.00
13 PNAH samples @ $250/sample:	3,250.00
Labor for 4 hours @ $45/hour	180.00
SUBTOTAL	$5,536.00

Assume Two Rounds of Sampling:	$11,072.00
Disposal to Corporate Facility (Wyoming) ($84.50/Cubic Yard)	**Disposal to Local Landfill** ($20/Cubic Yard)
TOTAL $328,958.00	**TOTAL $181,890.00**

These costs do not include the removal and disposal of a concrete pad located 13.5 to 15 feet below grade as shown in the TB-5 boring log. The extent of the concrete pad is unknown.

As noted in Attachment 1, the next preferred alternative would be on-site thermal destruction. However, the disadvantages are that an air permit and extensive monitoring may be required, However, if other facilities would have similar needs, this approach may be cost effective.

Soil vapor extraction will not likely effectively remediate the PNAH constituents to acceptable levels in a reasonable time period.

On-site bioremediation may be useful more as a final polishing step than as the primary remediation system because of susceptibility to temperature fluctuations and significant long-term O & M costs.

A corrective action plan incorporating the preferred remedial alternative as well as a schedule for implementation will need to be submitted the Michigan Department of Natural Resources for approval. In addition to the removal of the source area at TB-5, a corrective action plan will also specify the cleanup criteria, which in this case appears to be a generic industrial Type C closure. Attachment 6 lists the Type C closure requirements.

5.0 SIGNATURE BLOCK

The information contained in this report is based on existing site conditions disclosed or discovered during the current site investigation activities.

Prepared by: Constance Boris

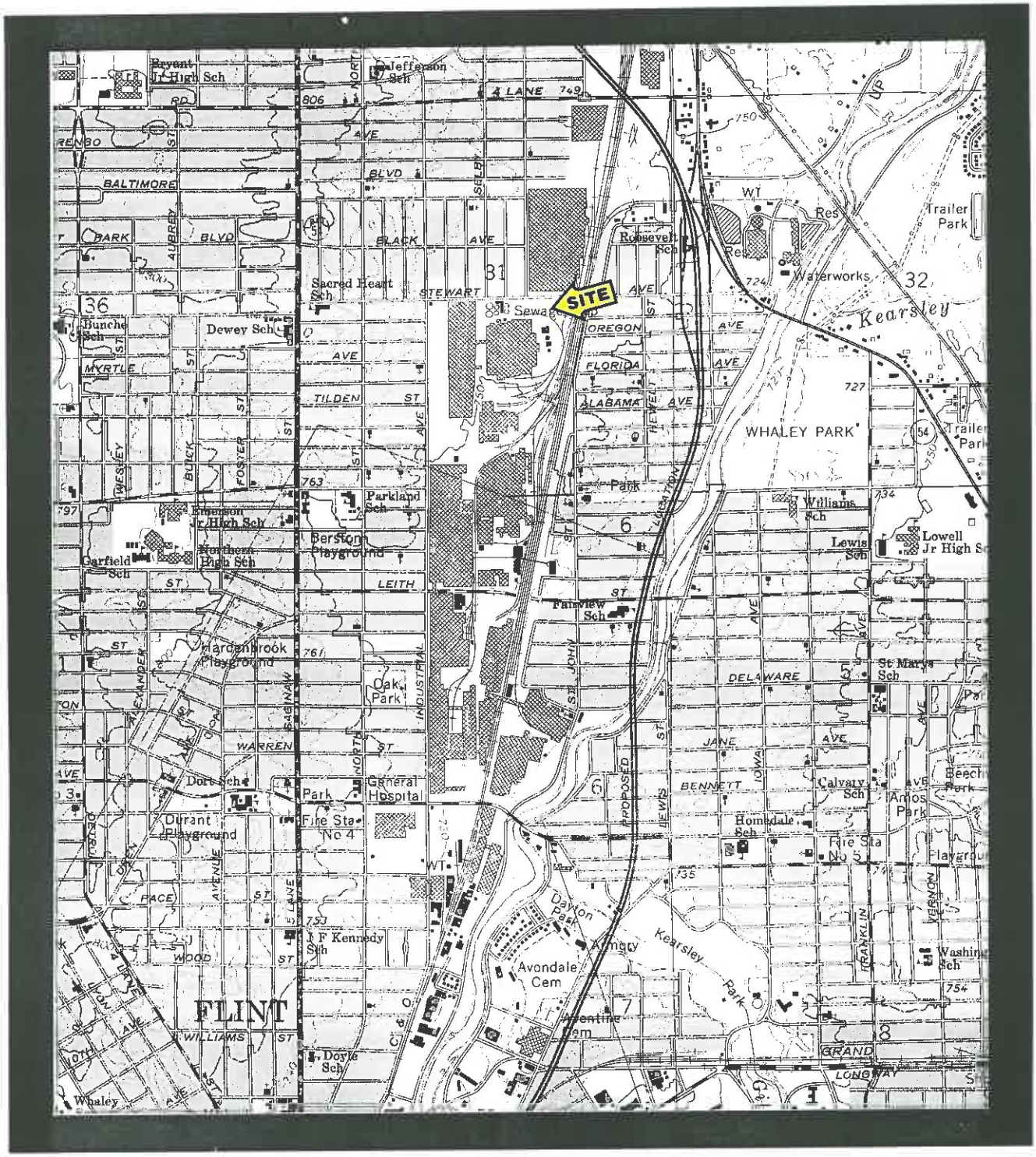
Constance M. Boris, Ph.D., Sr. Project Engineer

Reviewed by:

Mark C. Matheny, Sr. Project Manager

Date: February 17, 1994

FIGURES



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ADVANCED ENVIRONMENTAL, INC.

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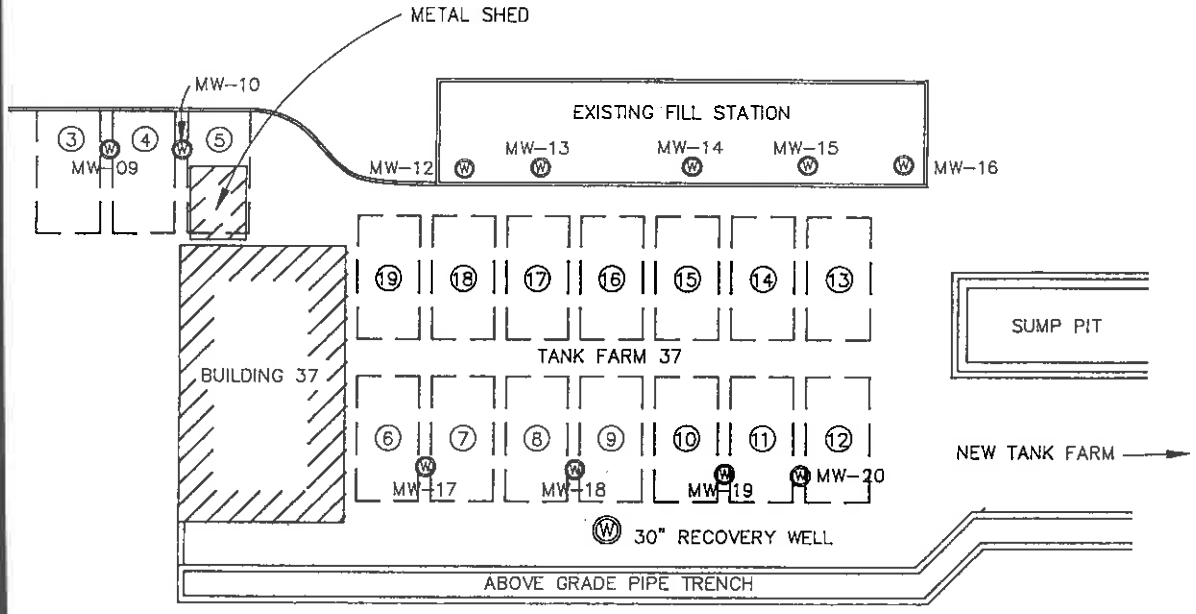
TITLE: U.S. GEOLOGICAL SURVEY/TOPOGRAPHIC MAP FORMER TANK FARM NUMBER 37 BOC FLINT AUTOMOTIVE DIVISION – FLINT, MI.	
FIGURE: 1	PROJECT MGR: CMB
SCALE: 1:24 000	PROJECT NO: 3114IE



LEGEND:

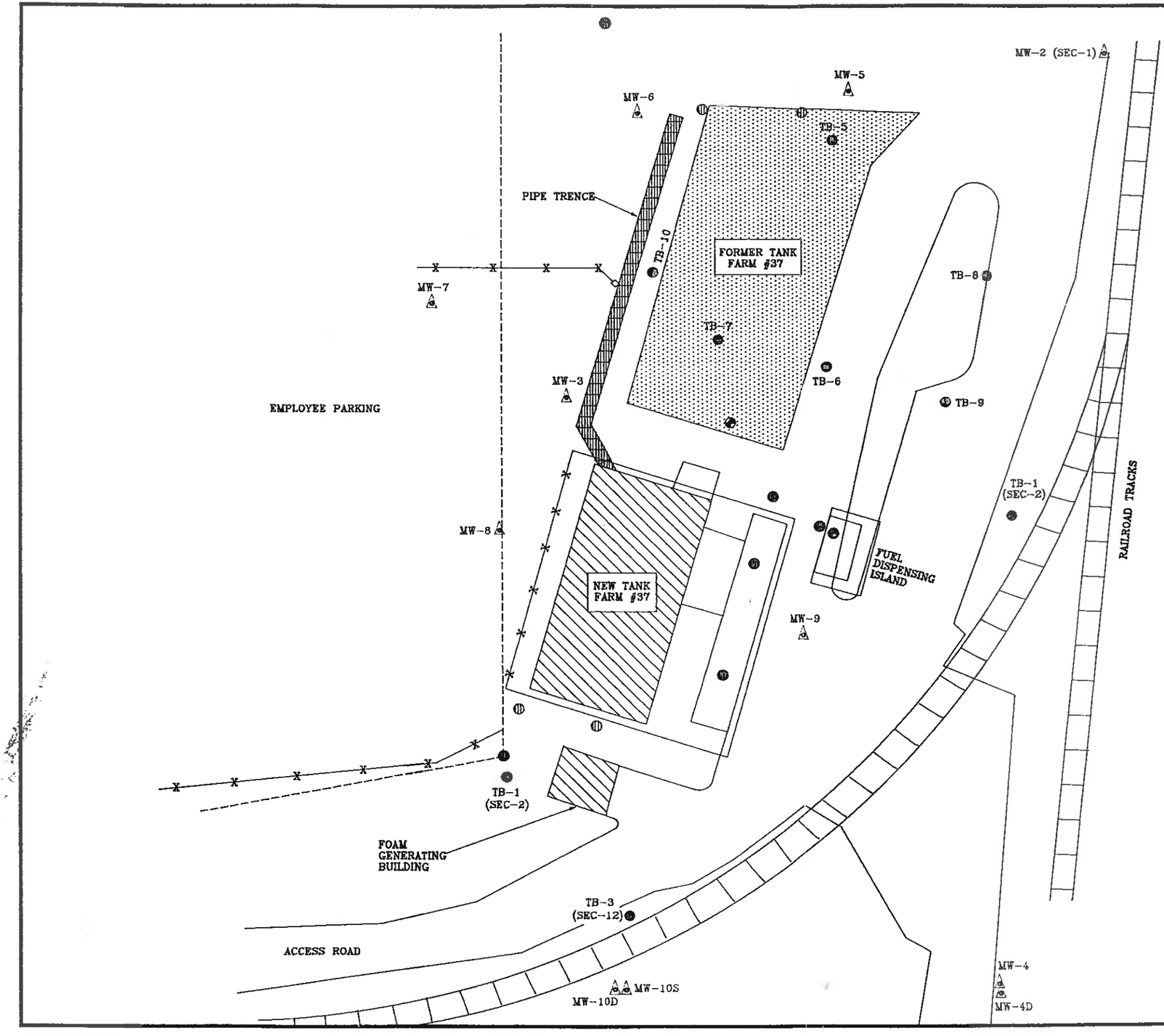
MW-12 Ⓦ = **MONITORING WELL LOCATION**

③ = **TANK NUMBER**

— — — = **TANK OUTLINE**

****ADAPTED FROM THE WWES REPORT**

ADVANCED ENVIRONMENTAL, INC.	
ENVIRONMENTAL MANAGEMENT CONSULTANTS	
TITLE: TANK FARM LAYOUT FORMER TANK FARM NUMBER 37 BOC FLINT AUTOMOTIVE DIVISION – FLINT, MI.	
FIGURE: 2	PROJECT MGR: CMB
SCALE: 1 1/4" = 40 FEET	PROJECT NO: 3114IE



GM TANK FARM #37

TITLE: SITE DIAGRAM TANK FARM #37 GM–NAO–BUICK CITY – FLINT, MI	
DATE: 1/27/94	APPROVED BY: B.D.H.
SCALE: 1"=40'	PREPARED BY: C.G.S.
FIGURE NUMBER: 3	PROJECT NUMBER: 3114IE

ADVANCED ENVIRONMENTAL, INC.
ENVIRONMENTAL MANAGEMENT CONSULTANTS

ATTACHMENT 1

TABLE 1
SOIL AND GROUND-WATER QUALITY

Former Tank Farm No. 37
BOC-Flint Automotive Division
Flint, Michigan

	SOIL SAMPLE LOCATION AND DEPTH (IN FEET)						GROUND-WATER SAMPLES		
	TYPE B Cleanup Criteria	Sec 1/TB-1 SS-3 (7.5 ft.)	Sec 1/TB-1 SS-4 (10.0 ft.)	Sec 2/MW-3 SS-4 (10.0 ft.)	Sec 2/TB-1 SS-9 (22.5 ft)	Sec 12/TB-3 SS-5 (12.5 ft.)	TYPE B Cleanup Criteria	Sec 1/MW-2	Sec 12/MW-4
CONTAMINANT:									
Benzene (ppb)	20	<10	<10	<10	n/a	<10	1	<1.0	<1.0
Toluene (ppb)	20000	10	12	60	n/a	11	800	<1.0	<1.0
Ethylbenzene (ppb)	1000	<10	<10	13	n/a	<10	70	<1.0	<1.0
Xylene (Total) (ppb)	6000	<10	<10	55	n/a	<10	300	<1.0	<1.0
Lead (ppm)	*	n/a	n/a	1.8	17	n/a		n/a	n/a

NOTE: Type B cleanup criteria based on the MDNR document dated 8/23/91
* Based on local background...see report text

TABLE 2
Summary of Soil Sample Laboratory Analytical Results
Former Tank Farm No. 37
BOC-Flint Automotive Division

(Units as Given)

Sample I.D. Sample Designation Sample Date Sample Depth (in feet)		Type A Criteria	Type B Criteria 20xGW	MW-5 SS-1 7/17/92 14-16	TB-5 SS-5 7/15/92 11-13	TB-5 SS-10 7/15/92 23.5-25.5	MW-6 SS-4 7/23/92 8.5-10.5	TB-6 SS-1 7/16/92 14-16	TB-6 SS-5 7/16/92 24-26	MW-7 SS-4 7/22/92 8.5-10.5
Polynuclear Aromatics (PNA'S)	Units									
Acenaphthene	ug/kg	330	8000	ND	840	ND	ND	ND	ND	ND
Acenaphthylene	ug/kg	330	ID	ND	380	ND	ND	ND	ND	ND
Anthracene	ug/kg	330	40,000	ND	1300	ND	ND	ND	ND	ND
Benzo (a) anthracene	ug/kg	330	@200	ND	2500	ND	ND	ND	ND	350
Benzo (a) pyrene	ug/kg	330	@200	ND	2600	ND	ND	ND	ND	400
Benzo (b) fluoranthene	ug/kg	330	@200	ND	2100	ND	ND	ND	ND	340
Benzo (ghi) perylene	ug/kg	330	ID	ND	1700	ND	ND	ND	ND	330
Benzo (k) fluoranthene	ug/kg	330	@200	ND	2200	ND	ND	ND	ND	ND
Chrysene	ug/kg	330	@200	ND	2900	ND	ND	ND	ND	400
Dibenzo (a,h) anthracene	ug/kg	330	@200	ND	380	ND	ND	ND	ND	ND
Fluoranthene	ug/kg	330	6000	ND	4700	ND	ND	ND	ND	600
Fluorene	ug/kg	330	6000	ND	1100	ND	ND	ND	ND	ND
Indeno (1,2,3-cd) pyrene	ug/kg	330	@200	ND	1500	ND	ND	ND	ND	ND
Naphthalene	ug/kg	330	600	ND	6400	ND	ND	ND	ND	ND
Phenanthrene	ug/kg	330	ID	ND	4500	ND	ND	ND	ND	340
Pyrene	ug/kg	330	4000	ND	4300	ND	ND	ND	ND	660
Polychlorinated Biphenyls (PCB'S)	Units									
PCB Aroclor's	ug/kg	33	@1000	ND	ND	ND	ND	ND	ND	ND
Volatile Organic Compounds Detected (BTEX)	Units									
Benzene	ug/kg	10	20	32	31000	ND	ND	ND	ND	ND
Ethylbenzene	ug/kg	10	1400	62	190000	ND	ND	ND	ND	ND
Toluene	ug/kg	10	16000	56	260000	ND	ND	ND	ND	ND
Xylenes (o, m, and p)	ug/kg	30	6000	2600	680000	ND	ND	ND	ND	ND
Total Lead	mg/kg	1	0.08	11	41	18	4.7	8.0	19	15

ug/kg = microgram per kilogram
mg/kg = milligram per kilogram
ND=Not Detected
=organic compounds detected above Type B Criteria
ID = Insufficient data for MDNR to establish Type B Criteria @ = Direct contact value
** = analytical results for samples analyzed after holding time expired

83106.12/Pat-g:t2boc37a/SL/10-19-92/bmm/General Motors Corporation

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Summary of Soil Sample Laboratory Analytical Results
Former Tank Farm No. 37
BOC-Flint Automotive Division

(Units as Given)

Sample I.D. Sample Designation Sample Date Sample Depth (in feet)		Type A Criteria	Type B Criteria 20xGW	TB-7 SS-1 7/16/92 14-16	TB-7 SS-5 7/16/92 24-26	MW-8 SS-4 7/20/92 8.5-10.5	TB-8 SS-4 7/16/92 8.5-10.5	MW-9 SS-4 7/23/92 8.5-10.5	MW-9 SS-4 Dup 8.5-10.5	TB-9 SS-4 7/21/92 8.5-10.5
Polynuclear Aromatics (PNA'S)	**Units**									
Acenaphthene	ug/kg	330	8000	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ug/kg	330	ID	ND	ND	ND	ND	ND	ND	ND
Anthracene	ug/kg	330	40,000	ND	ND	ND	ND	ND	ND	ND
Benzo (a) anthracene	ug/kg	330	@200	ND	ND	ND	ND	ND	630	ND
Benzo (a) pyrene	ug/kg	330	@200	ND	ND	ND	ND	ND	ND	ND
Benzo (b) fluoranthene	ug/kg	330	@200	ND	ND	ND	ND	ND	ND	ND
Benzo (ghi) perylene	ug/kg	330	ID	ND	ND	ND	ND	ND	ND	ND
Benzo (k) fluoranthene	ug/kg	330	@200	ND	ND	ND	ND	ND	ND	ND
Chrysene	ug/kg	330	@200	ND	ND	ND	ND	ND	1100	ND
Dibenzo (a,h) anthracene	ug/kg	330	@200	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ug/kg	330	6000	ND	ND	ND	ND	ND	450	ND
Fluorene	ug/kg	330	6000	ND	ND	ND	ND	ND	ND	ND
Indeno (1,2,3-cd) pyrene	ug/kg	330	@200	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ug/kg	330	600	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ug/kg	330	ID	ND	ND	ND	ND	ND	600	ND
Pyrene	ug/kg	330	4000	ND	ND	ND	ND	ND	1200	ND
Polychlorinated Biphenyls (PCB'S)	**Units**									
PCB Arocior's	ug/kg	33	@1000	ND	ND	ND	ND	ND	ND	ND
Volatile Organic Compounds Detected (BTEX)	**Units**									
Benzene	ug/kg	10	20	76	ND	ND**	ND	ND	ND	ND
Ethylbenzene	ug/kg	10	1400	440	ND	ND**	ND	ND	ND	ND
Toluene	ug/kg	10	16000	ND	ND	ND**	ND	ND	ND	ND
Xylenes (o, m, and p)	ug/kg	30	6000	1400	ND	ND**	ND	ND	ND	ND
Total Lead	mg/kg	1	0.08	10	7.3	6.9	6.6	3.7	4.6	3.8

ug/kg = microgram per kilogram
mg/kg = milligram per kilogram

ND=Not Detected
= detected above Type B Criteria

ID = Insufficient data for MDNR to establish Type B Criteria @ = Direct contact value

** = analytical results for samples analyzed after holding time expired

83106.12/Pat-g:t2boc37a/SL/10-19-92/bmm/General Motors Corporation

TABLE 2 (Continued)
Summary of Soil Sample Laboratory Analytical Results
Former Tank Farm No. 37
BOC-Flint Automotive Division

(Units as Given)

Sample I.D. Sample Designation Sample Date Sample Depth (In feet)		Type A Criteria	Type B Criteria 20xGW	MW-10D SS-4 7/23/92 8.5-10.5	TB-10 SS-1 7/21/92 14-16	TB-10 SS-5 7/21/92 24-26
Polynuclear Aromatics (PNA'S)	Units					
Acenaphthene	ug/kg	330	8000	ND	ND	ND
Acenaphthylene	ug/kg	330	ID	ND	ND	ND
Anthracene	ug/kg	330	40,000	ND	ND	ND
Benzo (a) anthracene	ug/kg	330	@200	ND	ND	ND
Benzo (a) pyrene	ug/kg	330	@200	ND	ND	ND
Benzo (b) fluoranthene	ug/kg	330	@200	ND	ND	ND
Benzo (ghl) perylene	ug/kg	330	ID	ND	ND	ND
Benzo (k) fluoranthene	ug/kg	330	@200	ND	ND	ND
Chrysene	ug/kg	330	@200	ND	ND	ND
Dibenzo (a,h) anthracene	ug/kg	330	@200	ND	ND	ND
Fluoranthene	ug/kg	330	6000	ND	ND	ND
Fluorene	ug/kg	330	6000	ND	ND	ND
Indeno (1,2,3-cd) pyrene	ug/kg	330	@200	ND	ND	ND
Naphthalene	ug/kg	330	600	ND	ND	ND
Phenanthrene	ug/kg	330	ID	ND	ND	ND
Pyrene	ug/kg	330	4000	ND	ND	ND
Polychlorinated Biphenyls (PCB'S)	Units					
PCB Aroclor's	ug/kg	33	@1000	ND	ND	ND
Volatile Organic Compounds Detected (BTEX)	Units					
Benzene	ug/kg	10	20	ND	ND**	ND
Ethylbenzene	ug/kg	10	1400	ND	ND**	ND
Toluene	ug/kg	10	16000	ND	ND**	ND
Xylenes (o, m, and p)	ug/kg	30	6000	ND	ND**	ND
Total Lead	mg/kg	1	0.08	3.2	3.9	9.4

ug/kg = microgram per kilogram mg/kg = milligram per kilogram 3 of 3

ND=Not Detected [ ] = detected above Type B Criteria

ID = Insufficient data for MDNR to establish Type B Criteria @ = Direct contact value

** = analytical results for samples analyzed after holding time expired

83106.12/Pat-g:t2boc37a/SL/10-19-92/bmm/General Motors Corporation

TABLE 3
Summary of Ground-Water Sample Laboratory Analytical Results
Former Tank Farm No. 37
BOC-Flint Automotive Division
Detected Compounds Only
(Units as Given)

Sample I.D. Sample Date Screen Interval (in feet)		Type A Criteria	Type B Criteria	SEC. 1 MW-2 7/28/92 7.7-12.7	SEC. 12 MW-4 7/28/92 10.5-15.5	MW-4D 7/28/92 14.3-19.3	MW-5 7/28/92 13.1-18.1	MW-6 7/28/92 12.9-17.9	MW-7 7/28/92 9.5-14.5
Polynuclear Aromatics (PNA'S)	Units								
Phenanthrene	ug/l	5	ID	ND	ND	ND	ND	ND	ND
Polychlorinated Biphenyls (PCB'S)	Unit								
PCB Aroclor's	ug/l	0.1	0.02	ND	ND	ND	ND	ND	ND
Volatile Organic Compounds (BTEX)	Units								
Benzene	ug/l	1	1	ND	ND	ND	1.5	ND	ND
Ethylbenzene	ug/l	1	70	ND	ND	ND	16	ND	ND
Toluene	ug/l	1	800	ND	ND	ND	2.9	ND	ND
Xylenes (o, m, and p)	ug/l	3	300	ND	ND	ND	56	1.9	ND
Trichloroethene	ug/l	1	3	ND	ND	ND	ND	ND	39
1,1,1-Trichloroethane	ug/l	1	200	ND	ND	ND	ND	ND	28.0
1,1-Dichloroethane	ug/l	1	700	ND	ND	ND	ND	ND	6
1,1-Dichloroethene	ug/l	1	7	ND	ND	ND	ND	ND	2.4
cis-1,2-Dichloroethene	ug/l	1	70	ND	ND	ND	ND	ND	42
Vinyl Chloride	ug/l	1	0.02	ND	ND	ND	ND	ND	6.2
Dissolved Lead	ug/l	3	4***	ND	ND	ND	4.9	3.7	6.4

ug/l = microgram per liter
ND = not detected
*** = based on total lead
[A] = detected above Type B Criteria
ID = insufficient data for MDNR to establish Type B Criteria

TABLE 3 (continued)
Summary of Ground-Water Sample Laboratory Analytical Results
Former Tank Farm No. 37
BOC-Flint Automotive Division
Detected Compounds Only
(Units as Given)

Sample I.D. Sample Date Screen Interval (in feet)		Type A Criteria	Type B Criteria	MW-8 7/28/92 10.9-15.9	MW-8 Dup 7/28/92 10.9-15.9	MW-9 7/28/92 9.9-14.9	MW-10S 7/28/92 9.9-14.2	MW-10D 7/28/92 14.8-19.8
Polynuclear Aromatics (PNA'S)	Units							
Phenanthrene	ug/l	5	ID	6	5	ND	ND	ND
Polychlorinated Biphenyls (PCB'S)	Unit							
PCB Aroclor's	ug/l	0.1	0.02	ND	ND	ND	ND	ND
Volatile Organic Compounds (BTEX)	Units							
Benzene	ug/l	1	1	ND	ND	ND	ND	ND
Ethylbenzene	ug/l	1	70	ND	ND	ND	ND	ND
Toluene	ug/l	1	800	ND	ND	ND	ND	ND
Xylenes (o, m, and p)	ug/l	3	300	ND	ND	ND	ND	ND
Trichloroethene	ug/l	1	3	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ug/l	1	200	47	62	ND	ND	ND
1,1-Dichloroethane	ug/l	1	700	20	24	ND	ND	ND
1,1-Dichloroethene	ug/l	1	7	ND	ND	ND	ND	ND
CIS-1,2-Dichloroethene	ug/l	1	70	200	290	ND	ND	ND
Vinyl Chloride	ug/l	1	0.02	ND	ND	ND	ND	ND
Dissolved Lead	ug/l	3	4***	3.0	ND	ND	ND	ND

ug/l = microgram per liter
ND = not detected
*** = based on total lead
[ ] = detected above Type B Criteria
ID = insufficient data for MDNR to establish Type B Criteria

ATTACHMENT 2

Log of Boring

Project No. 83106.00

Client BOC-Flint Automotive Division
Location Flint, Michigan
Logged By D. Kanzer
Contractor Stearns Drilling Co.
Driller Roger Christensen

Boring Designation Section 1 / TB-1
Start Date 10/23/91 Completed 10/23/91
Ground Surface Elevation: 751.1 feet msl based on a U.S.G.S. datum

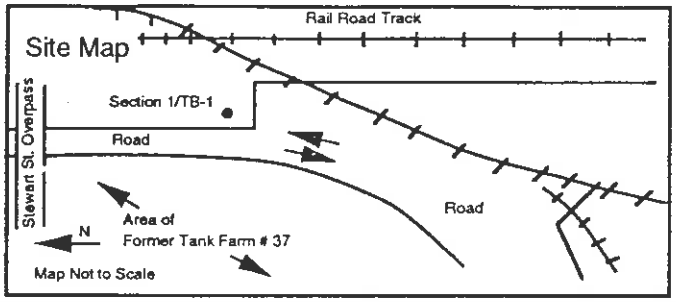
Drilling Method(s)	Depth Range
4 1/2" ID Hollow Stem Auger	0-15.0 feet

Sampling Method(s)	Depth Range
2" OD. Split-Spoon Sampler	2.5 feet intervals

Grouting Material/Method	Depth Range
Bentonite/Cement Slurry pressure pumped from bottom of borehole to surface.	0 - 15 feet

General Notes
No monitoring well was installed at this test boring location.

Ground-Water Data
Ground water was encountered during drilling at approximately 9.0 feet below ground surface.



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch Intervals)	Standard Penetration (N)	OVA-Headspace Reading (ppm)	PID-Headspace Reading (ppm)	Graphic Log	Depth (feet)	Subsurface Description
									3"	Crushed Stone GRAVEL
1										
2				3					2.5	Fill: Medium to Stiff Light Brown to Gray SILTY CLAY, trace gravel
3	SS-1	2.5	18	3 3	6	42	119			
4				2						
5	SS-2	5.0	14	3 5	8	ND	108			
6										
7				5					7.5	Loose Orange to Brown Medium SAND, trace silt, moist
8	SS-3	7.5	20	5 6	11	ND	180			
9				2						(9')
10	SS-4	10.0	18	4 5	9	ND	N/A			
11										
12				4						
13	SS-5	12.5	18	5 7	12	5	N/A		14.0	Medium Compact Brown to Gray Medium SAND, trace silt, occasional black stained layers, wet
14				3						
15	SS-6	15.0	16	3 5	8	ND	N/A		15.0	Medium Gray CLAYEY SILT, wet
										END OF BORING

Figure A1

Log of Boring

Project No. 83106.00

Client BOC-Flint Automotive Division
Location Flint, Michigan
Logged By D. Kanzer
Contractor Stearns Drilling Co.
Driller Roger Christensen

Boring Designation Section 12 / TB-3
Start Date 10/24/91 Completed 10/24/91
Ground Surface Elevation: 751.6 feet msl based on a U.S.G.S. datum

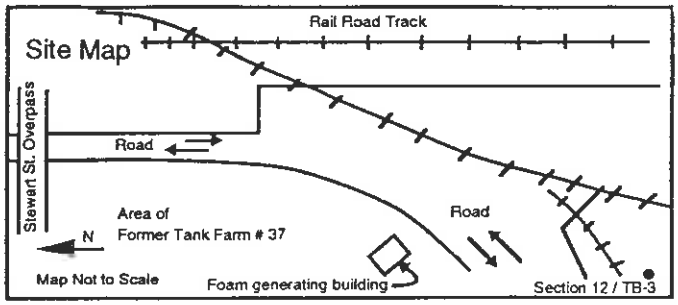
Drilling Method(s) — Depth Range
4.5 Inch ID Hollow Stem Auger — 0-15.0 feet

Sampling Method(s) — Depth Range
2.0 Inch OD Split Spoon — 2.5 feet intervals

Grouting Material/Method — Depth Range
Bentonite/Cement Slurry pressure pumped from bottom of borehole to surface. — 0-15.0 feet

General Notes
No monitoring well installed at this test boring location.

Ground-Water Data
Groundwater was encountered druing drilling at a depth of approximately 9.5 feet below ground surface.



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch Intervals)	Standard Penetration (N)	OVA Headspace Reading (ppm)	PID Headspace Reading (ppm)	Graphic Log	Depth (feet)	Subsurface Description
									2.5	Fill: Loose Black Stained Medium SAND, with slag, concrete and gravel
	SS-1	3.5	14	2, 2, 2, 3	4	2.0	47.7			
	SS-2	5.0	14	2, 4	6	ND	36.1		6.0	Medium to Stiff Gray SILTY CLAY, some sand, moist
	SS-3	7.5	18	4, 7, 10	17	ND	47.0			
	SS-4	10.0	18	4, 6, 9	15	0.8	17.0			▼
	SS-5	12.5	18	5, 7, 8	15	1.3	19.7			
	SS-6	15.0	18	4, 6, 7		3.5	9.5			Medium Compact Brown Fine to Medium SAND, little silt, some staining, wet
										END OF BORING

Figure A5

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client BOC-Flint Automotive Division - Tank Farm 37
Location Flint, MI.
Logged By G. Schmalz
Driller R. Christensen
Contractor Stearns Drilling Company

Drilling Method(s) — **Depth Range**
4.25 Inch I.D. Hollow Stem Auger — 0.0 - 20.0 feet

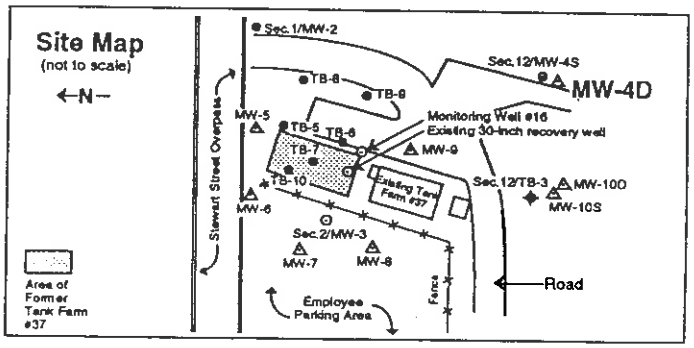
Sampling Method(s) — **Depth Range**
2.0 Inch O.D. Split Spoon — 18.0 - 20.0 feet

Grouting Material/Method
Monitoring Well MW-4D installed in borehole with well screen tip at 19.3 feet.

General Notes
No soil sample submitted for laboratory analysis.
Soil descriptions from 0 to 15.5 feet taken from the Log of Boring, Sec. 12/TB-4. Profile drilling to 15.5 feet. No samples taken.

Boring Designation MW-4D
Start Date 7-21-92 **Completed** 7-21-92
Ground Surface Elevation: 752.5 feet msl
Ground-Water Data
Ground water encountered at 12.5 feet during drilling.

Site Map
(not to scale)



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
									GRAVEL (railroad bed)
1								0.5	FILL: Loose SAND AND GRAVEL, dry
2									
3									
4								3.5	Loose Brown SILT, some clay, little fine sand, moist
5									
6								5.0	Medium Compact Light Brown FINE TO MEDIUM SAND, some iron staining, moist
7									
8									
9									
10									
11									
12									
13									▼ (12.5) Wet
14									
15									
16								15.5	Stiff Gray SILT, little fine sand, wet
17									
18									
19				2 3					
20	SS-1	20.0	24	3 4	6	0		19.5	Medium Gray CLAY, moist
									END OF BORING AT 20.0 FEET

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client BOC-Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller D. Decater
Contractor Stearns Drilling Company

Drilling Method(s) — **Depth Range**
4.25 Inch I.D. Hollow Stem Auger — 0.0 - 18.5 feet

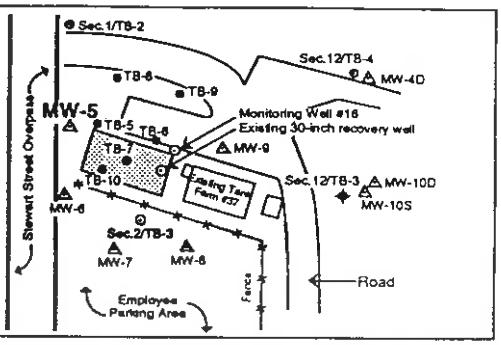
Sampling Method(s) — **Depth Range**
2.0 Inch O.D. Split Spoon — 14.0 - 18.5 feet
2.5 foot intervals

Grouting Material/Method
Monitoring Well MW-5 installed in borehole with well screen tip at 18.1 feet.

General Notes
Soil sample SS-1 was submitted for laboratory analysis. Soil descriptions from 0 to 14 feet were taken from the Log of Boring MW-6.

Boring Designation MW-5
Start Date 7-17-92 **Completed** 7-17-92
Ground Surface Elevation: 752.5 feet msl
Ground-Water Data
Ground water encountered at 10.5 feet during drilling.

Site Map
(not to scale)
←N←



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
									Concrete
1								0.8	Gravel (sub-base)
2								1.0	FILL: Straight drill, Medium Compact Light Brown FINE SAND, little silt, trace gravel, dry
3									
4									(3.5) Very Loose
5									
6									
7									
8									
9									
10									
11									▼ (10.5) Wet
12									
13									
14									
15				8 8				14.0	Medium Compact Gray SILT, hydrocarbon odor, wet
16	SS-1	16.0	24	5 5	13	45			(16.5) No odor
17				7 8					
18	SS-2	18.5	24	6 6	14	0			
19									END OF BORING AT 18.5 FEET
20									

Log of Boring

Project No. 83106.11

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller D. Decater
Contractor Stearns Drilling Company

Boring Designation TB-5
Start Date 7-15-92 **Completed** 7-15-92
Ground Surface Elevation: 752.2 feet msl
Ground-Water Data
Ground water encountered at 16.0 feet during drilling.

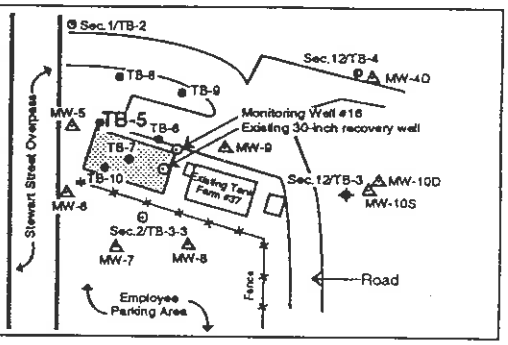
Drilling Method(s)	Depth Range
4.25 Inch I.D. Hollow Stem Auger	0.0 - 23.5 feet

Sampling Method(s)	Depth Range
2.0 Inch O.D. Split Spoon	1.0 - 25.5 feet
	2.5 foot intervals

Grouting Material/Method	Depth Range
Cement/Bentonite Slurry	0.0 - 25.5 feet

General Notes
Soil samples SS-5 and SS-10 were submitted for laboratory analysis.
No monitoring well was installed at this location.

Site Map
(not to scale)
←N→



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
									GRAVEL (parking lot)
1				4				1.0	FILL: Medium Compact Brown FINE TO MEDIUM SAND, trace gravel, no odor, moist
2				5					
3	SS-1	3.0	22	9 18	14	0			
4				2					
5				2 4	6				
6	SS-2	5.5	22	6		0			
7				2 5					
8	SS-3	8.0	22	3 3	8	140		(7.5)	Stained, strong hydrocarbon odor
9				2					
10				3 2	5				
11	SS-4	10.5	18	2		140		(11.0)	Very stained, very strong hydrocarbon odor
12				2					
13	SS-5	13.0	18	4 2	6	100			
14								13.5	CONCRETE
15									
16	SS-6	15.5	0	100/1"				15.0	Very Loose Gray FINE SILTY SAND, slight hydrocarbon odor
17				1 0					▼(16.0) Wet
18	SS-7	18.0	22	0 1	0	0			
19				2				18.5	Loose Gray SILT , lenses of clayey silt, slight hydrocarbon odor, wet
20				2 2					
	SS-8	20.5	24	2	4	0			

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Notes

Boring Designation TB-5
Start Date 7-15-92 Completed 7-15-92
Ground Surface Elevation: 752.2 msl

Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
21									Loose Gray SILT, lenses of clayey silt, slight hydrocarbon odor, wet
22				0 2	7			21.0	Medium Gray SILTY CLAY, no odor, moist
23	SS-9	23.0	24	5 2		0		22.0	Medium Gray CLAY, no odor, moist
24				1				22.5	Medium Gray SILTY CLAY, moist
25				2 4	6			23.5	Medium Gray CLAY, lenses of silty clay, moist
26	SS-10	25.5	24	4		0			END OF BORING AT 25.5 FEET
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client BOC-Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller R. Christensen
Contractor Stearns Drilling Company

Drilling Method(s) — **Depth Range**
4.25 Inch I.D. Hollow Stem Auger — 0.0 - 18.0 feet

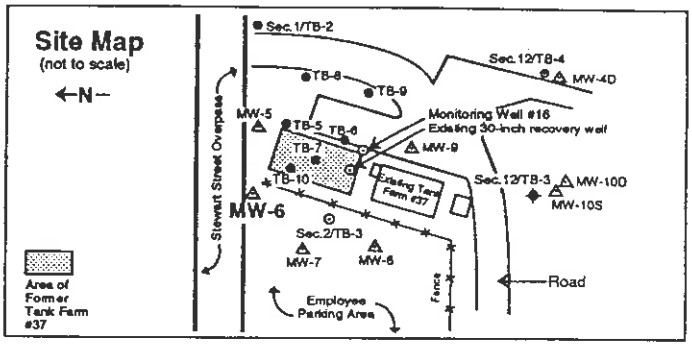
Sampling Method(s) — **Depth Range**
2.0 Inch O.D. Split Spoon — 1.0 - 18.5 feet
2.5 foot intervals

Grouting Material/Method
Monitoring Well MW-6 installed in borehole with well screen tip at 17.9 feet.

General Notes
Soil sample SS-4 was submitted for laboratory analysis.

Boring Designation MW-6
Start Date 7-23-92 **Completed** 7-23-92
Ground Surface Elevation: 751.2 feet msl
Ground-Water Data
Ground water encountered at 10.0 feet during drilling.

Site Map
(not to scale)
←N→



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-Inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
1									CONCRETE
2				2 6				1.0	FILL: Medium Compact Light Brown FINE SAND, little silt, trace gravel, dry
3	SS-1	3.0	15	8 6	14	0			
4				1 1				(3.5)	Very loose
5				1 1	2				
6	SS-2	5.5	20	1 1		0			
7				1 1					
8	SS-3	8.0	22	1 1	2	0			
9				1 1					
10				1 1	2			▼ (10.0)	Wet
11	SS-4	10.5	22	1 1		0			
12				6 6				11.0	Gravel, wet
13	SS-5	13.0	15	2 6	8	0		12.5	Medium Brown SILTY CLAY, slightly plastic, moist
14				4 4				13.5	Loose Brown FINE SILTY SAND, wet
15				5	9				
16	SS-6	15.5	20	5 0		0		(15.3)	Gray
17				1 2				16.0	Very Loose Gray FINE TO MEDIUM SAND, wet
18	SS-7	18.0	22	4	14	0		17.9	Very Loose Gray SILT, wet
19									END OF BORING AT 18.0 FEET
20									

Log of Boring

Project No. 83106.11

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller D. Decater
Contractor Stearns Drilling Company

Boring Designation TB-6
Start Date 7-16-92 **Completed** 7-16-92
Ground Surface Elevation: 751.9 feet msl
Ground-Water Data
Ground water encountered at 14.0 feet during drilling.

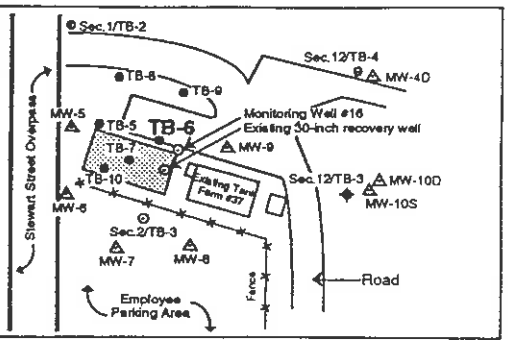
Drilling Method(s)	Depth Range
4.25 Inch I.D. Hollow Stem Auger	0.0 - 24.0 feet

Sampling Method(s)	Depth Range
2.0 Inch O.D. Split Spoon	14.0 - 26.0 feet
	2.5 foot intervals

Grouting Material/Method	Depth Range
Cement/Bentonite slurry	0.0 - 26.0 feet

General Notes
Soil samples SS-1 and SS-5 were submitted for laboratory analysis.

Site Map
(not to scale)



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
									CONCRETE
1								0.8	GRAVEL (sub-base)
2								1.0	Straight drill through fill materials previously placed within the former UST excavated area.
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14				2					
15				3				14.0	Loose Gray FINE SILTY SAND, slight hydrocarbon odor, wet
16	SS-1	16.0	24	4 6	7	0			
17				2				16.5	Loose Gray SILT , no odor, wet
18				3					
19	SS-2	18.5	24	3 6	6	0			
20				0					
				3					
	SS-3	21.0	24	2 3	5	0		20.9	Loose Gray SILT , little clay, wet

Log of Boring

Project No. 83106.11

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Notes

Boring Designation TB-6
Start Date 7-16-92 Completed 7-16-92
Ground Surface Elevation: 751.9 msl

Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-Inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
21									Loose Gray SILT, little clay, wet
22				1				21.5	Soft Gray SILTY CLAY, moist
23				3	4				
24	SS-4	23.5	24	1 2		0			
25				1				24.0	Soft Gray CLAY, moist
26	SS-5	26.0	24	2 1 2	3	0			END OF BORING AT 26.0 FEET
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

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Log of Boring

Project No. 83106.11

Client BOC-Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller R. Christensen
Contractor Stearns Drilling Company

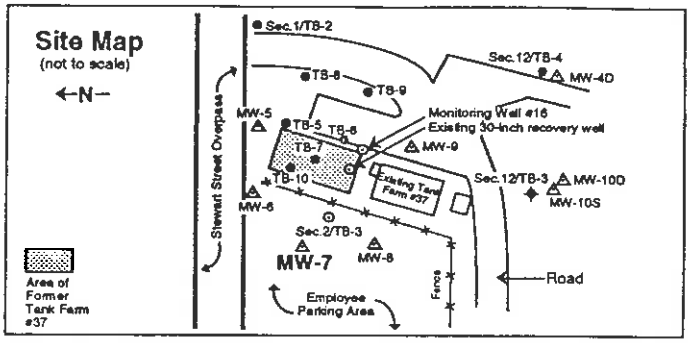
Drilling Method(s)	Depth Range
4.25 Inch I.D. Hollow Stem Auger	0.0 - 16.0 feet

Sampling Method(s)	Depth Range
2.0 Inch O.D. Split Spoon	1.0 - 18.0 feet
	2.5 foot intervals

Grouting Material/Method
Monitoring Well MW-7 installed in borehole with well screen tip at 14.5 feet.

General Notes
Soil sample SS-4 was submitted for laboratory analysis.

Boring Designation MW-7
Start Date 7-22-92 **Completed** 7-22-92
Ground Surface Elevation: 752.3 feet msl
Ground-Water Data
Ground water encountered at 10.3 feet during drilling.



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
									ASPHALT
1								0.3	Brown SAND AND GRAVEL (sub-base)
2				3 4	8			1.0	FILL: Loose Light Brown FINE SAND, little silt and gravel, some stains, no odor, moist
3	SS-1	3.0	20	4 5		0			(2.8) Slag
4				2 3					
5				2	5				
6	SS-2	5.5	20	3		0			(5.3) Slag
7				1 1					
8	SS-3	8.0	18	1 1	2	0			
9				1 0					
10				1	1				▼ (10.3) Slight hydrocarbon odor, wet
11	SS-4	10.5	15	0		0			
12				1 0				11.0	Very Loose Brown FINE SILTY SAND, trace gravel, no odor, wet
13	SS-5	13.0	22	1 0	1	0			
14				4 5				13.5	Loose Brown SILT, no odor, wet
15				5	10				
16	SS-6	15.5	22	6		0		15.0	Loose Gray FINE SILTY SAND, no odor, wet
17				0 0					
18	SS-7	18.0	15	2 2	2	0			
19									END OF BORING AT 18.0 FEET
20									

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller D. Decater
Contractor Stearns Drilling Company

Boring Designation TB-7
Start Date 7-16-92 Completed 7-16-92
Ground Surface Elevation 752.1 feet msl
Ground-Water Data
Ground water encountered at 14.0 feet during drilling.

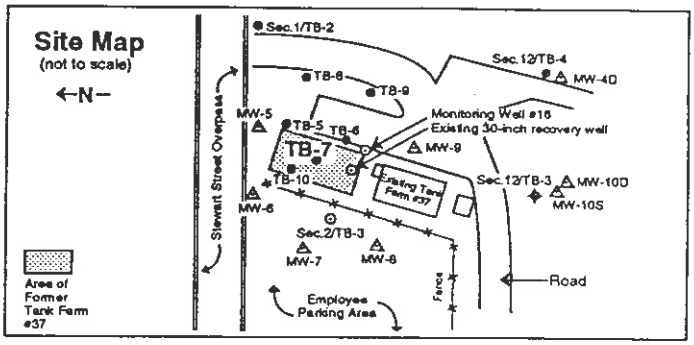
Drilling Method(s)	Depth Range
4.25 Inch I.D. Hollow Stem Auger	0.0 - 24.0 feet

Sampling Method(s)	Depth Range
2.0 Inch O.D. Split Spoon	14.0 - 26.0 feet
	2.5 foot intervals

Grouting Material/Method	Depth Range
Cement/Bentonite Slurry	0.0 - 26.0 feet

General Notes
Soil samples SS-1 and SS-5 were submitted for laboratory analysis.
No monitoring well was installed at this location.

Site Map
(not to scale)
←N←



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-Inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
1									GRAVEL
2								1.0	Straight drill through fill materials previously placed within the former UST excavated area
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15				2 3				14.0	Loose Brown FINE TO MEDIUM SAND, little gravel, slight hydrocarbon odor, wet
16	SS-1	16.0		4 2	7	9			
17				5 8				16.5	Medium Compact Gray FINE SILTY SAND, slight hydrocarbon odor, wet
18				4	12				
19	SS-2	18.5		2 3		3			
20				1				19.0	Very Loose Gray SILT, no odor, wet
	SS-3	21.0		1 2	2	0			

Log of Boring

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Notes

Boring Designation TB-7
Start Date 7-16-92 Completed 7-16-92
Ground Surface Elevation: 752.1 msl

Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-Inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
21									Very Loose Gray SILT, no odor, moist
22				0				21.5	Soft Gray SILTY CLAY, with silt lenses, no odor, moist
23				0					
	SS-4	23.5	24	1	1				
24				3		0			
				1				24.0	Soft Gray CLAY, no odor, moist
25				1					
				2	3				
26	SS-5	26.0		1		0			END OF BORING AT 26.0 FEET
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
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41									
42									
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44									
45									
46									
47									
48									
49									
50									

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Log of Boring

Project No. 83106.11

Client BOC-Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller R. Christensen
Contractor Stearns Drilling Company

Drilling Method(s) — **Depth Range**
4.25 Inch I.D. Hollow Stem Auger — 0.0 - 15.9 feet

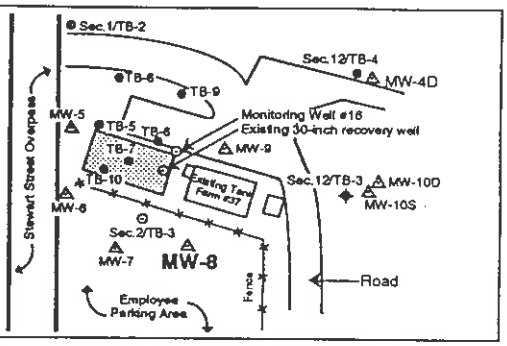
Sampling Method(s) — **Depth Range**
2.0 Inch O.D. Split Spoon — 1.0 - 15.5 feet
2.5 foot intervals

Grouting Material/Method
Monitoring Well MW-8 installed in borehole with well screen tip at 15.9 feet.

General Notes
Soil sample SS-4 was submitted for laboratory analysis.

Boring Designation MW-8
Start Date 7-20-92 **Completed** 7-22-92
Ground Surface Elevation: 752.6 feet msl
Ground-Water Data
Ground water encountered at 12.9 feet during drilling.

Site Map
(not to scale)
←N→



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
									ASPHALT
1								0.3	Brown SAND AND GRAVEL (sub-base)
2				3 3 3	6			1.0	FILL: Loose Brown FINE SILTY SAND, little gravel, moist
3	SS-1	3.0	22	4		0			
4				2 3 3	6				(5.0) Concrete rubble
5	SS-2	5.5	12	4		0			
6				2 2	4				
7	SS-3	8.0	20	2 2		0			
8				3 3 6	9				
9	SS-4	10.5	18	11 6		5			(10.5) Slight hydrocarbon odor (11.0) Gray
10				8 9	17				(12.8) Stained
11	SS-5	13.0	22	8 4 5		0		12.9 ▼	Medium Compact Gray SILT, stained, slight hydrocarbon odor, wet
12				6 8	11				
13	SS-6	15.5	20	8		0		15.0	Medium Compact Gray FINE SILTY SAND, no odor, wet
14									END OF BORING AT 15.9 FEET
15									
16									
17									
18									
19									
20									

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller D. Decater
Contractor Stearns Drilling Company

Boring Designation TB-8
Start Date 7-16-92 **Completed** 7-16-92
Ground Surface Elevation: 752.5 feet msl
Ground-Water Data
Ground waterencountered at 10.0 feet during drilling.

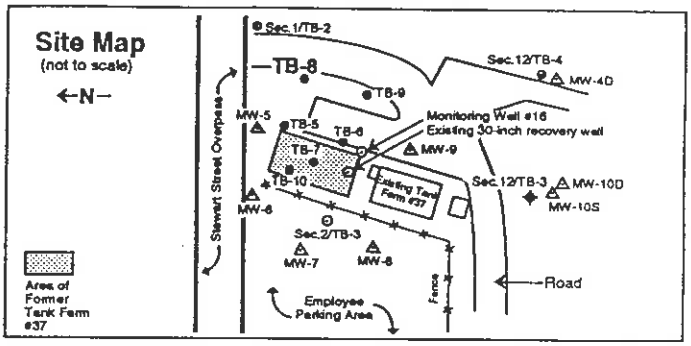
Drilling Method(s)	Depth Range
4.25 Inch I.D. Hollow Stem Auger	0.0 - 18.5 feet

Sampling Method(s)	Depth Range
2.0 Inch O.D. Split Spoon	1.0 - 20.5 feet
	2.5 foot intervals

Grouting Material/Method	Depth Range
Cement/Bentonite Slurry	0.0 - 20.5 feet

General Notes
Soil sample SS-4 was submitted for laboratory analysis.
No monitoring well was installed at this borehole location.

Site Map
(not to scale)
←N→



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
									COBBLES
1				4				1.0	FILL: Medium Compact Brown FINE TO MEDIUM SAND, little silt and gravel, no odor, moist
2				4					
3	SS-1	3.0	22	5 7	9	0			
4				3				3.5	Medium Brown SILTY CLAY, some sand, no odor, dry
5				3				4.5	Medium Brown CLAYEY SILT, some sand, no odor, moist
6	SS-2	5.5	24	3	6	0			
7				2 3					
8	SS-3	8.0	24	4 4	7	0			
9				1 2				8.5	Soft Brown SILTY CLAY, no odor, moist
10	SS-4	10.5	22	2 1	4	0		9.5	Loose Dark Gray FINE SILTY SAND, no odor, moist (10.0) Wet
11								11.0	Loose Brown FINE TO MEDIUM SAND, no odor, wet
12				2 3					
13	SS-5	13.0	24	3 4	6	0			
14				3 5				13.5	Medium Compact Brown FINE SILTY SAND, wet
15	SS-6	15.5	24	5 6	10	0		14.5	Medium Compact Brown SILT, no odor, wet
16				5					
17				4 7					
18	SS-7	18.0	24	9	11	0			
19				7					
20				10 14	24				
	SS-8	20.5	24	6		0		20.0	Stiff Gray CLAY, no odor, moist
									END OF BORING AT 20.5 FEET

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client BOC-Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller D. Decater
Contractor Stearns Drilling Company

Drilling Method(s) — **Depth Range**
4.25 Inch I.D. Hollow Stem Auger — 0.0 - 18.5 feet

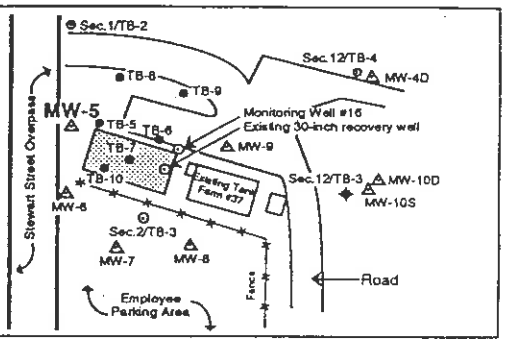
Sampling Method(s) — **Depth Range**
2.0 Inch O.D. Split Spoon — 14.0 - 18.5 feet
2.5 foot intervals

Grouting Material/Method
Monitoring Well MW-5 installed in borehole with well screen tip at 18.1 feet.

General Notes
Soil sample SS-1 was submitted for laboratory analysis.
Soil descriptions from 0 to 14 feet were taken from the Log of Boring MW-6 and from the soil cuttings generated during drilling at MW-5.

Boring Designation MW-5
Start Date 7-17-92 **Completed** 7-17-92
Ground Surface Elevation: 752.5 feet msl
Ground-Water Data
Ground water encountered at 10.5 feet during drilling.

Site Map
(not to scale)
←N→



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
									Concrete
1								0.8	Gravel (sub-base)
2								1.0	FILL: Straight drill, Medium Compact Light Brown FINE SAND, little silt, trace gravel, dry
3									
4									(3.5) Very Loose
5									
6									
7									
8									
9									
10									
11									▼ (10.5) Wet
12									
13									
14				8				14.0	Medium Compact Gray SILT, hydrocarbon odor, wet
15				8					
16	SS-1	16.0	24	5	13	45			(16.5) No odor
17				7					
18				8					
19	SS-2	18.5	24	6	14	0			END OF BORING AT 18.5 FEET
20									

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client BOC-Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller R. Christensen
Contractor Stearns Drilling Company

Drilling Method(s) — **Depth Range**
4.25 Inch I.D. Hollow Stem Auger — 0.0 - 14.9 feet

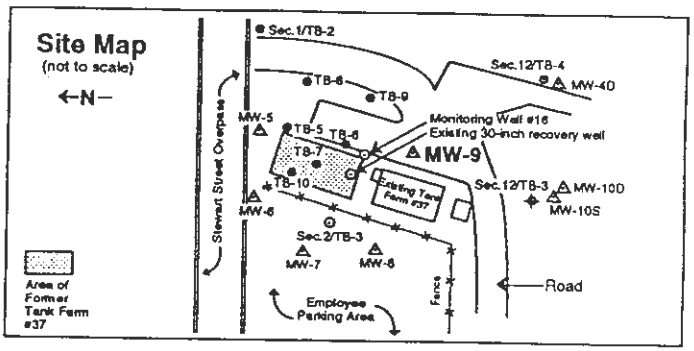
Sampling Method(s) — **Depth Range**
2.0 Inch O.D. Split Spoon — 1.0 - 15.5 feet
2.5 foot intervals

Grouting Material/Method
Monitoring Well MW-9 installed in borehole with well screen tip at 14.9 feet.

General Notes
Soil sample SS-4 was submitted for laboratory analysis. Duplicate sample of SS-4 was also submitted for laboratory analysis.

Boring Designation MW-9
Start Date 7-23-92 **Completed** 7-23-92
Ground Surface Elevation: 752.2 feet msl
Ground-Water Data
Ground water encountered at 10.0 feet during drilling.

Site Map
(not to scale)
←N←



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
									CONCRETE
				5 6				1.0	FILL: Medium Compact Dark Brown-Stained SAND AND GRAVEL, strong hydrocarbon odor, moist
	SS-1	3.0	20	11 23	17	18		1.5	Very Stiff Light Brown SILTY CLAY, some sand, moist
				7 5				2.8	Medium Compact Stained FINE TO MEDIUM SAND, strong hydrocarbon odor, moist
				28	33			3.5	Asphalt
	SS-2	5.5	18	2 2		25		5.0	COAL SLAG
				2 1	3			6.5	Very Loose Light Brown to Gray FINE SILTY SAND, stained, hydrocarbon odor, moist
	SS-3	8.0	20	1 1		15			
				3 6	9				(10.0) Very strong hydrocarbon odor, wet
	SS-4	10.5	22	7 2		45			
				2 1	3				
	SS-5	13.0	20	5 3		8			
				5 1	6			14.5	Medium Gray CLAYEY SILT, no odor, wet
	SS-6	15.5	24	5		0			END OF BORING AT 15.5 FEET

Log of Boring

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller D. Decater
Contractor Stearns Drilling Company

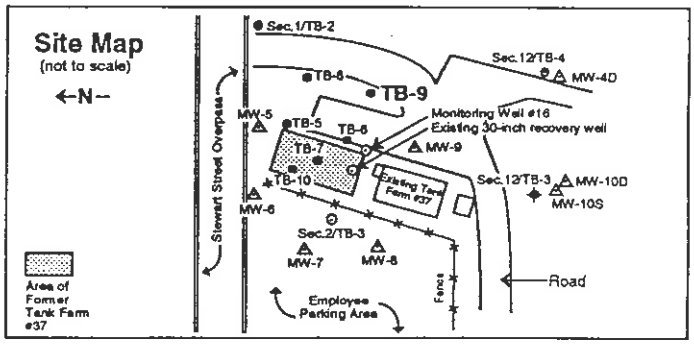
Boring Designation TB-9
Start Date 7-21-92 **Completed** 7-21-92
Ground Surface Elevation: 752.8 feet msl
Ground-Water Data
Ground water encountered at 10.0 feet during drilling.

Drilling Method(s)	Depth Range
4.25 Inch I.D. Hollow Stem Auger	0.0 - 21.0 feet

Sampling Method(s)	Depth Range
2.0 Inch O.D. Split Spoon	0.0 - 23.0 feet
	2.5 foot intervals

Grouting Material/Method	Depth Range
Cement/Bentonite Slurry	0.0 - 23.0 feet

General Notes
Soil sample SS-4 was submitted for laboratory analysis.
No monitoring well was installed at this borehole location.



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
1				3 2					GRAVEL (road median)
2	SS-1	2.0	20	2 3	4	0		1.0	FILL: Very Loose Brown SILTY CLAY, some sand, moist
3				2					
4				2				3.0	Loose Brown SILT, moist
5	SS-2	5.5	22	3 4	5	0		3.5	Loose, FINE SILTY SAND, moist to dry
6									
7				4 4					
8	SS-3	8.0	20	4 5	8	0			
9				2					
10	SS-4	10.5	20	3 3	6	0			▼ (10.0) Wet
11									
12				2 2				11.0	Very Loose Brown FINE TO MEDIUM SAND, wet
13	SS-5	13.0	22	2 5	4	0			
14				2				13.5	Loose Brown SILT, wet
15	SS-6	15.5	24	3 3 6	6	0			
16									
17				8 11					
18	SS-7	18.0	12	12 13	23	0			
19				6					
20				6 11	17				
	SS-8	20.5	20	17		0			

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Notes

Boring Designation TB-9
Start Date 7-21-92 Completed 7-21-92
Ground Surface Elevation: 752.8 msl

Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
21									Loose Brown SILT, wet
22				12 7				21.0	Stiff Gray CLAY, moist
23	SS-9	23	22	7 6	14	0		(22.5)	Lens of gray silt, wet
									END OF BORING AT 23.0 FEET
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client BOC-Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller R. Christensen
Contractor Stearns Drilling Company

Drilling Method(s) — **Depth Range**
4.25 Inch I.D. Hollow Stem Auger — 0.0 - 20.0 feet

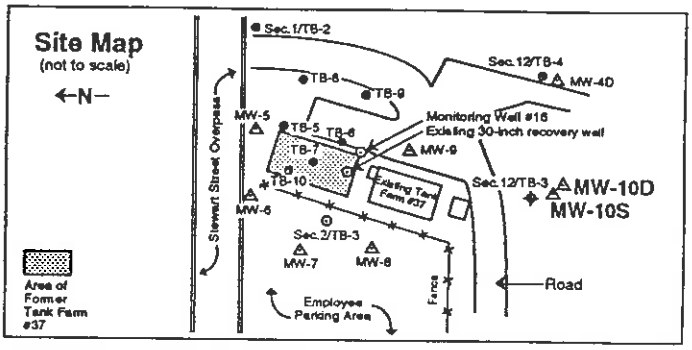
Sampling Method(s) — **Depth Range**
2.0 Inch O.D. Split Spoon — 1.0 - 20.5 feet
2.5 foot intervals

Grouting Material/Method
Monitoring Well MW-10D installed in borehole with well screen tip at 20.0 feet, and monitoring Well MW-10S installed in nearby borehole with well screen tip at 14.0 feet.

General Notes
Soil sample SS-4 was submitted for laboratory analysis.

Boring Designation MW-10D
Start Date 7-23-92 **Completed** 7-23-92
Ground Surface Elevation: 752.6 feet msl
Ground-Water Data
Ground water encountered at 10.0 feet during drilling.

Site Map
(not to scale)
←N→



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-Inch Intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
									GRAVEL
1				3				1.0	FILL: Medium Compact Light Brown FINE TO MEDIUM SAND, little gravel, stained, no odor, dry
2				7					
3	SS-1	3.0	20	8 12	15	18			
4				3				3.5	Stiff Light Brown SILTY CLAY, some sand, moist
5				5 7	12			4.8	Medium Compact Light Brown SILT, moist
6	SS-2	5.5	20	6		25		5.0	Medium Compact Light Brown FINE TO MEDIUM SAND, moist
7				4 6					
8	SS-3	8.0	20	8 11	14	15		7.5	Medium Compact Light Brown FINE SILTY SAND, moist
9				3					
10				5 6				(9.5)	Stained, no odor
11	SS-4	10.5	22	7	11	45		(10.0)	Wet
12				3 3				11.0	Loose Light Brown SILT, wet
13	SS-5	13.0	22	4 5	7	8		12.5	Loose Gray FINE TO MEDIUM SAND, wet
14				2				13.5	**Very Loose Gray SILT, wet**
15				2 2	4				
16	SS-6	15.5	15	2		0			
17				2 2	7				
18	SS-7	18.0	24	5 4		0			
19				1					
20				1 1	2			20.0	Very Soft Gray CLAY, moist
	SS-8	20.5	20	2		0			END OF BORING AT 20.5 FEET

Log of Boring

Project No. 83106.11

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Logged By G. Schmalz
Driller R. Christensen
Contractor Stearns Drilling Company

Boring Designation TB-10
Start Date 7-21-92 **Completed** 7-21-92
Ground Surface Elevation: 752.0 feet msl

Drilling Method(s)	Depth Range
4.25 Inch I.D. Hollow Stem Auger	0.0 - 26.0 feet

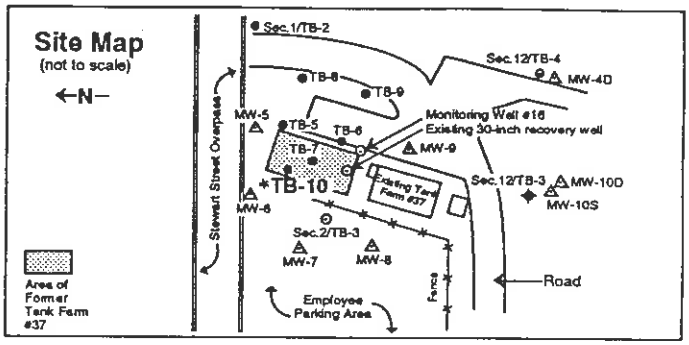
Sampling Method(s)	Depth Range
2.0 Inch O.D. Split Spoon	14.0 - 26.0 feet
Shelby Tube	26.0 - 28.0 feet

Grouting Material/Method	Depth Range
Cement/Bentonite Slurry	0.0 - 28.0 feet

Ground-Water Data
Ground water encountered at 16.0 feet during drilling.

General Notes
Soil sample SS-1 and SS-5 submitted for laboratory analysis. Shelby Tube sample was taken at 26.0 - 28.0 foot interval and sent to the laboratory for hydraulic conductivity analysis.

Site Map
(not to scale)
←N→



Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-inch intervals)	Standard Penetration (N)	HNu (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
1									GRAVEL
2								1.0	Straight drill through fill materials previously placed within the former UST excavated area
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14				3				14.0	Medium Compact Brown FINE SILTY SAND, slight hydrocarbon odor, wet
15				5					
16	SS-1	16.0	22	7 4	12	2			▼ (16.0) Wet
17				2					
18				2 2	4				
19	SS-2	18.5	20	3		0		18.0	Very Loose Brown SILT, slight hydrocarbon odor, wet
20				2 2					
	SS-3	21.0	20	2 4	4	0			

WW Engineering & Science, Inc.

Log of Boring

Project No. 83106.11

Client B.O.C. Flint Automotive Division - Tank Farm #37
Location Flint, MI.
Notes

Boring Designation TB-10
Start Date 7-21-92 Completed 7-21-92
Ground Surface Elevation: 752.0 msl

Borehole Depth (feet)	Sample Type and Number	Depth of Sample Tip (feet)	Sample Recovered (inches)	Hammer Blows (6-Inch Intervals)	Standard Penetration (N)	PID Readings (ppm)	Graphic Log	Depth Below Ground Surface (feet)	Subsurface Description
21									Very Loose Brown SILT, slight hydrocarbon odor, wet
22				2					(21.5) No odor
23				3 2	5				
	SS-4	23.5	20	2		0		23.0	Medium Gray CLAY, no odor, moist
24				2					
25				2					
				3	5				
26	SS-5	26.0	20	2		0			
27									
28	ST-1	28.0	20		—	—			END OF BORING AT 28.0 FEET
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

WW Engineering & Science, Inc.

Project Name: BOC-Flint Automotive Division/Tank Farm 37 Flint, MI.

Project No.: 83106.11

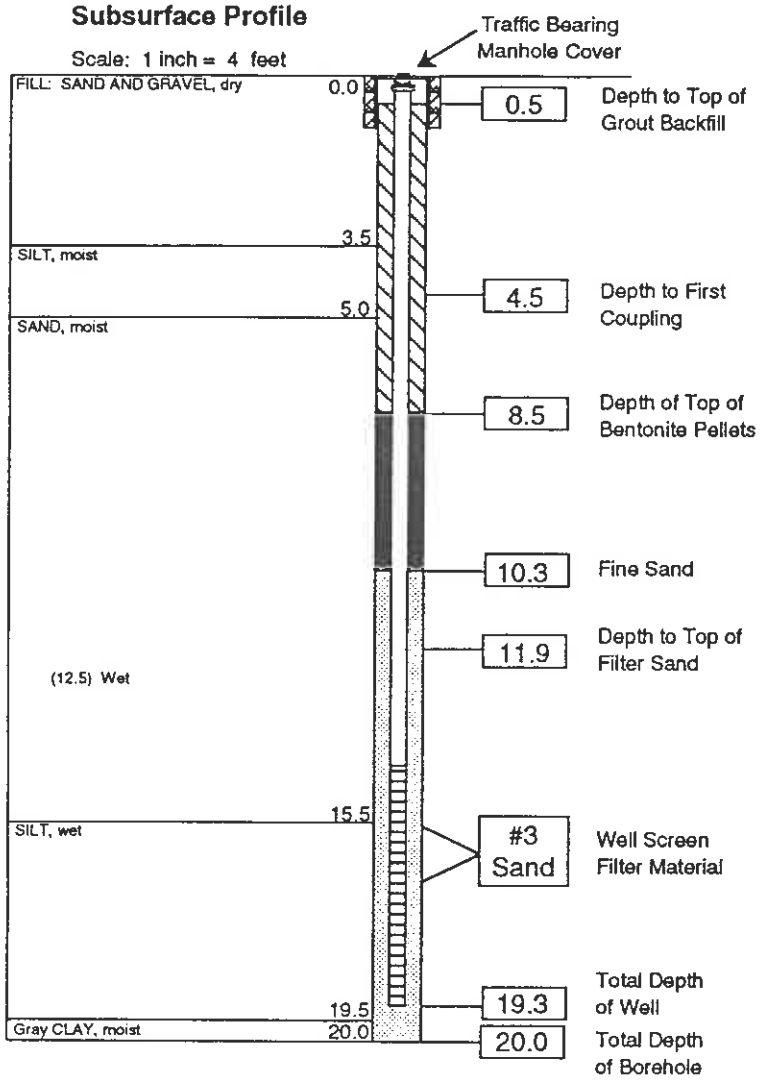
Log of Well Installation

Well Designation: MW-4D

Date(s) of Installation: 7-21-92 **To** 7-21-92

Generalized Subsurface Profile

Scale: 1 inch = 4 feet



Ground Surface Elevation:	752.5
Top of Casing Elevation:	752.20
Well Screen Tip Elevation:	733.2

Well Casing

- Diameter: 2.0 inches
- Total Length: 14.0 feet
- Material: Schedule 40 PVC
- Cap (Y/N): Locking J-Plug

Well Screen

- Diameter: 2.0 inches
- Length: 5.0 feet
- Mesh: 0.010 inch slot
- Material: Schedule 40 PVC
- Well Screen Interval: 14.3 - 19.3

Protective Well Casing Cover

- Material: Steel Flush Cap
- Diameter: 9.0 inches
- Length: 12.0 inches
- Lock (Y/N): 7/8 inch bolt

Inspector: G. Schmalz
Driller: R. Christensen
Contractor: Stearns Drilling Company
Drilling Equipment: CME 750 Trailer Mount

Well Screen Filter Material: #3 Sand
Grout Backfill Material: Cement/Bentonite slurry
Other well materials used: Bentonite pellets/Fine sand

Water Level Data

Datum: Top of Well Casing

Date	Water Level Elevation
7-28-92	741.40
8-14-92	741.56
8-25-92	741.33

General Notes:

Figure

WW Engineering & Science, Inc.

Project Name: BOC-Flint Automotive Division/Tank Farm #37 Flint, MI.

Project No.: 83106.11

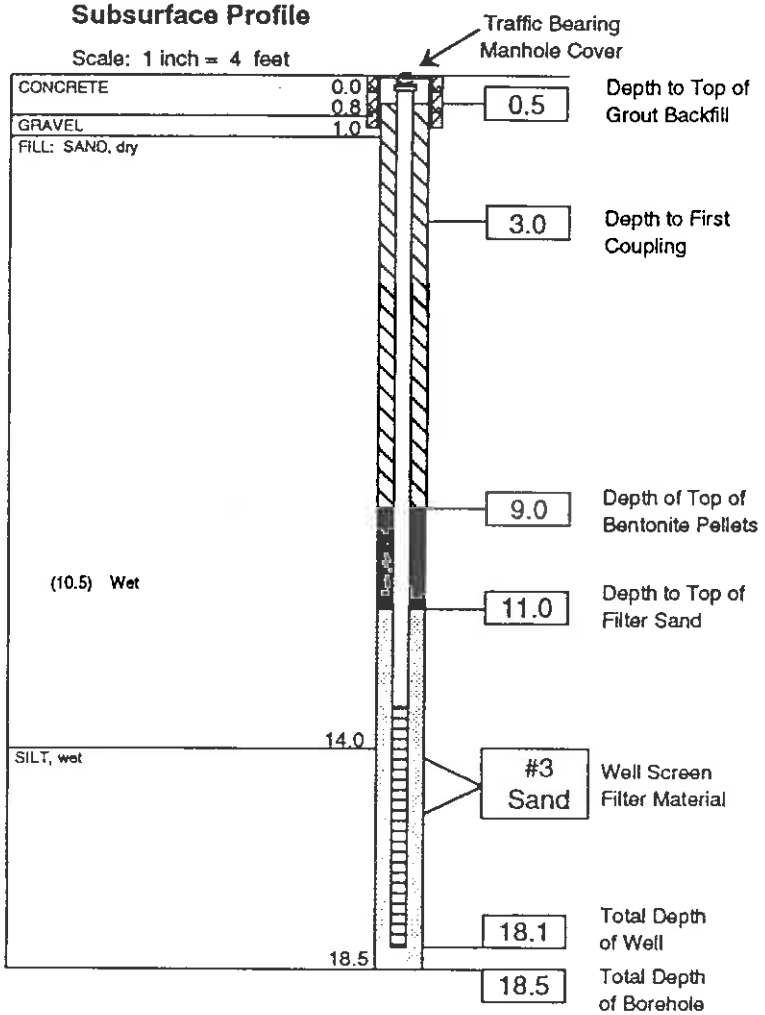
Log of Well Installation

Well Designation: MW-5

Date(s) of Installation: 7-17-92 **To** 7-17-92

Generalized Subsurface Profile

Scale: 1 inch = 4 feet



Ground Surface Elevation:	751.8
Top of Casing Elevation:	751.24
Well Screen Tip Elevation:	733.7

Well Casing

- Diameter: 2.0 inches
- Total Length: 12.5 feet
- Material: Schedule 40 PVC
- Cap (Y/N): Locking J-Plug

Well Screen

- Diameter: 2.0 inches
- Length: 5.0 feet
- Mesh: 0.010 inch slot
- Material: Schedule 40 PVC
- Well Screen Interval: 13.1 - 18.1

Protective Well Casing Cover

- Material: Steel Flush Cap
- Diameter: 9.0 inches
- Length: 12.0 inches
- Lock (Y/N): 7/8 inch bolt

Inspector: G. Schmalz
Driller: D. Decater
Contractor: Stearns Drilling Company
Drilling Equipment: CME 750 Trailer Mount

Well Screen Filter Material: #3 Sand
Grout Backfill Material: Cement/Bentonite slurry
Other well materials used: Bentonite pellets

Water Level Data

Datum: Top of Well Casing

Date	Water Level Elevation
7-28-92	740.89
8-14-92	740.99
8-25-92	740.89

General Notes:

Figure

WW Engineering & Science, Inc.

Project Name: BOC-Flint Automotive Division/Tank Farm #37
Flint, MI
Project No.: 83106.11

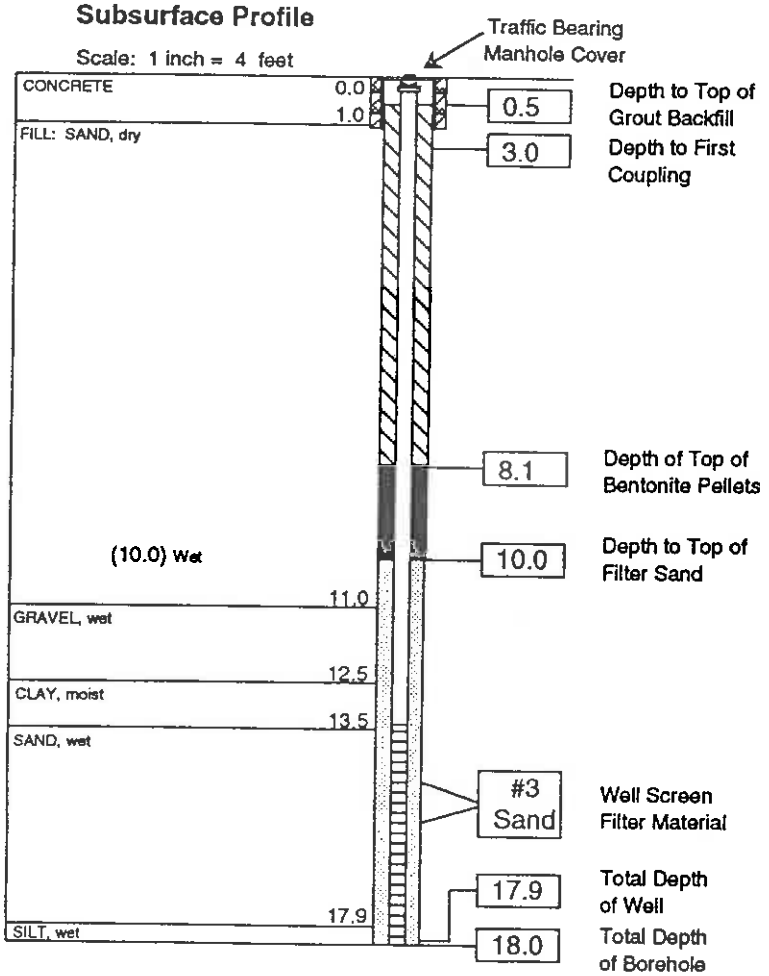
Log of Well Installation

Well Designation: MW-6

Date(s) of Installation: 7-23-92 To 7-23-92

Generalized Subsurface Profile

Scale: 1 inch = 4 feet



Ground Surface Elevation:	751.2
Top of Casing Elevation:	750.80
Well Screen Tip Elevation:	733.3

Well Casing

- Diameter: 2.0 inches
- Total Length: 12.5 feet
- Material: Schedule 40 PVC
- Cap (Y/N): Locking J-Plug

Well Screen

- Diameter: 2.0 inches
- Length: 5.0 feet
- Mesh: 0.010 inch slot
- Material: Schedule 40 PVC
- Well Screen Interval: 12.9 - 17.9 feet

Protective Well Casing Cover

- Material: Steel Flush Cap
- Diameter: 9.0 inches
- Length: 12.0 inches
- Lock (Y/N): 7/8 inch bolt

Inspector: G. Schmalz
Driller: R. Christensen
Contractor: Stearns Drilling Company
Drilling Equipment: CME 750 Trailer Mount

Well Screen Filter Material: #3 Sand
Grout Backfill Material: Cement/Bentonite slurry
Other well materials used: Bentonite pellets

Water Level Data

Datum: Top of Well Casing

Date	Water Level Elevation
7-28-92	740.38
8-14-92	740.74
8-25-92	740.64

General Notes:

Figure

WW Engineering & Science, Inc.

Project Name: BOC-Flint Automotive Division/Tank Farm #37 Flint, MI.
Project No.: 83106.11

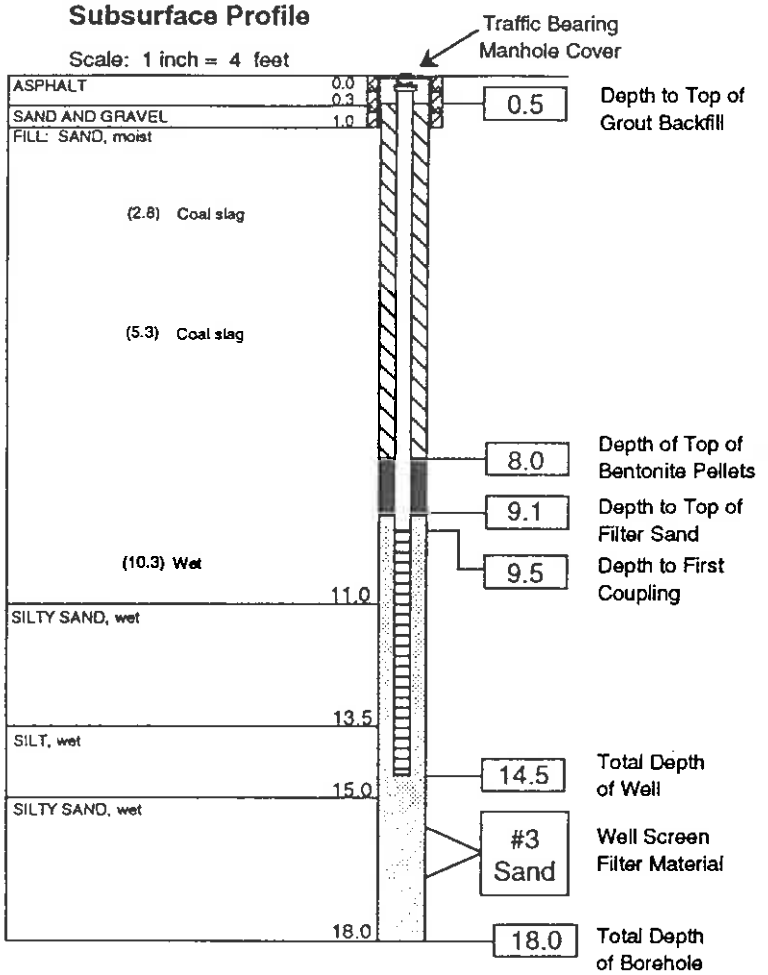
Log of Well Installation

Well Designation: MW-7

Date(s) of Installation: 7-22-92 To 7-22-92

Generalized Subsurface Profile

Scale: 1 inch = 4 feet



Ground Surface Elevation:	752.3
Top of Casing Elevation:	751.80
Well Screen Tip Elevation:	737.8

Well Casing

- Diameter: 2.0 inches
- Total Length: 9.0 feet
- Material: Schedule 40 PVC
- Cap (Y/N): Locking J-Plug

Well Screen

- Diameter: 2.0 inches
- Length: 5.0 feet
- Mesh: 0.010 inch slot
- Material: Schedule 40 PVC
- Well Screen Interval: 9.5 - 14.5 feet

Protective Well Casing Cover

- Material: Steel Flush Cap
- Diameter: 9.0 inches
- Length: 12.0 inches
- Lock (Y/N): 7/8 inch bolt

Inspector: G. Schmalz
Driller: R. Christensen
Contractor: Steams Drilling Company
Drilling Equipment: CME 750 Trailer Mount

Well Screen Filter Material: #3 Sand
Grout Backfill Material: Cement/Bentonite slurry
Other well materials used: Bentonite pellets

Water Level Data

Datum: Top of Well Casing

Date	Water Level Elevation
7-28-92	741.12
8-14-92	741.16
8-25-92	741.11

General Notes:

Figure

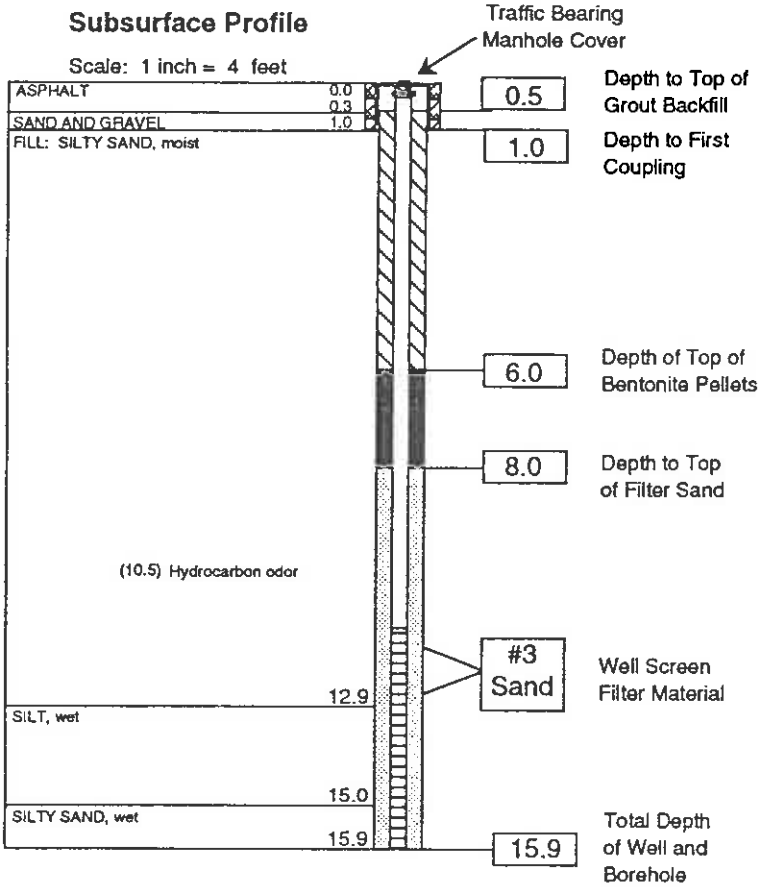
Log of Well Installation

Well Designation: MW-8

Date(s) of Installation: 7-22-92 **To** 7-22-92

Generalized Subsurface Profile

Scale: 1 inch = 4 feet



Ground Surface Elevation:	752.6
Top of Casing Elevation:	752.22
Well Screen Tip Elevation:	736.7

Well Casing

- Diameter: 2.0 inches
- Total Length: 10.5 feet
- Material: Schedule 40 PVC
- Cap (Y/N): Locking J-Plug

Well Screen

- Diameter: 2.0 inches
- Length: 5.0 feet
- Mesh: 0.010 inch slot
- Material: Schedule 40 PVC
- Well Screen Interval: 10.9 - 15.9 feet

Protective Well Casing Cover

- Material: Steel Flush Cap
- Diameter: 9.0 inches
- Length: 12.0 inches
- Lock (Y/N): 7/8 inch bolt

Inspector: G. Schmalz
Driller: R. Christensen
Contractor: Stearns Drilling Company
Drilling Equipment: CME 750 Trailer Mount

Well Screen Filter Material: #3 Sand
Grout Backfill Material: Cement/Bentonite slurry
Other well materials used: Bentonite pellets

Water Level Data

Datum: Top of Well Casing

Date	Water Level Elevation
7-28-92	740.76
8-14-92	740.76
8-25-92	740.78

General Notes:

Figure

WW Engineering & Science, Inc.

Project Name: BOC-Flint Automotive Division/Tank Farm #37 Flint, MI.

Project No.: 83106.11

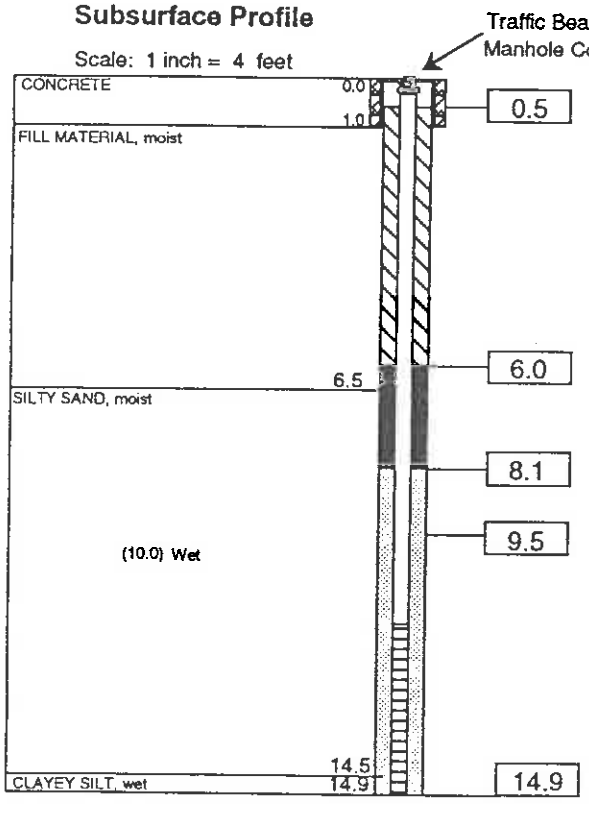
Log of Well Installation

Well Designation: MW-9

Date(s) of Installation: 7-23-92 To 7-23-92

Generalized Subsurface Profile

Scale: 1 inch = 4 feet



Ground Surface Elevation:	752.2
Top of Casing Elevation:	751.81
Well Screen Tip Elevation:	737.3

Well Casing

- Diameter: 2.0 inches
- Total Length: 9.5 feet
- Material: Schedule 40 PVC
- Cap (Y/N): Locking J-Plug

Well Screen

- Diameter: 2.0 inches
- Length: 5.0 feet
- Mesh: 0.010 inch slot
- Material: Schedule 40 PVC
- Well Screen Interval: 9.9 - 14.9 feet

Protective Well Casing Cover

- Material: Steel Flush Cap
- Diameter: 9.0 inches
- Length: 12.0 inches
- Lock (Y/N): 7/8 inch bolt

Inspector: G. Schmalz

Driller: R. Christensen

Contractor: Stearns Drilling Company

Drilling Equipment: CME 750 Trailer Mount

Well Screen Filter Material: #3 Sand

Grout Backfill Material: Cement/Bentonite slurry

Other well materials used: Bentonite pellets

Water Level Data

Datum: Top of Well Casing

Date	Water Level Elevation
7-28-92	740.63
8-14-92	741.78

General Notes:

Figure

WW Engineering & Science, Inc.

Project Name: BOC-Flint Automotive Division/Tank Farm #37
Flint, MI
Project No.: 83106.11

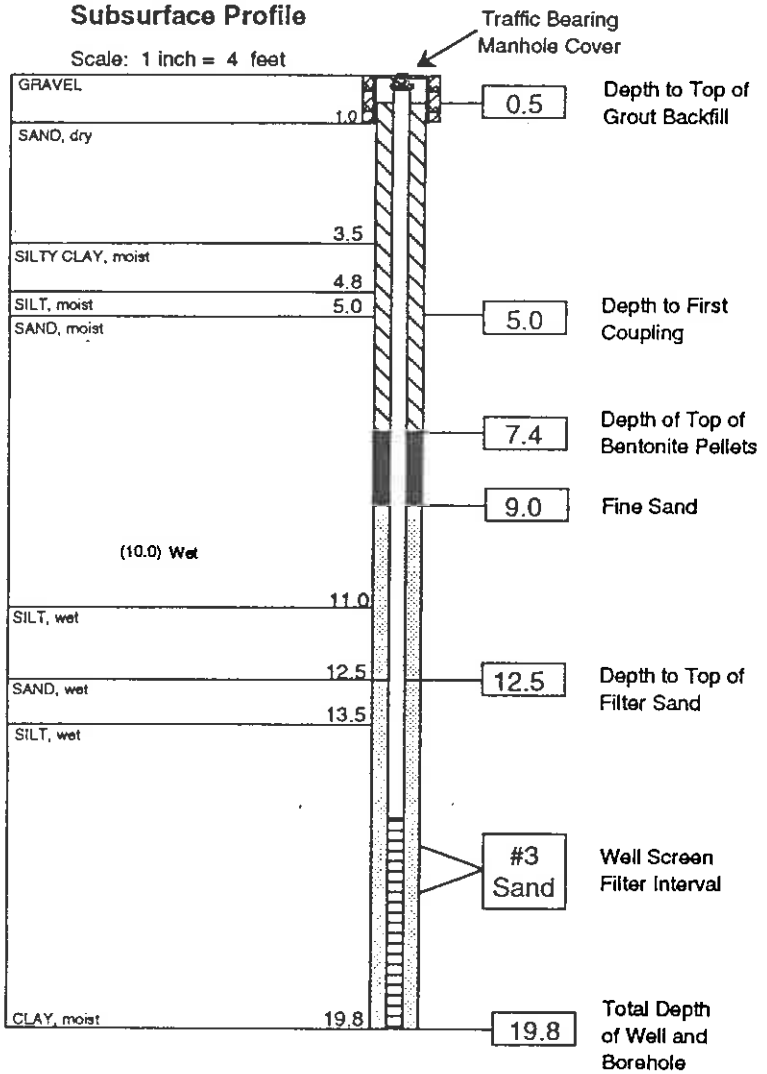
Log of Well Installation

Well Designation: MW-10D

Date(s) of Installation: 7-23-92 **To** 7-23-92

Generalized Subsurface Profile

Scale: 1 inch = 4 feet



Ground Surface Elevation:	752.5
Top of Casing Elevation:	752.20
Well Screen Tip Elevation:	732.7

Well Casing
- Diameter: 2.0 inches
- Total Length: 14.5 feet
- Material: Schedule 40 PVC
- Cap (Y/N): Locking J-Plug

Well Screen
- Diameter: 2.0 inches
- Length: 5.0 feet
- Mesh: 0.010 inch slot
- Material: Schedule 40 PVC
- Well Screen Interval: 14.8- 19.8 feet

Protective Well Casing Cover
- Material: Steel Flush Cap
- Diameter: 9.0 inches
- Length: 12.0 inches
- Lock (Y/N): 7/8 inch bolt

Inspector: G. Schmalz
Driller: R. Christensen
Contractor: Stearns Drilling Company
Drilling Equipment: CME 750 Trailer Mount

Well Screen Filter Material: #3 Sand
Grout Backfill Material: Cement/Bentonite slurry
Other well materials used: Bentonite pellets/Fine sand

Water Level Data

Datum: Top of Well Casing

Date	Water Level Elevation
7-28-92	741.40
8-14-92	741.64
8-25-92	741.26

General Notes:

Figure

Project Name: BOC-Flint Automotive Division/Tank Farm #37
Flint, MI
Project No.: 83106.11

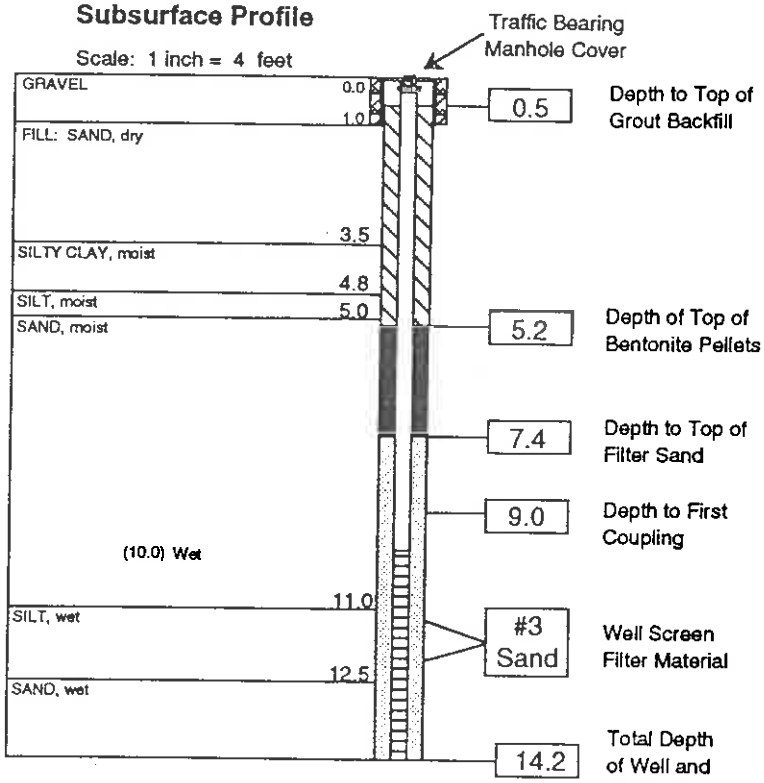
Log of Well Installation

Well Designation: MW-10S

Date(s) of Installation: 7-23-92 To 7-24-92

Generalized Subsurface Profile

Scale: 1 inch = 4 feet



Ground Surface Elevation:	752.0
Top of Casing Elevation:	751.33
Well Screen Tip Elevation:	737.8

Well Casing
- Diameter: 2.0 inches
- Total Length: 8.5 feet
- Material: Schedule 40 PVC
- Cap (Y/N): Locking J-Plug

Well Screen
- Diameter: 2.0 inches
- Length: 5.0 feet
- Mesh: 0.010 inch slot
- Material: Schedule 40 PVC
- Well Screen Interval: 9.2 - 14.2 feet

Protective Well Casing Cover
- Material: Steel Flush Cap
- Diameter: 9.0 inches
- Length: 12.0 inches
- Lock (Y/N): 7/8 inch bolt

Inspector: G. Schmalz
Driller: R. Christensen
Contractor: Stearns Drilling Company
Drilling Equipment: CME 750 Trailer Mount

Well Screen Filter Material: #3 Sand
Grout Backfill Material: Cement/Bentonite slurry
Other well materials used: Bentonite pellets

Water Level Data

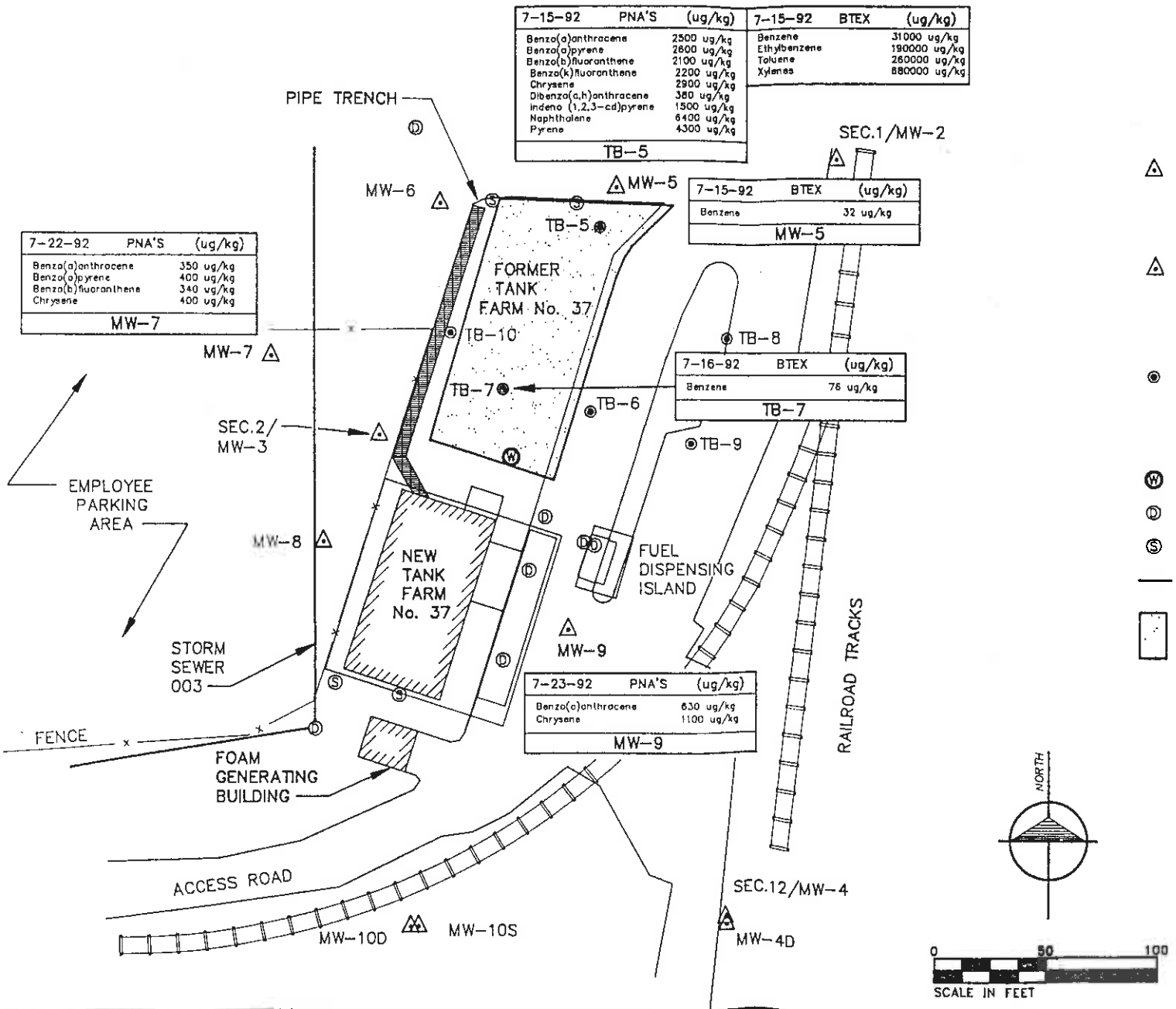
Datum: Top of Well Casing

Date	Water Level Elevation
7-28-92	740.71
8-14-92	740.94
8-25-92	740.61

General Notes:

Figure

ATTACHMENT 3



LEGEND:

- △ = MONITORING WELL INSTALLED OCTOBER 23 THROUGH OCTOBER 25, 1991 BY STEARNS DRILLING CO. UNDER WWES SUPERVISION
- △ = MONITORING WELL INSTALLED JULY 15 THROUGH JULY 24, 1992 BY STEARNS DRILLING COMPANY UNDER WWES SUPERVISION
- ◉ = TEST BORING DRILLED JULY 15 THROUGH JULY 24, 1992 BY STEARNS DRILLING COMPANY UNDER WWES SUPERVISION
- Ⓦ = RECOVERY WELL LOCATION
- Ⓓ = STORM SEWER/CATCH BASIN LOCATIC
- Ⓢ = SANITARY SEWER MANHOLE LOCATION
- — = APPROXIMATE LOCATION OF STORM SEWER 003
- ▭ = APPROXIMATE LIMITS OF FORMER UST EXCAVATION

FORMER TANK FARM No. 37 COMPOUNDS DETECTED IN SOILS AT CONCENTRATIONS ABOVE TYPE-B CRITERIA

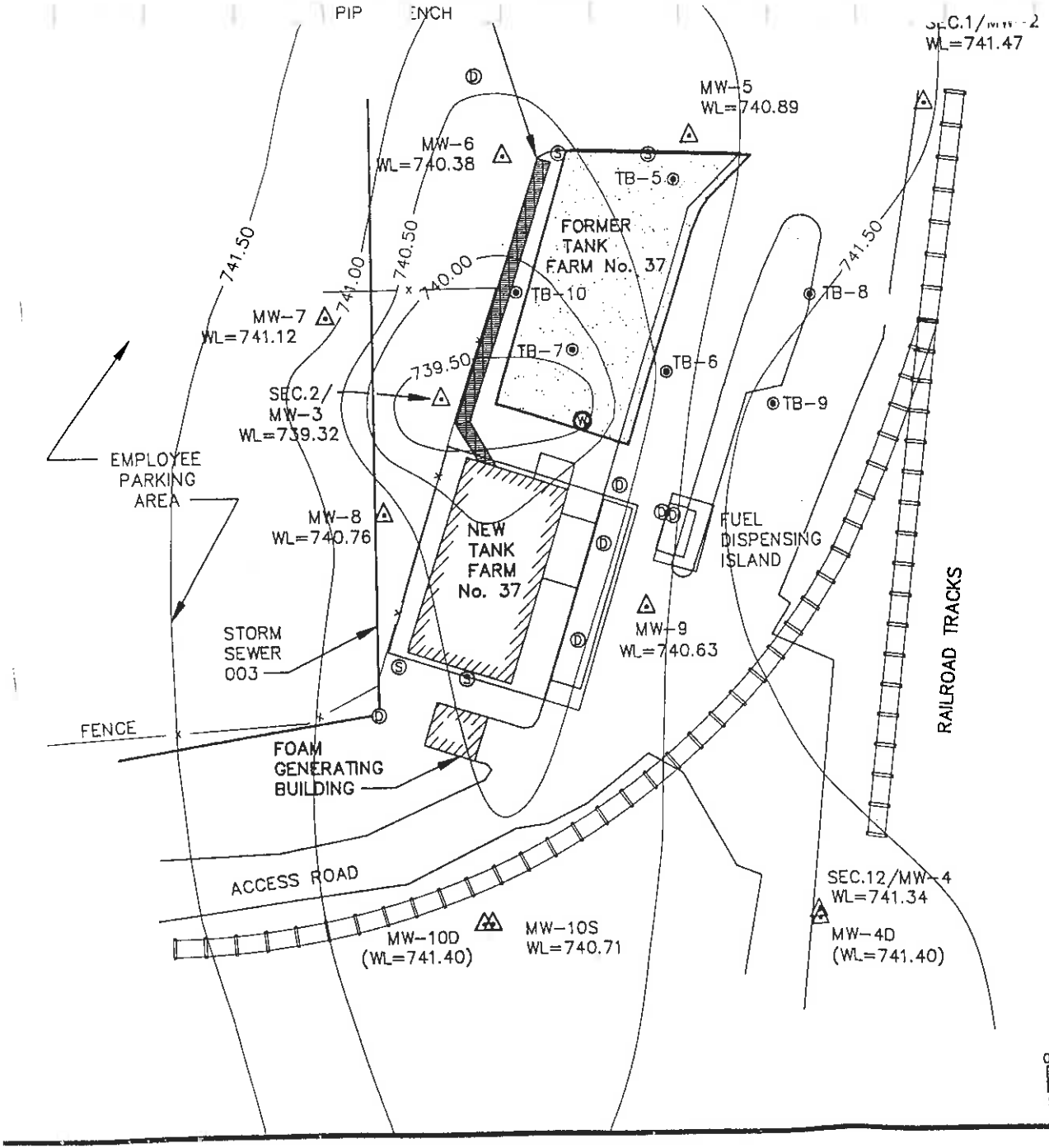
BOC FLINT AUTOMOTIVE DIVISION
FLINT, MICHIGAN

SEPTEMBER 1992 PROJECT NO. 6310

WW Engineering & Science

FIGUR 5

ATTACHMENT 4



LEGEND:

- WL = GROUND-WATER ELEVATION DATA COLLECTED ON JULY 28, 1992 DATA IN ( ) NOT USED IN CONTOUR LINES
- △ = MONITORING WELL INSTALLED OCTOBER 23 THROUGH OCTOBER 25, 1991 BY STEARNS DRILLING CO. UNDER WWES SUPERVISION
- △ = MONITORING WELL INSTALLED JULY 15 THROUGH JULY 24, 1992 BY STEARNS DRILLING COMPANY UNDER WWES SUPERVISION
- ◉ = TEST BORING DRILLED JULY 15 THROUGH JULY 24, 1992 BY STEARNS DRILLING COMPANY UNDER WWES SUPERVISION
- Ⓦ = RECOVERY WELL LOCATION
- Ⓓ = STORM SEWER/CATCH BASIN LOCATION
- Ⓢ = SANITARY SEWER MANHOLE LOCATION
- —— = APPROXIMATE LOCATION OF STORM SEWER 003
- = APPROXIMATE LIMITS OF FORMER UST EXCAVATION
- = GROUND-WATER CONTOUR LINE

741.00

CONTOUR INTERVAL = 0.5 FEET

NORTH

0 50 100

SCALE IN FEET

FORMER TANK FARM No. 37
GROUND-WATER CONTOUR MAP
7 / 28 / 92

BOC FLINT AUTOMOTIVE DIVISION
FLINT, MICHIGAN

SEPTEMBER 1992

PROJECT NO. 6310

WW Engineering & Science

39209 West Six Mile Road • Livonia, Michigan 48152 • (313)591-0572

FIGUR

ATTACHMENT 5

GM BOC FLINT TANK FARM 37

SOIL REMEDIATION ALTERNATIVE EVALUATION SUMMARY

REMEDIAL METHOD	ADVANTAGES	DISADVANTAGES
1. Excavation and Disposal	Can be implemented and completed quickly; clean closure obtainable, area disruption short term; no post-excavation monitoring or O & M costs	Liability of soils at landfill and during transit; costs incurred immediately; contamination relocated
2. Soil-Vapor Extraction	*In situ* treatment method; limited disruption of area; lower range of initial capital investment costs	Will not likely afford acceptable remediation of PNAH constituents; attaining ACT 307 cleanup levels for soils is uncertain; uncertain operational period;
3. On-site Thermal Destruction	Clean closure of site soils is obtainable, destroys contaminants; can fill excavation with treated soils; can be implemented and completed quickly; no O & M costs	May require nearby fuel source; air permit required; permitting may invoke extensive monitoring requirements; permits may delay implementation of remedial action; costs incurred immediately
4. On-site Bioremediation	*In situ* treatment; lower range of initial capital investment; limited disruption to area; contaminants converted to non-hazardous compounds	May not attain desired clean closure levels; long-term remedial action is likely; affected by cold termperatures and temperature fluctuations; significant long-term O & M costs

GM BOC FLINT TANK FARM 37

SOIL REMEDIATION ALTERNATIVE FEASIBILITY EVALUATION

Remedial Method	Capital Cost Range	Operation & Maintenance Cost Per Month	Present Value (i = 7%, n = 5)
1. Excavation and Disposal		$0	$328,958
a. USPCI Wyoming Facility	$328,958	$0	$181,890
b. Local Landfill	$181,890		
2. Soil-vapor Extraction	$80,000 - $96,000	$3,000 - $3,500	$228,000 - $268,000
3. On-site Thermal Destruction	$145,000 - $195,000	$0	$145,000 - $195,000
4. In situ Bioremediation	$75,000 - $125,000	$2,700 - $3,750	$208,000 - $310,000

ATTACHMENT 6

ATTACHMENT 6

DATA NEEDS
TYPE C CLOSURE REQUEST
GM TANK FARM 37

Pursuant to the Michigan Environmental Response Act rules, a Type C closure request is based on a site-specific risk assessment. It should be noted that the Michigan Department of Natural Resources issued *Operational Memorandum #14* relating to Generic Remedial Action Plans using Industrial Site Risk Assessment Cleanup Criteria. However, for industrial sites where BTEX is present and where the groundwater/surface water interface (GSI) is the controlling variable, the Type C cleanup criteria is the same as the Type B cleanup criteria.

In accordance with the scope of work delineated in the Advanced Environmental, Inc. Proposal dated September 29, 1993, "Advanced will develop a list of data and other information needed...but not yet collected...to complete the Type C closure (or, if possible, an Industrial Type C closure....)".

The following outlines the data needed to prepare a site-specific Type C closure request based on a selected remedial action plan for the GM Tank Farm 94 site in accordance with MERA Rules 299.5601,299.5603,299.5719. These requirements apply whether an Industrial Type C or Site-Specific Type C closure is proposed.

TYPE C CLOSURE DATA REQUIREMENTS

PHYSICAL SETTING

Site Location

Site Map

Current Uses of the Site including Zoning Classification Documented by either a Map or a Current Property Record Card

Physical Structures

Surrounding Land Use

Reasonably Foreseeable Uses of the Site and Natural Resources.

Climate

Geology

Soils

Hydrogeology

ENVIRONMENTAL SITE SETTING

Environmental Media Affected

Background Soil, Groundwater, and Air Quality

Potential Pathways of hazardous Substance Migration

Potential Exposure of Human and Natural Resource Receptors

CHEMICAL CONCENTRATIONS

Form

Mobility

Persistence

Bioaccumulative Properties

Environmental Fate

Contribution to Food Chain Accumulation

EXTENT OF MIGRATION

Current Extent of Migration

Impact of Future Extent of Migration

DEGREE OF CLEANUP (Rule 299.5601)

MERA Type B and Type C Cleanup Criteria

ARARS (Applicable or Relevant and Appropriate Environmental Laws)

FEASIBILITY STUDY (EVALUATION OF REMEDIAL ACTION ALTERNATIVES) [Rule 299.5603]

Evaluation based on EPA's Nine Criteria including Coast Effectiveness

Uncertainties of the Risk Assessment

Ability to Measure Remedial Performance

DESCRIPTION OF REMEDIAL ACTION PLAN

POST-REMEDIATION RISK ASSESSMENT

IF ON-SITE CONTAINMENT, THEN THE FOLLOWING MUST BE MET:

Long-Term Monitoring to Assure Effectiveness

Land Use Restrictions/Restrictive Covenants

Continued Financial Responsibility

Governmental Access to Site to Monitor Effectiveness

Notice to MDNR if Land Conveyance

Prohibit Activities that Interfere with Remedial Action

Prohibit Activities that may result in Unacceptable Human Exposure

Description of Allowable Activities

Installation of a Permanent Marker on all sides of the Site