GME CONSULTANTS, INC.
CONSULTING ENGINEERS
Lake Shore Drive / P.O. Box 250
Crosby, MN 56441 / (218) 546-6371

August 19, 1993

Mr. Mark Koplitz
Minnesota Pollution Control Agency
Hazardous Waste Division
Tanks and Spills Section
520 Lafayette Road North
St. Paul, Minnesota 55155

GME Project No. C-2373-B

RE: Project Status Report and Clean-up Strategy Discussion Request for the Dittmer Oil Company Property located at the intersection of Highways 4 and 19 in Fairfax, Minnesota (MPCA Leaksite #00001940)

Dear Mr. Koplitz:

We are writing on behalf of Mr. Robert Dittmer to provide you with project status information, per our recent telephone conversation with you. We also are writing to request a clean-up strategy conference call with you and/or the MPCA project hydrogeologist, Mr. Dittmer and ourselves, per MPCA Guidance Document 25 dated April, 1993.

As requested in Guidance Document 25, we have attached the following items to this letter (they are listed in their order of attachment):

* Site Maps showing soil boring and monitoring well locations, above ground storage tank (AGST) and underground storage tank (UST) locations, and contaminant distributions,
* Groundwater Table Contour Maps,
* Tables of Soil Boring Results, Soil Chemistry Results, Water Level Measurements, and Water Chemistry Results,
* Soil Boring and Monitoring Well Logs,
* Groundwater Receptor Survey Information, and
* A Hydrogeologic Setting and Groundwater Contamination Worksheet.

BACKGROUND

The site is located southeast of the intersection of Highways 4 and 19 in the City of Fairfax, Minnesota (Figure 1). The property is relatively level, and most of the site is either paved or is covered by buildings. The primary man-made structure on the property houses both Dittmer Oil and the 419 Cafe. There are three USTs on-site to store regular leaded gasoline and unleaded gasoline for commercial sale. There also are several other USTs and AGSTs on-site (Figure 2).

The site is bounded by the Fairfax Farmers Elevators to the south, an agricultural field to the east, Highway 19 to the north, and Highway 4 to the west. Farther to the east is a farmhouse and out buildings. Directly across Highway 19 to the north is a residence and out buildings. A feed and seed business (formerly a retail gasoline station) is located to the northwest of the site, on the northwest corner of the intersection of Highways 19 and 4. A cafe (also formerly a retail gasoline station) is located west of the property, just across Highway 4.

A UST leak was reported at the Dittmer Oil Company site in October 1989, when approximately 2,300 gallons of leaded gasoline were discharged into the subsurface from a loose fitting on a product pipe connected to the 12,000 gallon gasoline UST. Free product was recovered and contaminated soils were removed and disposed of at that time. The impacts from that release were deemed to be remediated and that release was "closed" by the MPCA.

However, during remediation of the leaded gasoline release, evidence was encountered that indicated that several previous petroleum releases had occurred in conjunction with the gasoline UST installations. For example, the 12,000 gallon gasoline UST replaced another UST which had been leaking. Further, the 8,000 gallon gasoline UST had been leaking and was patched with fiberglass in approximately 1985. Also, an apparent spill or overfill near the fill pipe of the 4,000 gallon unleaded gasoline UST was identified. When the tanks were replaced in the excavation and the excavation was backfilled, most of the remaining impacts were located along the eastern wall of the excavation. These impacts ranged up to 192 parts per million (ppm) total petroleum hydrocarbons (TPHCs) as (likely unleaded) gasoline. Additional information regarding the above releases from the gasoline UST installations is reported in our March 28, 1990 Gasoline Discharge Remediation Report.

The purpose of our remedial investigation (RI) is to assess the extent and magnitude of the remaining petroleum impacts associated with the gasoline USTs. Our scope of work has included completion of 27 environmental soil borings (Figure 3), installation of 7 groundwater table monitoring wells and 1 deep groundwater monitoring well, completion of soil and groundwater sampling and laboratory analyses, completion of slug tests, and completion of potential receptor surveys.

INVESTIGATION RESULTS

Geology and Hydrogeology

Soil boring results indicate that primarily glacial till soils with some thin interbedded sand seams underlie the site. Figures 4 and 5 illustrate geological cross-sections across the site, and Figure 6 shows the plan view of the cross-section locations. As shown on the cross-sections, we encountered three general stratigraphic units: a light gray to light brown silty clay with trace to little sand and many fractures to approximately 8 to 14 feet below grade; a brown to dark brown silty clay with little sand and some fractures to a maximum of approximately 16 feet below grade; and, a dark gray non-fractured silty clay with trace to little sand and trace gravel to the final extent of our exploration at approximately 40 feet below grade. There also were sand seams identified in several of the borings; the thickest sand layers were encountered in the gray clay at approximately 20 to 30 feet below grade in boring B8.

A review of USGS Hydrologic Investigations Atlas HA-391 indicates that Pleistocene glacial till underlies the Fairfax area to a depth of approximately 200 feet. Underlying the glacial deposits are cretaceous shales and sandstones, and Precambrian granitic and metamorphic rocks, in turn. The top of the Precambrian rock apparently exists at an elevation of approximately 825 to 850 feet MSL. The primary aquifers in the Fairfax area are either the cretaceous sandstones or decomposed Precambrian granite, or sand seams within the glacial till. The well logs for two wells at the nearby Fairfax Farmers Elevators indicate that the overlying unconsolidated glacial materials are comprised primarily of clay with few sand seams. The wells are completed in a sand stratum located between 173 and 186 feet below grade.

The groundwater table currently exists at approximately 4 to 5 feet below grade, but was encountered at approximately 12 to 13 feet below grade in the excavation when the leaded gasoline release was remediated in November, 1989. According to Hydrologic Investigations Atlas HA-391, the regional shallow groundwater flow within the glacial deposits generally is to the south. The apparent regional discharge site for the groundwater underlying the Fairfax area is the Minnesota River, which is located several miles to the south of Fairfax.

Table 1 summarizes the 6 rounds of water level measurements from our monitoring wells. These measurements indicate that the shallow groundwater flow under the site generally is to the south and southeast (Figures 7 and 8). Our water level measurements also indicate that a relatively steep lateral gradient exists in the fine grained soils.

Table 2 summarizes slug test data collected from 3 of our groundwater table monitoring wells. The average hydraulic conductivity measured from these results was 0.022 ft/min. The estimated lateral groundwater flow velocity near the groundwater table is approximately 1 ft/day, based on our slug test results, an estimated porosity of 30% and the gradient estimated from our groundwater level measurements. These results are higher than would be expected for a clay and may indicate that the fractures in the upper two till units play a major role in controlling the groundwater flow at this site. Sand seams also will cause preferential groundwater flow where they are present in the clay tills.

Organic Vapors and Soil Chemistry

Tables 3 and 4 summarize the organic vapor concentrations and soil chemistry results for soil samples collected from our soil borings. The organic vapor concentrations also are on the attached soil boring logs.

As this information indicates, most of the significant soil impacts encountered in the borings are from approximately 6 to 14 feet below grade, and especially from 8 to 12 feet below grade. Therefore, it appears as if most of the impacts at the site are limited to the few feet below the groundwater table. Exceptions to this were soil samples collected from borings B8 (24 to 26 feet below grade), B21 (28 to 30 feet below grade) and MW8. The samples from borings B8 and B21, collected from a sand seam with an organic vapor detection of 4.5 ppm and from the gray clay with an organic vapor detection of 6 ppm, had slight petroleum parameter detections just above the laboratory method detection limits. The sample from

boring MW8, collected from near where the well was screened (in the gray clay at 37 to 39 feet below grade) also indicated relatively low petroleum parameter detections (but no organic vapor detections); these detections are further discussed in the following section.

Groundwater Chemistry

Groundwater chemistry results are summarized in Table 5. These data indicate that primarily unleaded gasoline has impacted the groundwater at the site. Leaded gasoline and fuel oil also may be source petroleum products for the petroleum parameters detected in our groundwater samples. Most of the impacts encountered in the groundwater monitoring wells appear to be related and do not appear to have been significantly affected by biodegradation (i.e., gasoline range organic (GRO) concentrations are higher than diesel range organic (DRO) concentrations and benzene concentrations are still moderate to high in 3 wells). Groundwater samples from well MW2 have contained the highest concentrations of petroleum product parameters. The concentrations in wells MW1, MW4 and MW7 also have been high and the Minnesota Department of Health (MDH) Recommended Allowable Limits (RALs) for at least one parameter have been exceeded on at least one sampling event in each of those wells.

Very low concentrations of benzene, toluene, and MTBE (volatile constituents) were detected just above the laboratory method detection limits in the water sample collected from deep monitoring well MW8. This sample was collected only approximately 1 day after the well had been installed (August 5). To reduce the potential for cross-contamination when installing that well, a 10 inch I.D. hollow stem auger was drilled to 20 feet below grade and then an 8 1/4 inch O.D. hollow stem auger was telescoped through the 10 inch casing to complete the boring. Although this outer casing was placed approximately 7 feet past the last known depth of impacts (based on HNU readings from adjacent well MW4), it is uncertain whether the groundwater impacts from the water table zone were completely sealed off from leakage into the advancing borehole. After the borehole was advanced to final depth (40 feet below grade), the well was installed into a very tight non-fractured gray clay. A small amount of water from the municipal water supply was required to be placed in the well to hold the well in place while removing the augers and grouting the borehole. The borehole around the well was pressure grouted with a tremie pipe from the top of the sand pack through the water table to near the ground surface. Upon completion, the 40 foot well had approximately 36 feet of water in it (most of it likely from the well installation procedure). We bailed the well dry twice and it recharged approximately 1 foot prior to our collecting the above mentioned

water sample.

We returned to the site on the evening of August 17 and rechecked the water level in deep monitoring well MW8 and found it to be approximately 24 feet below grade. Therefore, the water level in that well had recharged only 15 additional feet since our August 5 sampling event (approximately 1 foot per day). Although there may be downward vertical groundwater gradients, it is unlikely that they would be as steep as this water level would indicate (approximately 1 foot per foot). Therefore, the water level in well MW8 likely still was not stabilized as of August 17; this is an indication of the low permeability of the non-fractured gray clay. After measuring the water level in the well on August 17, we again bailed the well dry. On the morning of August 18, the well had recharged approximately 1 foot and we collected another water sample. The analytical results for this sample should be available by August 27. ~~AB~~ BTEX for all (BETX, DRO, GRO, MTBE)

In summary, the initial petroleum parameter detections in soil and groundwater samples collected from well MW8 should be re-evaluated after the well has been additionally purged and sampled. There were no organic vapor detections or petroleum odors observed in soil samples from that boring. Also, there were no sand seams apparent in that boring, and field observations and recharge observations indicate that the gray clay has a very low permeability. Further, recharge observations indicate that the annulus has been grouted properly to eliminate borehole leakage into the well. However, some leakage of contaminated water from the fractured clays near the water table into the borehole may have occurred during drilling. This leakage would be magnified in the initial well sampling results from a well such as MW8 placed in a low permeability clay, because of the lack of recharge. Therefore, the well may have to be purged several times to flush out the slight impacts that may have leaked into the borehole from above. Alternatively, if steep downward vertical groundwater gradients or impacted sand seams near the well screen were to exist, the impacts detected in well MW8 would be expected to be stable or increase over time.

Figure 9 illustrates the estimated lateral extent of the groundwater impacts. Based on the soil boring and monitoring well sampling results, it appears that preferential groundwater flow through the fractures in the glacial till units has caused the gasoline impacts to have migrated upgradient, sidegradient and downgradient from the UST installations. Although the impacts have migrated upgradient to the north, northeast and northwest of the USTs, the plume primarily has migrated sidegradient and downgradient to the east, southeast and south of the USTs.

Besides affecting the speed of migration and the apparent extensiveness of the plume, the fractures in the till in conjunction with significant water level fluctuations could further affect the groundwater chemistry. This possible affect is possibly illustrated by the data for wells MW1 and MW2 (Table 5). Since these wells were installed, the water levels have increased dramatically. These water table fluctuations or slug flow migration may explain the results for these two wells. When they were installed, soil sample chemistry and organic vapor measurements indicated that more impacts existed near well MW1. Initial water sampling results for that well confirmed these data. Results for monitoring well MW4, just downgradient from monitoring well MW1, also confirmed that gasoline impacts existed in that area. However, recent groundwater sampling results for well MW1 indicate that it is relatively clear of impacts. In the meantime, concentrations in well MW2 have increased until a dramatic decrease on the last round of sampling. Again, these results, coupled with the lateral extensiveness of the impacts at the groundwater table indicate that both groundwater table fluctuations and the fractures in the till likely play major roles in groundwater contaminant migration at the site.

Potential Receptors

As part of a vapor receptor survey for the site, we monitored for organic vapors in the small basement underneath the Dittmer Oil building. We encountered no petroleum related vapors in the basement.

Our groundwater receptor survey results indicate that the likely primary groundwater receptors in the area are the 2 wells located directly south of the site at the Fairfax Farmers Elevators. Those wells are approximately 183 and 186 feet deep, and have 4 to 8 foot long screens. Their well logs do not indicate any information regarding the casing or grouting characteristics of the wells. We sampled the Co-op well shown on Figure 2 in August, 1993 and no detections of BTEX or GRO were observed.

Based on the information obtained from the Minnesota Geological Survey (MGS) and Hydrologic Investigations Atlas HA-391, the City of Fairfax uses 2 municipal wells located to the west of Fairfax. Only one other water supply well is registered in Fairfax, at the Fairfax Flour Mill in the southwest portion of the city. Both the City wells and the flour mill well are completed in bedrock at over 200 feet below grade.

Although not registered, it is very likely that the residence located approximately 1000 feet east of Dittmer Oil also has a private well. The Dittmer Oil site and other nearby sites to the west are on the municipal water supply system.

CORRECTION ACTION ALTERNATIVES

Based on the petroleum parameter concentrations in groundwater samples from wells MW2, MW4 and MW7, the lateral extensiveness of the groundwater impacts, the apparent relatively fast migration of the impacts through the soil fractures, and the nearby locations of at least 2 potential groundwater receptors to the east and south of the site, it is our opinion that the on-site shallow groundwater should be remediated. Further, this groundwater remediation should be conducted in conjunction with source control measures (i.e., in this case, additional soil remediation).

The results to date are not clear as to whether natural biodegradation is occurring within the surficial soils. National research indicates that hydrocarbons are most amenable to natural biodegradation in shallow sands where oxygen is readily available. Therefore, based on the possible lack of success of natural biodegradation processes, the fine-grained characteristics of the soils, and the potential for large groundwater table fluctuations, in-situ remediation techniques likely would not be feasible. An exception to this might be injecting bacteria to allow bioremediation to occur, especially in the fractured zones just above and within the upper portion of the groundwater table. However, it has been our experience that permitting of bioremediation can be difficult. Therefore, we recommend that additional soil excavation be completed eastward from the eastern side of the UST excavation (in the unpaved area). We anticipate that approximately 300 to 500 cubic yards of petroleum impacted soil could be removed from that location. Disposal of this soil on nearby farmland should be relatively cost-effective.

A groundwater collection system appears to be the primary option for remediating the shallow groundwater. This could be accomplished at this site by a groundwater collection trench placed along the eastern property line and a portion of the southern property line. The trench could be installed to approximately 15 feet below grade, and perforated PVC pipe would be placed in the trench and it would be backfilled with pea gravel. The pipe and trench would be sloped to manholes which would be pumped. The trench installation and additional pumping would create a draw down and collect on-site groundwater as well as "pull back" some of the

impacted groundwater which has migrated off the site. A groundwater collection trench should work at this site, because it would intersect the fractures in the till and it would continue to work during the groundwater table fluctuations experienced at this site. Based on the results of the above recommended soil excavation, it also may be desirable to place another PVC lateral in that excavation and connect it with the main trench. This lateral could enhance clean-up of the groundwater near the UST installations.

Extracted groundwater either would be discharged directly into the sanitary sewer system or would be treated then discharged. An alternative would be to treat and oxygenate the extracted groundwater, then allow it to reinfiltrate upgradient of the plume to enhance plume attenuation and migration toward the collection trench.

An alternative to groundwater remediation, if you determine that the 2 nearby potential receptors are the primary reason remediation would be necessary, would be to hook-up both of these properties to the nearby municipal water supply. This likely would be more cost-effective than undertaking groundwater remediation solely for the purpose of protecting those two wells. If these properties were hooked-up to the municipal water supply instead of remediating the site's groundwater, on-going groundwater monitoring of the site monitoring wells still should be conducted for at least two years. Whether or not remediation is required at the site, we also would recommend that additional groundwater table monitoring wells be placed near the locations of borings B7 and B12 to monitor the migration of petroleum impacts to the south and east of the site.

CLOSURE

After your review of this letter, please contact me to advise us of a suitable time to schedule a conference call with ourselves and Mr. Dittmer. Please try to complete your review and schedule our conference call as soon as possible as Mr. Dittmer is very anxious to proceed with further work at the site.

If you have any questions regarding the information that we have provided, please telephone me at 218-546-6371. We appreciate your consideration and timely review of the data from this site.

Sincerely,

GME CONSULTANTS, INC.

Mark D. Millsop

Mark D. Millsop
Senior Hydrogeologist
Corporate Environmental Division Manager

Attachments: As described on page 1 of text

c: Mr. Robert Dittmer
Dittmer Oil Company
Highways 4 & 19
Fairfax, Minnesota

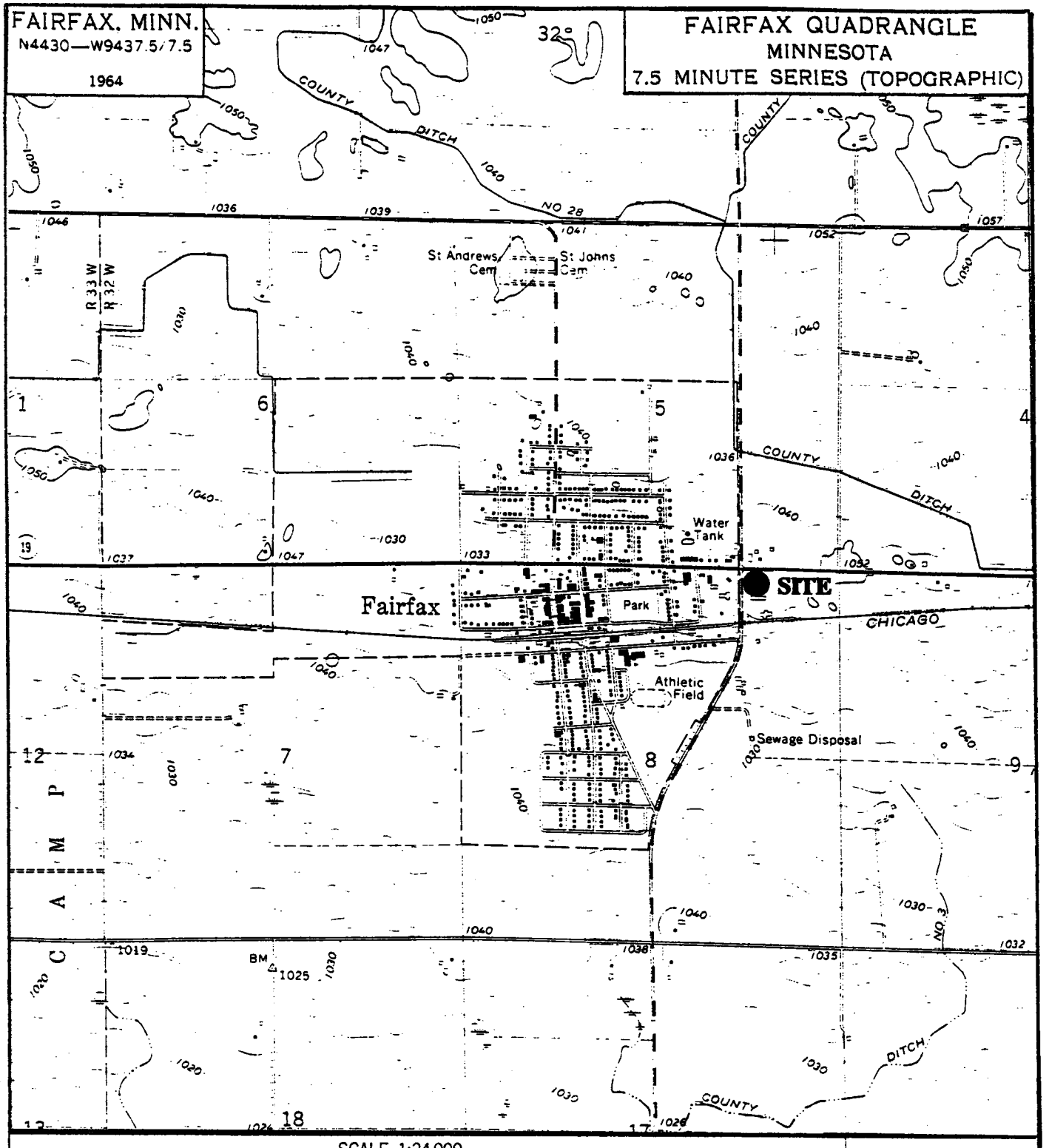

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FIGURE 1: Regional Location Diagram
Dittmer Oil Company, Inc.
Fairfax, Minnesota

MDM		7-21-93	C2373C

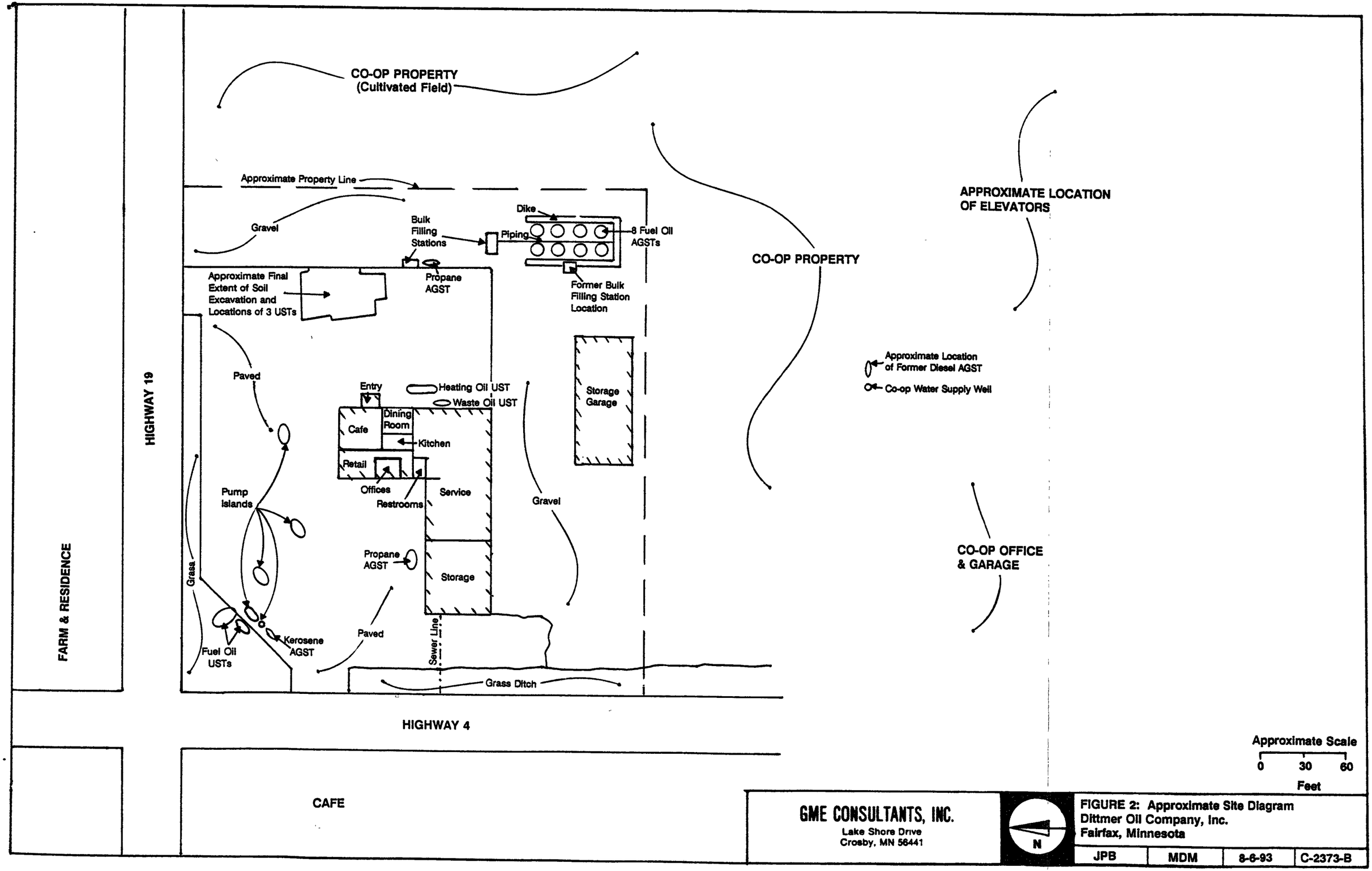

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FIGURE 2: Approximate Site Diagram
Dittmer Oil Company, Inc.
Fairfax, Minnesota

JPB	MDM	8-6-93	C-2373-B

LEGEND

- GME MONITORING WELL LOCATION
- GME SOIL BORING LOCATION

NOTE: All Dimensions and Locations are Approximate. Dimensions and Orientations of USTs and AGSTs also are approximate.

HIGHWAY 19

CO-OP PROPERTY (Field)

CO-OP PROPERTY

Approximate Property Line

B13 clean

B12 clean

B17 clean

B9 good

B20 clean

MW2 redrill

B8 clean

B14/MW7 good?

B15 good

B16 clean

B18 good

Gravel

B3 good

Fuel Oil AGSTs

Dike

MW5 Good

B21 good TD = 20

Approximate Final Extent of Soil Excavation and Locations of 3 USTs

B4 good

B2 good

B1 ?

MW1 redrill

MW4 good

B19/MW8 clean

B6 clean at TD

B7 clean (gw dirty)

B10 clean

Pavement

Grass

Heating Oil UST

Waste Oil UST

Entry

SE Well

MW3

Cafe

Dining Room

Kitchen

Service

Retail

Offices

Restrooms

Storage Garage

MW6 clean

B5 clean

Note: Boring B11 is located approximately 220 feet west. clean

Approximate Location of Former Diesel AGST

Co-op Water Supply Well

Approximate Scale

0 20 40

Feet

N

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Crosby, MN 56441

FIGURE 3: Soil Boring and Monitoring Well Locations
Dittmer Oil Company, Inc.
Fairfax, Minnesota

JPB	MDM	8-6-93	C-2373-B

LEGEND

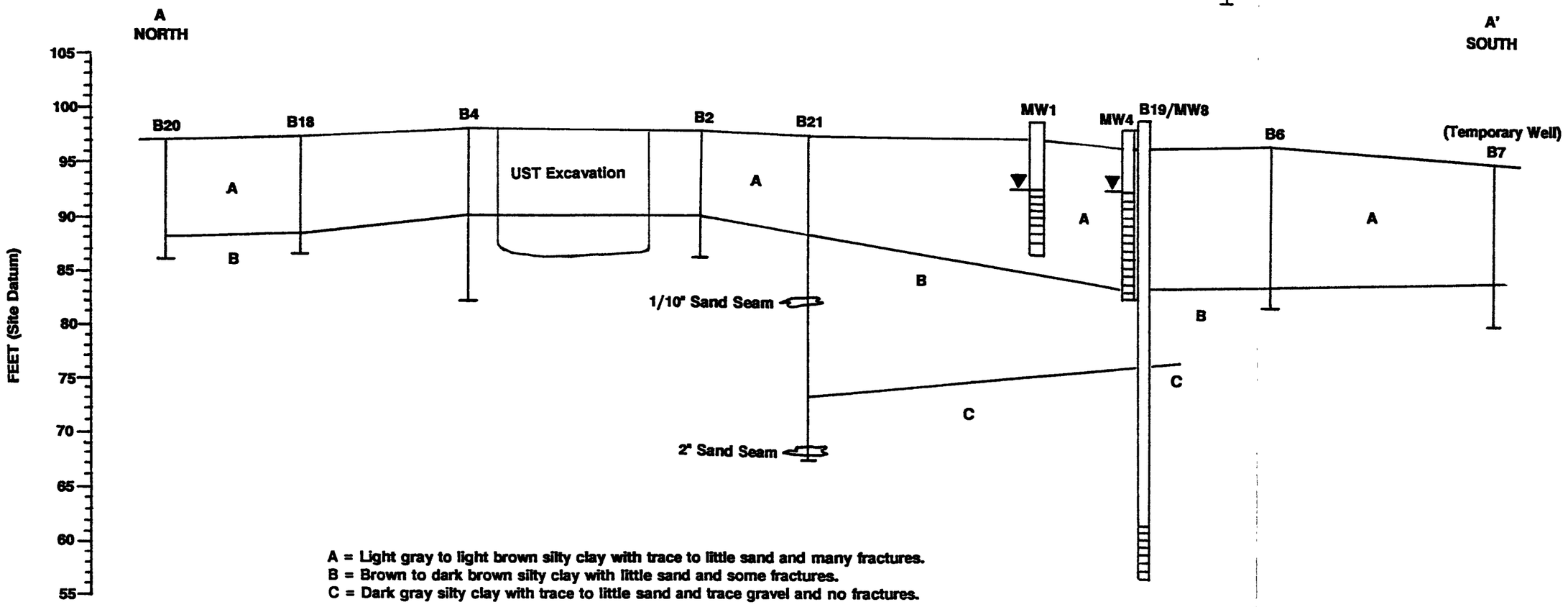
APPROXIMATE STRATIGRAPHIC BOUNDARY

APPROXIMATE GROUNDWATER LEVEL ON 8-4-93

RISER PIPE

WELL SCREEN

SOIL BORING



A = Light gray to light brown silty clay with trace to little sand and many fractures.
B = Brown to dark brown silty clay with little sand and some fractures.
C = Dark gray silty clay with trace to little sand and trace gravel and no fractures.

HORIZONTAL SCALE: 1 INCH = 40 FEET
VERTICAL SCALE: 1 INCH = 10 FEET
VERTICAL EXAGGERATION: 4X

NOTES:

1. Well elevations are referenced to site datum. The concrete slab in the doorway at the northeast entrance to the main building (cafe entrance) was used as the benchmark.
2. Stratigraphic boundaries are estimated. Actual boundaries may differ.
3. Topography is estimated.

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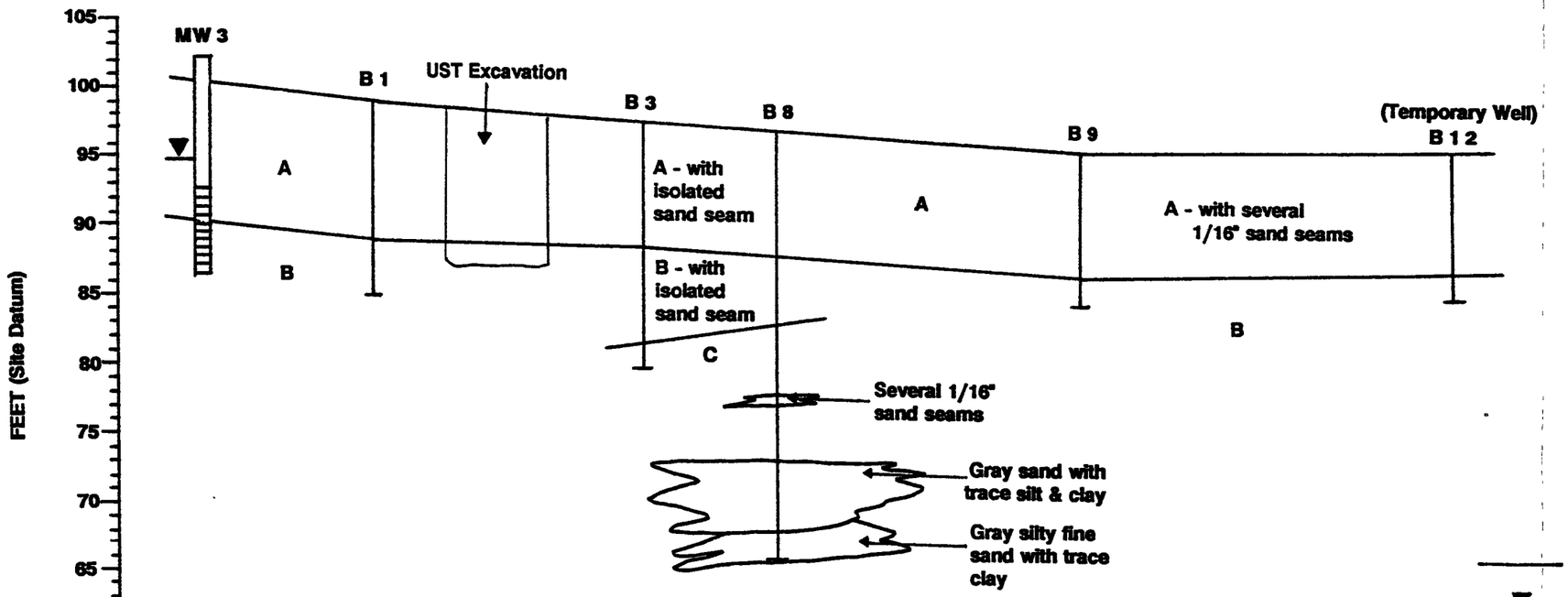
FIGURE 4: Geologic Cross Section A-A'
Dittmer Oil Company
Fairfax, Minnesota

JPB	MDM	8-16-93	C-2373-B

B
WEST

B'
EAST



A = Light gray to light brown silty clay with trace to little sand and many fractures.
B = Brown to dark brown silty clay with little sand and some fractures.
C = Dark gray silty clay with trace to little sand and trace gravel and no fractures.

LEGEND

- APPROXIMATE STRATIGRAPHIC BOUNDARY
- APPROXIMATE GROUNDWATER LEVEL ON 8-4-93
- RISER PIPE
- WELL SCREEN
- SOIL BORING

HORIZONTAL SCALE: 1 INCH = 40 FEET
VERTICAL SCALE: 1 INCH = 10 FEET
VERTICAL EXAGGERATION: 4X

NOTES:

1. Well elevations are referenced to site datum. The concrete slab in the doorway at the northeast entrance to the main building (cafe entrance) was used as the benchmark.
2. Stratigraphic boundaries are estimated. Actual boundaries may differ.
3. Topography is estimated.

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FIGURE 5: Geologic Cross Section B-B'
Dittmer Oil Company
Fairfax, Minnesota

JPB	MDM	8-16-93	C-2373-B

LEGEND

- GME MONITORING WELL LOCATION
- GME SOIL BORING LOCATION

NOTE: All Dimensions and Locations are Approximate. Dimensions and Orientations of USTs and AGSTs also are approximate.

B' B13 B12 B17 CO-OP PROPERTY (Field) B9 B8 Approximate Property Line MW2 B14/MW7 B15 CO-OP PROPERTY A B20 B18 Gravel B3 AGSTs Dike B16 MW5 HIGHWAY 19 Approximate Final Extent of Soil Excavation and Locations of 3 USTs B21 B4 B2 MW1 MW4 B19/MW8 B6 B7 A' B1 B10 Pavement Approximate Location of Former Diesel AGST Co-op Water Supply Well Heating Oil UST Entry SE Well Waste Oil UST Storage Garage MW6 MW3 B5 B Dining Room Cafe Kitchen Service Retail Offices Restrooms Grass Note: Boring B11 is located approximately 220 feet west.

Approximate Scale
0 20 40
Feet

N

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FIGURE 6: Geologic Cross-Section Index
Dittmer Oil Company
Fairfax, Minnesota

JPB	MDM	8-16-93	C-2373-B

NOTE: All Dimensions and Locations are Approximate. Dimensions and Orientations of USTs and AGSTs also are Approximate.

LEGEND

- GME MONITORING WELL LOCATION
- GME SOIL BORING LOCATION
- 94.57' GROUNDWATER ELEVATION (8-4-93)
- 93.00 APPROXIMATE GROUNDWATER TABLE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

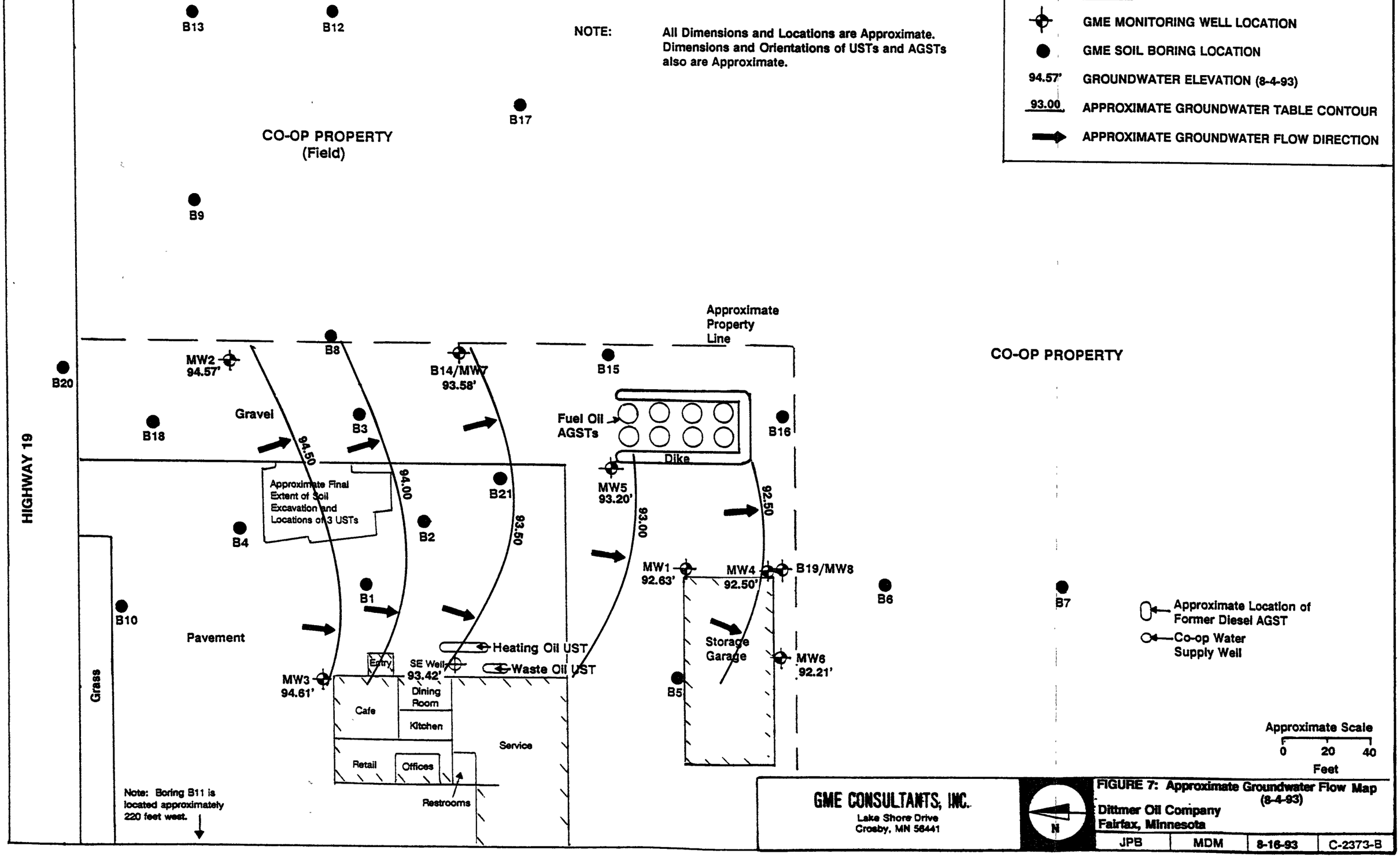

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FIGURE 7: Approximate Groundwater Flow Map (8-4-93)
Dittmer Oil Company
Fairfax, Minnesota

JPB	MDM	8-16-93	C-2373-B

LEGEND

- GME MONITORING WELL LOCATION
- GME SOIL BORING LOCATION
- 92.87' GROUNDWATER ELEVATION (12-6-91)
- 93.00 APPROXIMATE GROUNDWATER TABLE CONTOUR
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE: All Dimensions and Locations are Approximate. Dimensions and Orientations of USTs and AGSTs also are Approximate.

B13 B12 B17 B9 B8 B20 MW2 92.87' B14/MW7 B15 B18 B3 B16 B21 B2 B4 B1 B10 B5 B6 B7 MW1 91.98' MW4 B19/MW8 MW5 MW6 MW3 93.31' B11

CO-OP PROPERTY (Field)

CO-OP PROPERTY

Approximate Property Line

HIGHWAY 19

Gravel

AGSTs

Dike

Approximate Final Extent of Soil Excavation and Locations of 3 USTs

92.50

92.00

93.00

Pavement

Grass

Heating Oil UST

Waste Oil UST

SE Well

Entry

Cafe

Dining Room

Kitchen

Service

Retail

Offices

Restrooms

Storage Garage

Note: Boring B11 is located approximately 220 feet west.

Approximate Location of Former Diesel AGST

Co-op Water Supply Well

Approximate Scale

0 20 40

Feet

N

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FIGURE 8: Approximate Groundwater Flow Map (12-6-91)
Dittmer Oil Company
Fairfax, Minnesota

JPB	MDM	8-16-93	C-2373-B

LEGEND

- GME MONITORING WELL LOCATION
- GME SOIL BORING LOCATION

NOTE: All Dimensions and Locations are Approximate. Dimensions and Orientations of USTs and AGSTs also are approximate.

HIGHWAY 19

B13 B12 B17

CO-OP PROPERTY (Field)

Estimated Lateral Extent of Groundwater Impacts

B9

Approximate Property Line

CO-OP PROPERTY

B20 MW2 B8 B14/MW7 B15

Gravel

B18 B3

Fuel Oil AGSTs

Dike

B16

MW5

Approximate Final Extent of Soil Excavation and Locations of 3 USTs

B21

B4 B2

MW1 MW4 B19/MW8

B6 B7

B1

B10

Pavement

Heating Oil UST

Waste Oil UST

Storage Garage

MW6

Grass

Entry SE Well MW3

B5

Dining Room

Cafe

Kitchen

Service

Retail Offices

Restrooms

Note: Boring B11 is located approximately 220 feet west.

Approximate Location of Former Diesel AGST

Co-op Water Supply Well

Approximate Scale

0 20 40

Feet

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N

FIGURE 9: Estimated Lateral Extent of Groundwater Impacts
Dittmer Oil Company
Fairfax, Minnesota

JPB	MDM	8-16-93	C-2373-B

TABLE 1
GROUNDWATER ELEVATION SUMMARY
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Groundwater Elevations (Site Datum)

Monitoring Well Number	12-6-91	1-21-92	6-3-93	6-17-93	7-15-93	8-4-93	8-17-93
MW1	91.98	91.41	93.30	93.65	92.84	92.63	92.60
MW2	92.87	93.51	94.00	96.00	93.03	94.57	94.49
MW3	93.31	92.45	94.41	96.61	94.86	94.61	94.40
MW4			92.92	93.91	92.53	92.50	92.52
MW5			93.25	93.95	93.16	93.20	92.78
MW6			92.33	94.04	92.22	92.21	92.22
MW7						93.58	93.14
MW8							75.61*
TCT Well (SE Well)					93.43	93.42	93.48

Note: Elevations referenced to concrete slab in doorway at northeast entrance to main building (cafe entrance).

*Water level is not yet stabilized.

TABLE 2
SLUG TEST DATA ANALYSIS RESULTS
DITTMER OII COMPANY
GME PROJECT NO. C-2373-B

Monitoring Well Number	Hydraulic Conductivity (ft/min) Slug In	Slug Out
MW1	0.0026	0.0436
MW2	0.0024	0.0801
MW3	0.0006	0.0005
Average	0.0019	0.0414

Total Average = 0.022 ft/min

Note: Average values calculated using the geometric mean.

TABLE 3
SOIL VAPOR RESULTS FROM ENVIRONMENTAL SOIL BORINGS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring No.	Depth (feet)	OVA Reading (ppm)
MW1	0 - 2	26
	2 - 4	42
	4 - 6	50
	6 - 8	320
	8 - 10	410
	10 - 12	215
MW2	0 - 2	5
	2 - 4	15
	4 - 6	24
	6 - 8	32
	8 - 10	41
	10 - 12	21
	12 - 14	75
MW3	0 - 2	6
	2 - 4	8
	4 - 6	3
	6 - 8	20
	8 - 10	42
	10 - 12	24
	12 - 14	20
	14 - 16	8
B1	0 - 2	0
	2 - 4	14
	4 - 6	46
	6 - 8	200
	8 - 10	415
	10 - 12	220
	12 - 14	110
B2	0 - 2	22
	2 - 4	34
	4 - 6	20
	6 - 8	120
	8 - 10	380
	10 - 12	10

TABLE 3 (CONTINUED)
SOIL VAPOR RESULTS FROM ENVIRONMENTAL SOIL BORINGS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring No.	Depth (feet)	OVA Reading (ppm)
B3	0 - 2	40
	2 - 4	65
	4 - 6	38
	6 - 8	34
	8 - 10	260
	10 - 12	220
	12 - 14	19
	14 - 16	11
	16 - 18	3
B4	0 - 2	3
	2 - 4	0
	4 - 6	5
	6 - 8	8
	8 - 10	460
	10 - 12	320
	12 - 14	42
	14 - 16	12
		HNU Reading (ppm)
MW4	4 - 6	0
	7 - 9	185
	9 - 11	175
	13 - 15	0
MW5	4 - 6	3
	9 - 11	25
	13 - 15	0
B5	4 - 6	0
	7 - 9	0
	9 - 11	0
B6	4 - 6	0
	7 - 9	0
	9 - 11	200
	13 - 15	0
MW6	4 - 6	0
	7 - 9	0
	9 - 11	0
	14 - 16	0

TABLE 3 (CONTINUED)
SOIL VAPOR RESULTS FROM ENVIRONMENTAL SOIL BORINGS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring No.	Depth (feet)	HNU Reading (ppm)
B7	4 - 6	2
	7 - 9	25
	9 - 11	4
	11 - 13	2.5
	13 - 15	1
B8	0 - 4 (AS)	0.5
	4 - 6	250
	9 - 11	4
	14 - 16	0.5
	19 - 21	1.2
	24 - 26	4.5
	29 - 31	0.5
B9	0 - 4 (AS)	0.5
	4 - 6	200
	6 - 8	200
	9 - 11	0.8
B10	0 - 4 (AS)	0.5
	4 - 6	0
	6 - 8	5
	9 - 11	0.5
B11	0 - 4 (AS)	0
	4 - 6	0
	6 - 8	0
	9 - 11	0
B12	0 - 4 (AS)	0
	4 - 6	0
	6 - 8	0
	9 - 11	0
B13	0 - 4 (AS)	0
	4 - 6	0
	6 - 8	0
	9 - 11	0

TABLE 3 (CONTINUED)
SOIL VAPOR RESULTS FROM ENVIRONMENTAL SOIL BORINGS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring No.	Depth (feet)	HNU Reading (ppm)
B14/MW7	0 - 4 (AS)	0.2
	4 - 6	0.2
	6 - 8	190
	9 - 11	130
	13 - 15	2.0
B15	0 - 4 (AS)	0
	4 - 6	0.2
	6 - 8	0.2
	9 - 11	170
	14 - 16	0.2
B16	0 - 4 (AS)	1.5
	4 - 6	8.5
	6 - 8	4.0
	9 - 11	0
B17	0 - 4 (AS)	0
	4 - 6	0
	6 - 8	0
	9 - 11	0
B18	0 - 4	30
	4 - 6	200
	6 - 8	250
	9 - 11	2.0
B19/MW8	13 - 15	0
	20 - 22	0
	24 - 26	0
	29 - 31	0
	31 - 33	0
	33 - 35	0
	35 - 37	0
	37 - 39	0

TABLE 3 (CONTINUED)
SOIL VAPOR RESULTS FROM ENVIRONMENTAL SOIL BORINGS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring No.	Depth (feet)	HNU Reading (ppm)
B20	0 - 4 (AS)	0
	4 - 6	0
	6 - 8	0
	9 - 11	0
B21	0 - 4 (AS)	50
	4 - 6	6.5
	9 - 11	150
	14 - 16	2.0
	19 - 21	2.5
	24 - 26	2.0
	26 - 28	2.0
	28 - 30	6.0

OVA = organic vapor analyzer
HNU = HNU Model PI-101 photoionization detector
ppm = parts per million
AS = auger sample

TABLE 4
SOIL CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring & Sample	~~#OVA~~ PID	Depth (feet)	MDL	Parameter Analyzed	Concentration (ppm)
B1 (S-5)	415	8-10	1.6	TPHCs as Gasoline	210
			1.4	TPHCs as Fuel Oil	8.8
			0.059	Benzene	3.2
			0.063	Toluene	7.4
			0.041	Ethylbenzene	4.1
			0.18	Total Xylenes	19
			5	Lead	8
B1 (S-6)	220	10-12	1.6	TPHCs as Gasoline	3.3
			1.4	TPHCs as Fuel Oil	7.2
			0.059	Benzene	0.072
			0.063	Toluene	0.23
			0.041	Ethylbenzene	0.077
			0.18	Total Xylenes	0.38
B2 (S-5)	380	8-10	1.6	TPHCs as Gasoline	160
			1.4	TPHCs as Fuel Oil	130
			0.059	Benzene	1.9
			0.063	Toluene	1.5
			0.041	Ethylbenzene	0.80
			0.18	Total Xylenes	10
			5	Lead	6
B2 (S-6)	10	10-12	1.4	TPHCs as Fuel Oil	24
			5	Lead	8
B3 (S-5)	260	8-10	1.6	TPHCs as Gasoline	140
			1.4	TPHCs as Fuel Oil	100
			0.059	Benzene	1.0
			0.041	Ethylbenzene	2.4
			0.18	Total Xylenes	4.6
			4	Lead	9
B3 (S-6)	220	10-12	1.6	TPHCs as Gasoline	5.2
			1.4	TPHCs as Fuel Oil	3.9
			0.041	Ethylbenzene	0.066
			5	Lead	11

TABLE 4 (CONTINUED)
SOIL CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring & Sample # OVA/PID	Depth (feet)	MDL	Parameter Analyzed	Concentration (ppm)
B3 (S-7) 19	12-14	5	Lead	6
B4 (S-5) 460	8-10	1.6	TPHCs as Gasoline	150
		1.4	TPHCs as Fuel Oil	48
		0.059	Benzene	2.2
		0.063	Toluene	2.4
		0.041	Ethylbenzene	1.5
		0.18	Total Xylenes	4.6
		5	Lead	7
B4 (S-6) 320	10-12	1.6	TPHCs as Gasoline	72
		1.4	TPHCs as Fuel Oil	360
		0.059	Benzene	0.84
		0.041	Ethylbenzene	0.81
		0.18	Total Xylenes	2.5
		5	Lead	13
MW1 (S-6) 215	10-12	1.6	TPHCs as Gasoline	40
		1.4	TPHCs as Fuel Oil	38
		0.041	Ethylbenzene	0.32
		0.18	Total Xylenes	2.8
		5	Lead	9
MW2 (S-5) 21	8-10	1.4	TPHCs as Fuel Oil	2.1
		5	Lead	8
MW3 (S-7) 20	12-14	5	Lead	7
MW4 (SS2) 185	7-9	5.0	Gasoline Range Organics	109
		0.05	Benzene	*
		0.05	Toluene	1.62
		0.05	Ethylbenzene	0.69
		0.150	Total Xylenes	2.59
		0.05	MTBE	3.68
		NL	Lead	8.58

TABLE 4 (CONTINUED)
SOIL CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring & Sample #	PID	Depth (feet)	MDL	Parameter Analyzed	Concentration (ppm)
MW5 (SS2)	25	9-11	NL	Lead	8.85
MW6 (SS2)	0	7-9	NL	Lead	11
B5 (SS3)	0	9-11	5.0	Gasoline Range Organics	10.0
			0.05	Benzene	0.315
			0.05	Toluene	0.479
			0.05	Ethylbenzene	0.615
			0.150	Total Xylenes	1.82
			0.05	MTBE	0.631
			NL	Lead	7.95
B6 (SS3)	200	9-11	5.0	Gasoline Range Organics	55.3
			0.05	Benzene	0.265
			0.05	Toluene	0.546
			0.05	Ethylbenzene	1.01
			0.150	Total Xylenes	3.45
			0.05	MTBE	0.20
			NL	Lead	8.41
B7 (SS2)	25	7-9	NL	Lead	18.6
B8 (SS2)	250	4-6	1.0	Gasoline Range Organics	44.3
			5.0	Diesel Range Organics	8.2
			0.05	Benzene	0.478
			0.05	Toluene	0.411
			0.05	Ethylbenzene	0.719
			0.150	Total Xylenes	2.26
			0.05	MTBE	2.85
			**	Lead	**

TABLE 4 (CONTINUED)
SOIL CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring & Sample # PID	Depth (feet)	MDL	Parameter Analyzed	Concentration (ppm)
B8 (SS6) 4.5	24-26	1.0	Gasoline Range Organics	1.8
		0.05	Toluene	0.058
		**	Lead	**
B9 (SS2) ~~>200~~	4-6	1.0	Gasoline Range Organics	70.6
		0.05	Benzene	0.406
		0.05	Toluene	0.439
		0.05	Ethylbenzene	1.29
		0.150	Total Xylenes	2.34
		0.05	MTBE	7.0
		**	Lead	**
B10 (SS3) 5	6-8	1.0	Gasoline Range Organics	16.5
		0.05	Toluene	0.312
		0.05	Ethylbenzene	0.076
		0.150	Total Xylenes	0.563
		0.05	MTBE	1.03
		**	Lead	**
B11 (SS3) 0	6-8	**	Lead	**
B13 0	6-8	**	Lead	**
B15 (SS4) 170	9-11	1.0	Gasoline Range Organics	102
		5.0	Diesel Range Organics	5.3
		0.05	Toluene	1.10
		0.05	Ethylbenzene	0.502
		0.150	Total Xylenes	3.40
		0.05	MTBE	10.5
		**	Lead	**

TABLE 4 (CONTINUED)
SOIL CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring & Sample #	PID	Depth (feet)	MDL	Parameter Analyzed	Concentration (ppm)
B16 (SS2)	8.5	4-6	**	Lead	**
B17 (SS3)	0	6-8	**	Lead	**
B18 (SS3)	250	6-8	1.0	Gasoline Range Organics	129
			5.0	Diesel Range Organics	6.7
			0.05	Benzene	3.6
			0.05	Toluene	5.0
			0.05	Ethylbenzene	3.1
			0.150	Total Xylenes	8.3
			**	Lead	**
B19/MW8 (SS3)	0	20-22	0.05	Benzene	0.213
			0.05	Toluene	0.592
			0.05	Ethylbenzene	0.111
			0.150	Total Xylenes	0.516
			**	Lead	**
B19/MW8 (SS8)	0	37-39	0.05	Benzene	0.115
			0.05	Toluene	0.438
			0.150	Total Xylenes	0.210
			**	Lead	**
B20 (SS3)	0	6-8	**	Lead	**
B21 (SS3)	150	11	1.0	Gasoline Range Organics	348
			5.0	Diesel Range Organics	34.1
			0.05	Benzene	1.2
			0.05	Toluene	4.02
			0.05	Ethylbenzene	2.09
			0.150	Total Xylenes	5.88
			0.05	MTBE	14.2
			**	Lead	**

TABLE 4 (CONTINUED)
SOIL CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Boring & Sample #		Depth (feet)	MDL	Parameter Analyzed	Concentration (ppm)
B21 (SS7)	2	26-28	**	Lead	**
B21 (SS8)	6	28-30	1.0	Gasoline Range Organics	1.0
			**	Lead	**

Notes: MDL = method detection limit
TPHCs = total petroleum hydrocarbons
All results given in parts per million (ppm).
Results for analyzed parameters not detected above the MDLs are not included in this table.
NL = not listed
* = Masked
** = Results not received as of August 18, 1993

TABLE 5
GROUNDWATER CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Well #	Parameter Analyzed	Sampling Date 12-6-92 (Concentrations in parts per billion)	12-21-92	6-3-93	6-17-93	8-3,4,5-93
MW1	Gasoline Range Organics	29000*	27000*	ND	ND	ND
	Diesel Range Organics	20000**	8500**	ND	ND	ND
	Benzene	7300	6700	ND	ND	ND
	Toluene	3700	1700	ND	ND	ND
	Ethylbenzene	ND	120	ND	ND	ND
	Total Xylenes	3000	2500	ND	ND	ND
	MTBE	ND	68	ND	7.8	12.0
	Dissolved Lead	ND	ND	3	4	2.9
MW2	Gasoline Range Organics	ND*	ND*	35100	55400	41100
	Diesel Range Organics	ND**	ND**	6600	4900	2100
	Benzene	ND	ND	11300	7890	1390
	Toluene	ND	ND	6930	6180	1040
	Ethylbenzene	ND	ND	363	473	386
	Total Xylenes	ND	ND	2830	3950	1540
	MTBE	25	26	2620	21.6	794
	Dissolved Lead	ND	ND	3	8	4.5
MW3	Gasoline Range Organics	ND*	ND*	ND	ND	ND
	Diesel Range Organics	ND**	ND**	ND	ND	ND
	Benzene	ND	ND	1.8	ND	ND
	Toluene	ND	ND	ND	ND	ND
	Ethylbenzene	ND	ND	ND	ND	ND
	Total Xylenes	ND	ND	ND	ND	ND
	MTBE	8.2	8.6	ND	10.3	6.2
	Dissolved Lead	ND	ND	4	5	1.5

TABLE 5 (CONTINUED)
GROUNDWATER CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Well#	Parameter Analyzed	Sampling Date 12-6-92	12-21-92	6-3-93	6-17-93	8-3,4,5-93
		(Concentrations in parts per billion)				
MW4	Gasoline Range Organics		11900		700	16000
	Diesel Range Organics		1100		1800	1300
	Benzene		99.6		37.8	78.3
	Toluene		182		29.2	150.2
	Ethylbenzene		37.1		8.2	31.8
	Total Xylenes		309		154	425
	MTBE		5.3		5.9	1281
	Dissolved Lead		7		4	3.2
MW5	Gasoline Range Organics		400		500	500
	Diesel Range Organics		ND		ND	ND
	Benzene		8.9		9.7	16.6
	Toluene		2.9		4.8	3.7
	Ethylbenzene		3.0		ND	1.6
	Total Xylenes		9.4		ND	5.9
	MTBE		33.5		5.3	88.7
	Dissolved Lead		2		3	ND
MW6	Gasoline Range Organics		ND		ND	ND
	Diesel Range Organics		ND		ND	ND
	Benzene		1.5		ND	ND
	Toluene		ND		ND	ND
	Ethylbenzene		ND		ND	ND
	Total Xylenes		ND		ND	ND
	MTBE		ND		1.2	ND
	Dissolved Lead		2		4	0.0010

TABLE 5 (CONTINUED)
GROUNDWATER CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Well #	Parameter Analyzed	Sampling Date 12-6-92	12-21-92	6-3-93	6-17-93	8-2,3,4-93
		(Concentrations in parts per billion)				
MW7	Gasoline Range Organics					28900
	Diesel Range Organics					2300
	Benzene					74.9
	Toluene					62.2
	Ethylbenzene					556
	Total Xylenes					608
	MTBE					4770
	Dissolved Lead					2.4
MW8	Gasoline Range Organics					ND
	Diesel Range Organics					ND
	Benzene					2.9
	Toluene					2.8
	Ethylbenzene					ND
	Total Xylenes					ND
	MTBE					9.4
	Dissolved Lead					7
B12-WS (Temp. Well)	Gasoline Range Organics					ND
	Diesel Range Organics					ND
	Benzene					ND
	Toluene					ND
	Ethylbenzene					ND
	Total Xylenes					ND
	MTBE					ND
	Dissolved Lead					ND

TABLE 5 (CONTINUED)
GROUNDWATER CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Well #	Parameter Analyzed	Sampling Date 12-6-92	12-21-92	6-3-93	6-17-93	8-2,3,4-93
		(Concentrations in parts per billion)				
SE-WS (TCT Well)	Gasoline Range Organics					1200
	Diesel Range Organics					2700
	Benzene					ND
	Toluene					5.5
	Ethylbenzene					ND
	Total Xylenes					5.4
	MTBE					ND
	Dissolved Lead					2.3
Elevator-WS (Co-op Well)	Gasoline Range Organics					ND
	Diesel Range Organics					ND
	Benzene					ND
	Toluene					ND
	Ethylbenzene					ND
	Total Xylenes					ND
	MTBE					ND
	Dissolved Lead					7.2

TABLE 5 (CONTINUED)
GROUNDWATER CHEMISTRY RESULTS
DITTMER OIL COMPANY
GME PROJECT NO. C-2373-B

Well #	Parameter Analyzed	Sampling Date 5-20-93 (Concentrations in parts per billion)
B7-WS (Temp. Well)	Gasoline Range Organics	960
	Diesel Range Organics	ND
	Benzene	***
	Toluene	19.0
	Ethylbenzene	5.83
	Total Xylenes	18.6
	MTBE	155
	Dissolved Lead	2

Definitions:

MTBE = methyl tertiary butyl ether
ND = no detections
*** = Total Petroleum Hydrocarbons as Gasoline**
**** = Total Petroleum Hydrocarbons as Fuel Oil**
***** = masked**

LOG OF BORING MW1

PROJECT	SITE
Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 97.14'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1SS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - moist	26	7
	2SS				42	7
5	3SS				50	6
	4SS	▼			320	7
	5SS				410	10
10	6SS		12		215	12
15				End of boring at 12 feet. 8.25 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample DOMW1-S6 (10 - 12 feet) submitted for laboratory analysis. Installed monitoring well MW1.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
-O-
1 2 3 4 5
WATER CONTENT %
-●-
STANDARD PENETRATION (BLOWS/FOOT)
-⊗-
10 20 30 40 50

WATER LEVEL OBSERVATIONS

W.L. ▼ 8' while drilling
W.L.
W.L.

GME CONSULTANTS, INC.
Geotechnical • Materials • Environmental
14000 21st Avenue No.
Minneapolis, MN 55447
Office (612) 559-1859

BORING STARTED 10-17-91
BORING COMPLETED 10-17-91
RIG CME 55 DRILLER KJB
DRAWN JPB APPROVED MDM
PROJECT #C-2373-A SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING MW2

PROJECT	SITE
Remeidal Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
				SURFACE ELEVATION → 97.14'		
	1SS			Light gray to light brown silty clay (CL)- trace to little sand - many mottled fractures (primarily vertical) - soft - moist	5	7
	2SS				15	8
5	3SS		6		24	9
	4SS	▼		Brown to dark brown silty clay (CL)- little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) -soft to medium firm - very moist to wet	32	7
	5SS				41	9
10	6SS				21	8
	7SS		14		75	11
15				End of boring at 14 feet. 8.25 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample DOMW2-S5 (8 - 10 feet) submitted for laboratory analysis. Installed monitoring well MW2.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} -O- (1 2 3 4 5)
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- (10 20 30 40 50)

WATER LEVEL OBSERVATIONS

W.L. ▼ 8' while drilling
W.L.
W.L.

GME CONSULTANTS, INC.
Geotechnical • Materials • Environmental
14000 21st Avenue No.
Minneapolis, MN 55447
Office (612) 559-1859

BORING STARTED	10-17-91
BORING COMPLETED	10-17-91
RIG CME 55	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT #C-2373-A	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING MW3

PROJECT	SITE
Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION: 100.24'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1SS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - moist	6	5
	2SS				8	10
5	3SS				3	8
	4SS				20	8
	5SS	▼			42	12
10			10			
	6SS			Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) -medium firm - wet	24	15
	7SS				20	19
15	8SS				8	23
			16			
				End of boring at 16 feet. 8.25 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample DOMW3-S7 (12-14 feet) submitted for laboratory analysis. Installed monitoring well MW3.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} -O- (1 2 3 4 5)
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- (10 20 30 40 50)

WATER LEVEL OBSERVATIONS
W.L. ▼ 10' while drilling
W.L.
W.L.

GME CONSULTANTS, INC.
Geotechnical • Materials • Environmental
14000 21st Avenue No.
Minneapolis, MN 55447
Office (612) 559-1859

BORING STARTED	10-17-91
BORING COMPLETED	10-17-91
RIG CME 55	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT #C-2373-A	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B1

PROJECT: Remedial Investigation

SITE: Dittmer Oil Company, Fairfax, MN

CLIENT: Dittmer Oil Company

ARCHITECT-ENGINEER:

SURFACE ELEVATION: 99.04'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1SS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - moist	0	8
	2SS				14	8
5	3SS				46	8
	4SS	▼			200	8
	5SS				415	11
10			10			
	6SS			Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal)	220	18
	7SS				110	20
			14			
15				End of boring at 14 feet. 8.25 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample DOB1-S5 (8 - 10 feet) and DOB1-S6 (10 - 12 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5
WATER CONTENT %
STANDARD PENETRATION (BLOWS/FOOT)
10 20 30 40 50

WATER LEVEL OBSERVATIONS

W.L. ▼ 8' while drilling

W.L.

W.L.

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BORING STARTED 10-17-91
BORING COMPLETED 10-17-91
RIG CME 55 DRILLER KJB
DRAWN JPB APPROVED MDM
PROJECT# 2373-A SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B2

PROJECT: Remedial Investigation	SITE: Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER:

SURFACE ELEVATION: 98.16'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1SS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - moist	22	9
	2SS				34	6
5	3SS				20	7
	4SS	▼			120	7
			8			
	5SS			Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - medium firm - very moist to wet	380	11
10	6SS				10	23
			12			
15				End of boring at 12 feet. 8.25 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample DOB2-S5 (8-10 feet) and DOB2-S6 (10-12 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} — 1 2 3 4 5

WATER CONTENT %

STANDARD PENETRATION (BLOWS/FOOT) — 10 20 30 40 50

WATER LEVEL OBSERVATIONS

W.L. ▼ 10' while drilling

W.L. 7' after boring

W.L.

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BORING STARTED	10-17-91
BORING COMPLETED	10-17-91
RIG CME 55	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT E-2373-A	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B3

PROJECT	SITE
Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 97.65'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1SS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - moist - isolated sand seam	40	12
	2SS				65	8
5	3SS				38	6
	4SS	▼			34	6
	5SS		9	Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - soft to medium firm - very moist to wet - isolated sand seam	260	9
10	6SS				220	14
	7SS				19	8
15	8SS		16		11	11
	9SS			Dark gray silty clay (CL) - trace to little fine to coarse sand - trace gravel - no fractures - stiff - moist	3	21
20				End of boring at 18 feet. 8.25 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Samples DOB3-S5 (8-10 feet) and DOB3-S7 (12-14 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} — 1 2 3 4 5

WATER CONTENT %

STANDARD PENETRATION (BLOWS/FOOT) — 10 20 30 40 50

WATER LEVEL OBSERVATIONS

W.L. ▼ 8' while drilling

W.L.

W.L.

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BORING STARTED 10-17-91
BORING COMPLETED 10-17-91
RIG CME 55 DRILLER KJB
DRAWN JPB APPROVED MDM
PROJECT #-2373-A SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B4

PROJECT	SITE
Remedial Investigation	Dittmer Oil Company
CLIENT	**ARCHITECT-ENGINEER**
Dittmer Oil Company	

SURFACE ELEVATION 98.18'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1SS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - moist	3	7
	2SS				0	7
5	3SS				5	5
	4SS		8		8	10
	5SS	▼		Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - soft to medium - very moist to wet	460	7
10	6SS				320	8
	7SS				42	9
15	8SS		16		12	13
				End of boring at 16 feet. 8.25 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Samples DOB4-S5 (8-10 feet) and DOB4-S6 (10-12 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
-O-
1 2 3 4 5
WATER CONTENT %
-●-
STANDARD PENETRATION (BLOWS/FOOT)
-⊗-
10 20 30 40 50

WATER LEVEL OBSERVATIONS

W.L. ▼ 9' while drilling
W.L.
W.L.

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BORING STARTED	10-17-91
BORING COMPLETED	10-17-91
RIG CME 55	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT #C-2373-A	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING MW4

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 96.32'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
				Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist to wet		
5	1SS				0	5
		▼				
	2SS				185	7
10	3SS				175	7
			13			
	4SS			Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - medium firm - wet	0	12
15			15			
				End of boring at 15 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample MW4-SS2 (7 - 9 feet) submitted for laboratory analysis. Installed monitoring well MW4.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
-O-
1 2 3 4 5
WATER CONTENT %
-●-
STANDARD PENETRATION (BLOWS/FOOT)
-⊗-
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 8' while sampling
W.L.
W.L.

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BORING STARTED	5-19-93
BORING COMPLETED	5-19-93
RIG CME 750	DRILLER KJS
DRAWN JPB	APPROVED MDM
PROJECT €-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING MW5

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 97.96'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
				Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist to wet		
5	1SS	▼			3	6
			9			
10	2SS			Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - soft to medium firm - wet	25	6
	3SS				0	9
15			15	End of boring at 15 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample MW5-SS2 (9 - 11 feet) submitted for laboratory analysis. Installed monitoring well MW5.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5
WATER CONTENT %
STANDARD PENETRATION (BLOWS/FOOT)
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 7.5' while sampling
W.L.
W.L.

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BORING STARTED 5-19-93
BORING COMPLETED 5-20-93
RIG CME 750 DRILLER KJS
DRAWN JPB APPROVED MDM
PROJECT #C-2373-B SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B5

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 97.68'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
5	1SS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist to wet	0	4
	2SS	▼	9		0	6
10	3SS		11	Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - soft - wet	0	7
15				End of boring at 11 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B5-SS3 (9-11 feet) submitted for laboratory analysis. Backfilled boring with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
-O-
1 2 3 4 5
WATER CONTENT %
-●-
STANDARD PENETRATION (BLOWS/FOOT)
-⊗-
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 8.5' while sampling
W.L.
W.L.

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BORING STARTED 5-19-93
BORING COMPLETED 5-20-93
RIG CME 750 DRILLER KJS
DRAWN JPB APPROVED MDM
PROJECT #C-2373-B SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B6

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 96.74'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
				Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist to wet		
5	1SS				0	3
	2SS	▼			0	5
10	3SS				200	4
			13			
	4SS			Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - medium firm - wet	0	12
15			15			
				End of boring at 15 feet.		
				8 inch O.D. hollow stem auger used full depth.		
				HNU measurements in parts per million (ppm).		
				Soil Sample B6-SS3 (9 - 11 feet) submitted for laboratory analysis.		
				Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5
WATER CONTENT %
STANDARD PENETRATION (BLOWS/FOOT)
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 9' while sampling
W.L.
W.L.

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BORING STARTED 5-20-93
BORING COMPLETED 5-20-93
RIG CME 750 DRILLER KJS
DRAWN JPB APPROVED MDM
PROJECT E-2373-B SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING MW6

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
				SURFACE ELEVATION 97.12'		
				Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist to wet		
5	1SS				0	5
	2SS	▼			0	7
10	3SS				0	8
			14	Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) -soft - wet		
15	4SS		16		0	7
				End of boring at 16 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample MW6-SS2 (7 - 9 feet) submitted for laboratory analysis. Installed monitoring well MW6.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
-O-
1 2 3 4 5
WATER CONTENT %
-●-
STANDARD PENETRATION (BLOWS/FOOT)
-⊗-
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 8' while sampling
W.L.
W.L.

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BORING STARTED	5-20-93
BORING COMPLETED	5-20-93
RIG CME 750	DRILLER KJS
DRAWN JPB	APPROVED MDM
PROJECT C-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B7

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION: 95.17'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
				Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist to wet		
5	1SS	▼			2.0	5
	2SS				25.0	4
10	3SS				4.0	5
	4SS		11	Brown to dark brown silty clay (CL)- little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal)- soft to medium firm - wet	2.5	6
	5SS				1.0	13
15			15	End of boring at 15 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B7-SS2 (7 - 9 feet) submitted for laboratory analysis. Water Sample B7-WS submitted for laboratory analysis. Installed temporary monitoring well B7. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5
WATER CONTENT %
STANDARD PENETRATION (BLOWS/FOOT)
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 7' while sampling
W.L.
W.L.

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BORING STARTED 5-20-93
BORING COMPLETED 5-20-93
RIG CME 750 DRILLER KJS
DRAWN JPB APPROVED MDM
PROJECT C-2373-B SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B8

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT	**ARCHITECT-ENGINEER**
Dittmer Oil Company	

SURFACE ELEVATION 96.77'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	SPECIAL TEST RESULTS HNU (ppm)	N-VALUE (BLOWS/FT.)
	1AS	▼		Light gray to light brown silty clay (CL) - trace to litte sand - many mottled fractures (primarily vertical) - soft - very moist - petroleum odor at 4-6 feet	0.5	
5	2SS				250	6
			9			
10	3SS			Brown to dark brown silty clay (CL)- little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal)- medium firm - wet	4.0	10
			14			
15	4SS			Dark gray silty clay (CL) - trace to little fine to coarse sand - trace gravel - no fractures - soft to med. - very moist - several 1/16" gray fine to medium grained sand seams at 19-21 feet	0.5	8
20	5SS				1.2	19
			24			
25	6SS			Gray fine to medium sand (SP) - trace silt and trace clay - medium dense - wet	4.5	24
			29			
30	7SS			Gray silty very fine sand (SM)-trace clay - medium dense - wet	0.5	28
			31			

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} -○- 1 2 3 4 5
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 4' while sampling
W.L.
W.L.

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BORING STARTED 8-2-93
BORING COMPLETED 8-2-93
RIG CME 550 DRILLER KJB
DRAWN JPB APPROVED MDM
PROJECT E-2373-B SHEET 1 of 2

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B8

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} / WATER CONTENT % / STANDARD PENETRATION (BLOWS/FOOT)
				SURFACE ELEVATION 96.77'			1 2 3 4 5 / 10 20 30 40 50
				End of boring at 31 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Samples B8-SS2 (4-6 feet) and B8-SS6 (24-26 feet) submitted for laboratory analysis. Boring backfilled with cement grout. Shelby tube ST-1 (6-8 feet) and ST-2 (11 - 13 feet) collected for falling head permeability tests.			

WATER LEVEL OBSERVATIONS

W.L. ▼ 4' while sampling

W.L.

W.L.

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BORING STARTED	8-2-93
BORING COMPLETED	8-2-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT #C-2373-B	SHEET 2 of 2

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B9

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 95.20'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS	▼		Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist -	0.5	
5	2SS			some 1/16" fine sand seams - petroleum odor at 4 - 8 feet	200	7
	3SS				200	7
			9			
10	4SS		11	Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - medium firm - wet	0.8	12
15				End of boring at 11 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B9-SS2 (4-6 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} -O- (1 2 3 4 5)
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- (10 20 30 40 50)

WATER LEVEL OBSERVATIONS
W.L. ▼ 4' while sampling
W.L.
W.L.

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14000 21st Avenue No.
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Office (612) 559-1859

BORING STARTED	8-2-93
BORING COMPLETED	8-2-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MBM
PROJECT #C-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B10

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 97.07'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist - trace petroleum odor at 6 - 8 feet	0.5	
5	2SS	▼			0.0	7
	3SS				5.0	8
10	4SS				0.5	10
			11	End of boring at 11 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B10-SS3 (6-8 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		
15						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} -O- 1 2 3 4 5

WATER CONTENT % -●-

STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50

WATER LEVEL OBSERVATIONS

W.L. ▼ 6' while sampling

W.L.

W.L.

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Office (612) 559-1859

BORING STARTED 8-2-93
BORING COMPLETED 8-2-93
RIG CME 550 DRILLER KJB
DRAWN JPB APPROVED MDM
PROJECT C-2373-B SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B11

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION: 96.00'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft to medium - very moist to wet - 1" sand seams at 5.5 feet and 7 feet	0	
5	2SS	▼			0	8
	3SS				0	10
			9			
10	4SS		11	Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) -medium firm - wet - several very thin (1/16") sand seams	0	10
15				End of boring at 11 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B11-SS3 (6-8 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5
WATER CONTENT %
STANDARD PENETRATION (BLOWS/FOOT)
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 6' while sampling
W.L.
W.L.

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BORING STARTED	8-2-93
BORING COMPLETED	8-2-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT C-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B12

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT	**ARCHITECT-ENGINEER**
Dittmer Oil Company	

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
				SURFACE ELEVATION 95.38'		
	1AS	▼		Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist	0	
5	2SS				0	5
	3SS				0	5
			9			
10	4SS		11	Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - medium firm - wet	0	12
15				End of boring at 11 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Water Sample B12-WS submitted for laboratory analysis. Temporary monitoring well B12 installed. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
-O-
1 2 3 4 5
WATER CONTENT %
-●-
STANDARD PENETRATION (BLOWS/FOOT)
-⊗-
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 3' after boring
W.L.
W.L.

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BORING STARTED	8-2-93
BORING COMPLETED	8-2-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT #-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B13

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 94.81'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist	0	
5	2SS	▼			0	9
	3SS				0	8
			9			
10	4SS		11	Brown to dark brown silty clay (CL)- little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal)- medium dense - wet	0	10
15				End of boring at 11 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B13-SS3 (6-8 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} — 1 2 3 4 5
WATER CONTENT %
STANDARD PENETRATION (BLOWS/FOOT) — 10 20 30 40 50

WATER LEVEL OBSERVATIONS

W.L. ▼ 5' while sampling
W.L.
W.L.

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BORING STARTED	8-2-93
BORING COMPLETED	8-2-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT C-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B14/MW7

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 96.90'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS	▼		Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist - petroleum odor at 6-8 feet	0.2	
5	2SS				0.2	5
	3SS				190	7
			9			
10	4SS			Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - soft to medium dense - wet - petroleum odor at 9-11 feet	130	7
15	5SS				2.0	15
			16			
				End of boring at 16 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Grain size analysis samples collected at 4-8 feet and 13-15 feet. Installed monitoring well MW7.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} — 1 2 3 4 5
WATER CONTENT %
STANDARD PENETRATION (BLOWS/FOOT) — 10 20 30 40 50

WATER LEVEL OBSERVATIONS

W.L. ▼ 6.5' while sampling
W.L. 3.5' after boring
W.L.

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BORING STARTED	8-3-93
BORING COMPLETED	8-3-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT C-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B15

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 96.65'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft to medium firm - very moist	0	
5	2SS	▼			0.2	7
	3SS				0.2	10
			9			
10	4SS			Brown to dark brown silty clay (CL)) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - soft to medium firm - wet - petroleum odor at 9-11 feet	170	7
15	5SS				0.2	19
			16			
				End of boring at 16 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B15-SS4 (9-11 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
-O-
1 2 3 4 5
WATER CONTENT %
-●-
STANDARD PENETRATION (BLOWS/FOOT)
-⊗-
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 6' while sampling
W.L.
W.L.

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BORING STARTED	8-3-93
BORING COMPLETED	8-3-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT #-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B16

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 95.60'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	SPECIAL TEST RESULTS HNU (ppm)	N-VALUE (BLOWS/FT.)
	1AS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist - trace petroleum odor at 4-6 feet	1.5	
5	2SS	▼			8.5	5
	3SS				4.0	6
			9			
10	4SS		11	Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - medium firm - wet	0	10
15				End of boring at 11 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B16-SS2 (4-6 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} -O- (1 2 3 4 5)
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- (10 20 30 40 50)

WATER LEVEL OBSERVATIONS
W.L. ▼ 5' while sampling
W.L.
W.L.

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BORING STARTED	8-3-93
BORING COMPLETED	8-3-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT #C-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B17

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION: 96.34'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS	▼		Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft to medium firm - very moist	0	
5	2SS				0	4
	3SS				0	10
			9			
10	4SS		11	Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - medium firm - wet	0	13
15				End of boring at 11 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B17-SS3 (6-8 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} -O- 1 2 3 4 5
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼4.5' while sampling
W.L.
W.L.

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BORING STARTED	8-3-93
BORING COMPLETED	8-3-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT #E-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B18

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 97.49'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist - some petroleum odor at 0-4 feet - strong petroleum odor at 4-8 feet	30	
5	2SS	▼			200+	7
	3SS				250	9
			9			
10	4SS			Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - medium firm - wet	2.0	11
			11			
15				End of boring at 11 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B18-SS3 (6-8 feet) submitted for laboratory analysis. Boring backfilled with cement grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5
WATER CONTENT %
STANDARD PENETRATION (BLOWS/FOOT)
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 5' while sampling
W.L.
W.L.

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BORING STARTED	8-3-93
BORING COMPLETED	8-3-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT C-2373-B	SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B19/MW8

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT	ARCHITECT-ENGINEER
Dittmer Oil Company	

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
				SURFACE ELEVATION 96.66'		
5		▼		Dark gray silty clay (CL) - trace to little fine to coarse sand - trace gravel - no fractures - soft - very moist to wet (based on boring MW4		
10						
			13			
15	1SS			Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) -medium firm - wet	0	12
20			20			
	2SS			Dark gray silty clay (CL) - trace to little fine to coarse sand - trace gravel - no fractures - very stiff - moist	0	22
25	3SS				0	23
30	4SS				0	23

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
-O-
1 2 3 4 5
WATER CONTENT %
-●-
STANDARD PENETRATION (BLOWS/FOOT)
-⊗-
10 20 30 40 50

WATER LEVEL OBSERVATIONS

W.L. ▼ 5' while sampling
W.L.
W.L.

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BORING STARTED 8-4-93
BORING COMPLETED 8-4-93
RIG CME 550 DRILLER KJB
DRAWN JPB APPROVED MDM
PROJECT #C-2373-B SHEET 1 of 2

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B19/MW8

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
				SURFACE ELEVATION 96.66'		
30	4SS			Dark gray silty clay (CL) - trace to little fine to coarse sand - trace gravel - no fractures - stiff - moist		
	5SS				0	11
	6SS				0	13
35	7SS				0	27
	8SS				0	18
40			40	End of boring at 40 feet. Drilled with double casing: 8 inch I.D. hollow stem auger advanced to 20 feet; 8 inch O.D. hollow stem auger advanced to 40 feet. HNU measurements in parts per million (ppm). Soil Sample B19-SS3 (20-22 feet) and B19-SS8 (37-39 feet) submitted for laboratory analysis. Grain size analysis sample collected at 33-39 feet. Installed monitoring well MW8.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
-O-
1 2 3 4 5
WATER CONTENT %
-●-
STANDARD PENETRATION (BLOWS/FOOT)
-⊗-
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 5' while sampling
W.L.
W.L.

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BORING STARTED 8-4-93
BORING COMPLETED 8-4-93
RIG CME 550 DRILLER KJB
DRAWN JPB APPROVED MDM
PROJECT #C-2373-B SHEET 2 of 2

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B20

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT: Dittmer Oil Company	ARCHITECT-ENGINEER

SURFACE ELEVATION 97.07'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft to medium firm - very moist		
5	2SS	▼			0	7
	3SS				0	12
			9			
10	4SS		11	Brown to dark brown silty clay (CL)- little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal)- medium firm - wet	0	10
15				End of boring at 11 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in part per million (ppm). Soil Sample B20-SS3 (6-8 feet) submitted for laboratory analysis. Boring backfilled with cemet grout.		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
-O-
1 2 3 4 5
WATER CONTENT %
-●-
STANDARD PENETRATION (BLOWS/FOOT)
-⊗-
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 6' while sampling
W.L.
W.L.

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BORING STARTED 8-4-93
BORING COMPLETED 8-4-93
RIG CME 550 DRILLER KJB
DRAWN JPB APPROVED MDM
PROJECT #2373-B SHEET 1 of 1

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B21

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT Dittmer Oil Company	**ARCHITECT-ENGINEER**

SURFACE ELEVATION 97.55'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS			Light gray to light brown silty clay (CL) - trace to little sand - many mottled fractures (primarily vertical) - soft - very moist - petroleum odor in auger cuttings at approximately 7-9 feet	50	
5	2SS	▼			6.5	9
			9			
10	3ST			Brown to dark brown silty clay (CL) - little fine to coarse sand - trace gravel - some reddish brown mottled fractures (vertical and horizontal) - medium firm - wet - 1/10" sand seam at 15 feet	150+	
15	4SS				2.0	11
20	5SS				2.5	19
			24			
25	6SS			Dark gray silty clay (CL) - trace to little fine to coarse sand - trace gravel - no fractures - stiff to very stiff - moist - 2" sand seam at 29 feet	2.0	17
	7SS				2.0	35
	8SS				6.0	21
30			30			

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5
WATER CONTENT %
STANDARD PENETRATION (BLOWS/FOOT)
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. ▼ 6' while sampling
W.L.
W.L.

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BORING STARTED 8-5-93
BORING COMPLETED 8-5-93
RIG CME 550 DRILLER KJB
DRAWN JPB APPROVED MDM
PROJECT #C-2373-B SHEET 1 of 2

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING B21

PROJECT	SITE
Supplemental Remedial Investigation	Dittmer Oil Company, Fairfax, MN
CLIENT	ARCHITECT-ENGINEER
Dittmer Oil Company	

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	HNU (ppm) SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} / WATER CONTENT % / STANDARD PENETRATION (BLOWS/FOOT)
				SURFACE ELEVATION 97.55'			
				End of boring at 30 feet. 8 inch O.D. hollow stem auger used full depth. HNU measurements in parts per million (ppm). Soil Sample B21-SS3 (from tip of Shelby Tube at 11 feet), B21-SS7 (26-28 feet) and B21-SS8 (28-30 feet) submitted for laboratory analysis. Shelby Tube ST-3 (9-11 feet) collected for falling head permeability test. Boring backfilled with cement grout.			

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}: -O- (1 2 3 4 5)
WATER CONTENT %: -●-
STANDARD PENETRATION (BLOWS/FOOT): -⊗- (10 20 30 40 50)

WATER LEVEL OBSERVATIONS

W.L. ▼ 6' while sampling
W.L.
W.L.

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BORING STARTED	8-5-93
BORING COMPLETED	8-5-93
RIG CME 550	DRILLER KJB
DRAWN JPB	APPROVED MDM
PROJECT #C2373-B	SHEET 2 of 2

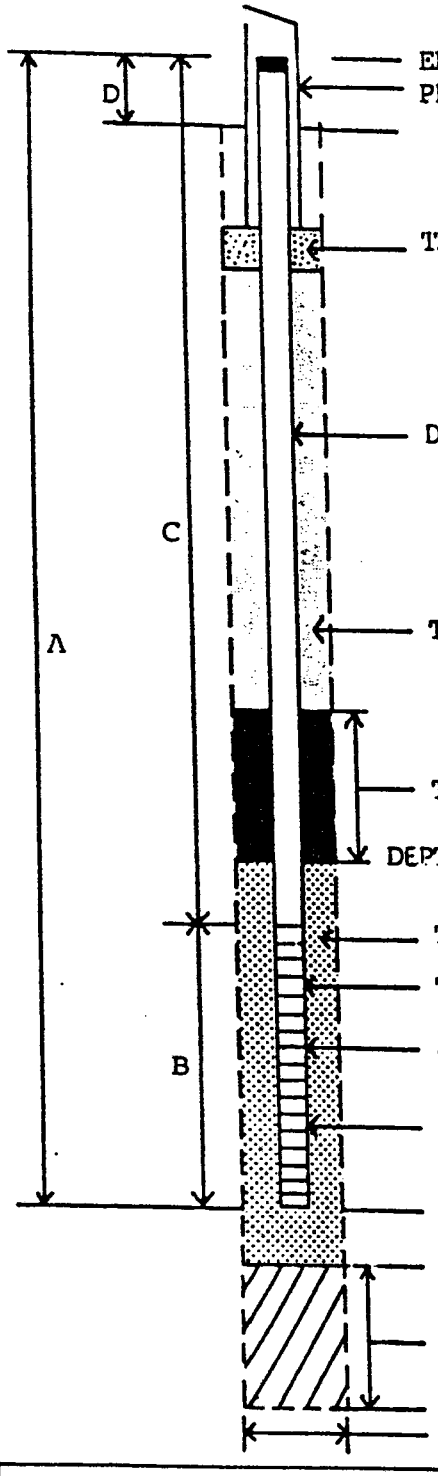
The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

A = total length of well 12.25'
B = length of well screen 6'
C = length of riser pipe 6.25'
D = stick-up at surface 1.6'

Minnesota Unique Well No. 475173

MONITORING WELL MW1
DATE INSTALLED 10-17-91
DRILLER/RIG KJB/CME 55
GROUND SURFACE ELEV. 97.14'

WATER LEVELS
93.65' (6-17-93)
92.63' (8-4-93)



ELEVATION OF TOP OF RISER PIPE	98.72'
PROTECTION PIPE	5" diameter steel
THICKNESS AND TYPE OF SURFACE SEAL	Neat Cement
DIAMETER AND TYPE OF RISER PIPE	2" steel
TYPE OF BACKFILL AROUND RISER PIPE	Neat Cement Grout
THICKNESS AND TYPE OF SEAL	10" bentonite
DEPTH TO TOP OF FILTER SAND	4'
TYPE OF FILTER AROUND SCREEN	#30 Red Flint
TYPE OF WELL SCREEN	Johnson PVC
SLOT SIZES	10 Slot
DIAMETER AND LENGTH OF SCREEN	2" / 6'
DEPTH TO BOTTOM OF MONITORING WELL	10.7'
DEPTH TO BOTTOM OF FILTER SAND	12'
THICKNESS AND TYPE OF SEAL	NA
DIAMETER AND DEPTH OF BOREHOLE	8" / 12'

GME CONSULTANTS, INC.
P.O. BOX 250 LAKE SHORE DRIVE
CROSBY, MINNESOTA 56441

Dittmer Oil Company
Fairfax, Minnesota

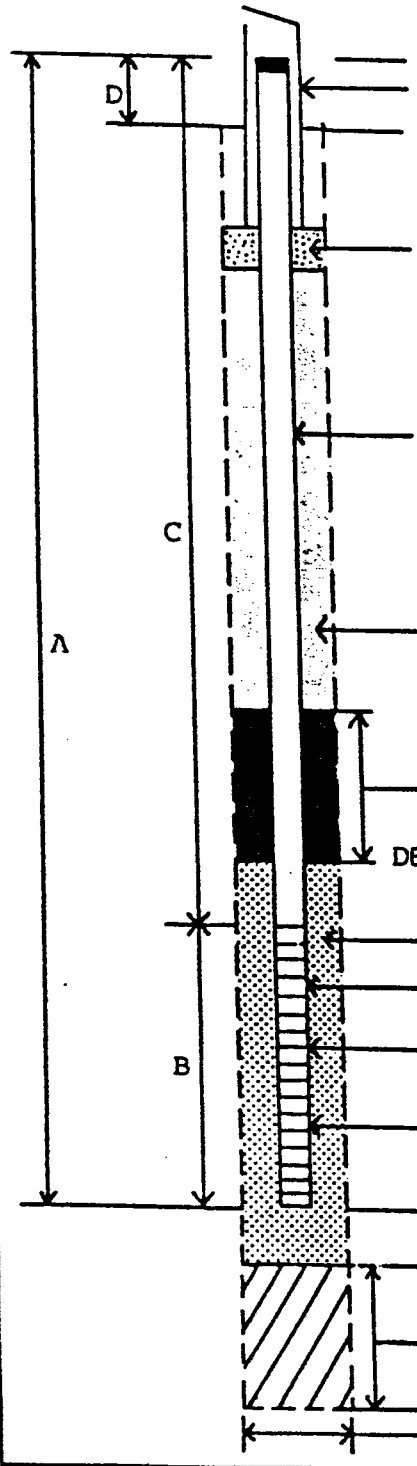
JPB	MDM	8-11-93	C-2373-A

A = total length of well 13.30'
B = length of well screen 6'
C = length of riser pipe 7.39'
D = stick-up at surface 1.96'

Minnesota Unique Well No. 475174

MONITORING WELL MW2
DATE INSTALLED 10-17-91
DRILLER/RIG KJB/CME 55
GROUND SURFACE ELEV. 97.14'

WATER LEVELS
96.00' (6-17-93)
94.57' (8-4-93)



ELEVATION OF TOP OF RISER PIPE	99.10'
PROTECTION PIPE	5" diameter steel
THICKNESS AND TYPE OF SURFACE SEAL	Neat Cement
DIAMETER AND TYPE OF RISER PIPE	2" Steel
TYPE OF BACKFILL AROUND RISER PIPE	Neat Cement Grout
THICKNESS AND TYPE OF SEAL	1.0' Bentonite
DEPTH TO TOP OF FILTER SAND	4.9'
TYPE OF FILTER AROUND SCREEN	#30 Red Flint
TYPE OF WELL SCREEN	Johnson PVC
SLOT SIZES	10 Slot
DIAMETER AND LENGTH OF SCREEN	2" / 6'
DEPTH TO BOTTOM OF MONITORING WELL	11.34'
DEPTH TO BOTTOM OF FILTER SAND	14'
THICKNESS AND TYPE OF SEAL	NA
DIAMETER AND DEPTH OF BOREHOLE	8" / 14'

GME CONSULTANTS, INC.
P.O. BOX 250 LAKE SHORE DRIVE
CROSBY, MINNESOTA 56441

Dittmer Oil Company
Fairfax, Minnesota

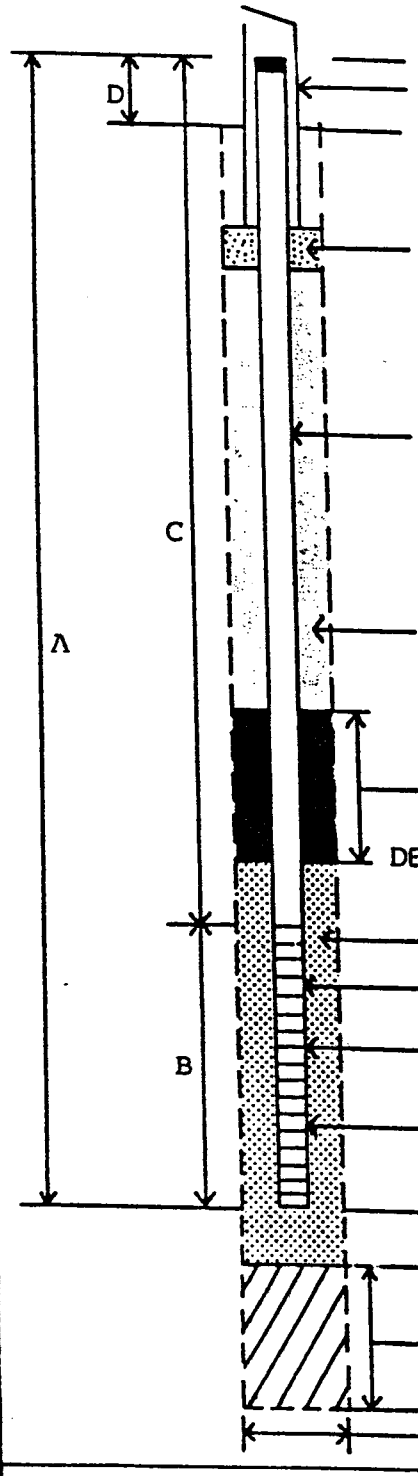
JPB	MDM	8-11-93	C-2373-A

A = total length of well 15.39'
B = length of well screen 6'
C = length of riser pipe 9.39'
D = stick-up at surface 1.92'

Minnesota Unique Well No. 475175

MONITORING WELL MW3
DATE INSTALLED 10-17-93
DRILLER/RIG KJB/CME 55
GROUND SURFACE ELEV. 100.24'

WATER LEVELS
96.61' (6-17-93)
94.61' (8-4-93)



ELEVATION OF TOP OF RISER PIPE	102.16'
PROTECTION PIPE	5" diameter steel
THICKNESS AND TYPE OF SURFACE SEAL	Neat Cement
DIAMETER AND TYPE OF RISER PIPE	2" Steel
TYPE OF BACKFILL AROUND RISER PIPE	Neat Cement Grout
THICKNESS AND TYPE OF SEAL	1.0' bentonite
DEPTH TO TOP OF FILTER SAND	6.7'
TYPE OF FILTER AROUND SCREEN	#30 Red Flint
TYPE OF WELL SCREEN	Johnson PVC
SLOT SIZES	10 Slot
DIAMETER AND LENGTH OF SCREEN	2" / 6'
DEPTH TO BOTTOM OF MONITORING WELL	13.47'
DEPTH TO BOTTOM OF FILTER SAND	16'
THICKNESS AND TYPE OF SEAL	NA
DIAMETER AND DEPTH OF BOREHOLE	8" / 16'

GME CONSULTANTS, INC.
P.O. BOX 250 LAKE SHORE DRIVE
CROSBY, MINNESOTA 56441

Dittmer Oil Company
Fairfax, Minnesota

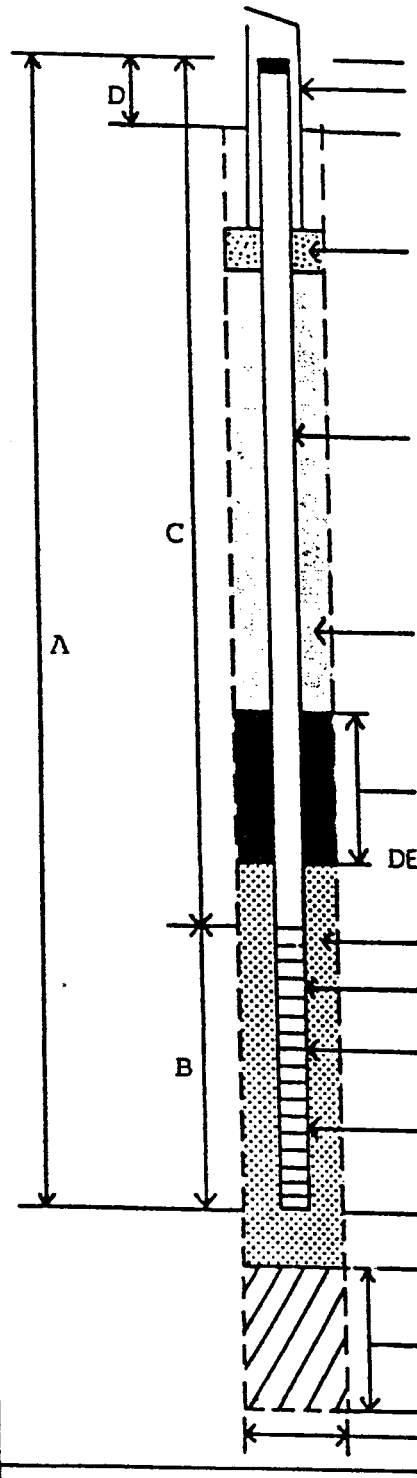
JPB	MDM	8-11-93	C-2373-A

A = total length of well 15.71'
B = length of well screen 10'
C = length of riser pipe 5.71'
D = stick-up at surface 1.92'

Minnesota Unique Well No. 524148

MONITORING WELL MW4
DATE INSTALLED 5-20-93
DRILLER/RIG KS/CME 750
GROUND SURFACE ELEV. 96.32'

WATER LEVELS
93.91' (6-17-93)
92.50' (8-4-93)



ELEVATION OF TOP OF RISER PIPE	98.24'
PROTECTION PIPE	5" diameter steel
THICKNESS AND TYPE OF SURFACE SEAL	2.79' neat cement
DIAMETER AND TYPE OF RISER PIPE	2" PVC
TYPE OF BACKFILL AROUND RISER PIPE	Neat Cement Grout
THICKNESS AND TYPE OF SEAL	0.5' bentonite
DEPTH TO TOP OF FILTER SAND	3.29'
TYPE OF FILTER AROUND SCREEN	#30 Red Flint
TYPE OF WELL SCREEN	Johnson PVC
SLOT SIZES	10 Slot
DIAMETER AND LENGTH OF SCREEN	2" / 10'
DEPTH TO BOTTOM OF MONITORING WELL	13.79'
DEPTH TO BOTTOM OF FILTER SAND	15'
THICKNESS AND TYPE OF SEAL	None
DIAMETER AND DEPTH OF BOREHOLE	8" / 15'

GME CONSULTANTS, INC.
P.O. BOX 250 LAKE SHORE DRIVE
CROSBY, MINNESOTA 56441

Dittmer Oil Company
Fairfax, Minnesota

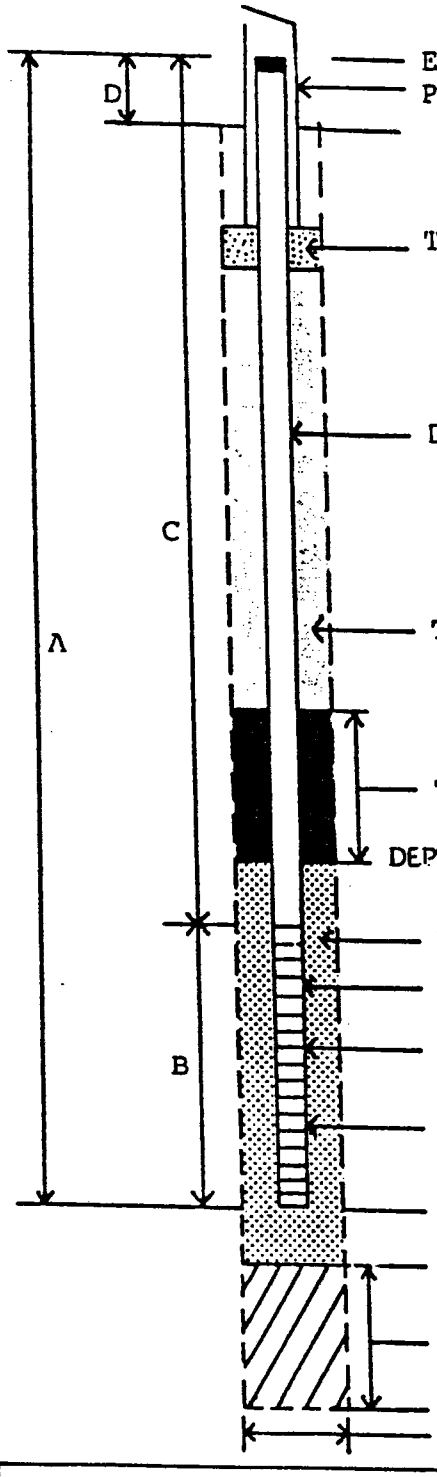
JPB	MDM	8-11-93	C-2373-B

A = total length of well 15.48'
B = length of well screen 10'
C = length of riser pipe 5.48'
D = stick-up at surface 2.09'

Minnesota Unique Well No. 524149

MONITORING WELL MW5
DATE INSTALLED 5-20-93
DRILLER/RIG KS/CME 750
GROUND SURFACE ELEV. 97.96'

WATER LEVELS
93.95' (6-17-93)
93.20' (8-4-93)



ELEVATION OF TOP OF RISER PIPE	100.05'
PROTECTION PIPE	5" diameter steel
THICKNESS AND TYPE OF SURFACE SEAL	2.39' neat cement
DIAMETER AND TYPE OF RISER PIPE	2" PVC
TYPE OF BACKFILL AROUND RISER PIPE	Neat Cement Grout
THICKNESS AND TYPE OF SEAL	0.5' bentonite
DEPTH TO TOP OF FILTER SAND	2.89'
TYPE OF FILTER AROUND SCREEN	#30 Red Flint
TYPE OF WELL SCREEN	Johnson PVC
SLOT SIZES	10 Slot
DIAMETER AND LENGTH OF SCREEN	2" / 10'
DEPTH TO BOTTOM OF MONITORING WELL	13.39'
DEPTH TO BOTTOM OF FILTER SAND	15'
THICKNESS AND TYPE OF SEAL	None
DIAMETER AND DEPTH OF BOREHOLE	8" / 15'

GME CONSULTANTS, INC.
P.O. BOX 250 LAKE SHORE DRIVE
CROSBY, MINNESOTA 56441

Dittmer Oil Company
Fairfax, Minnesota

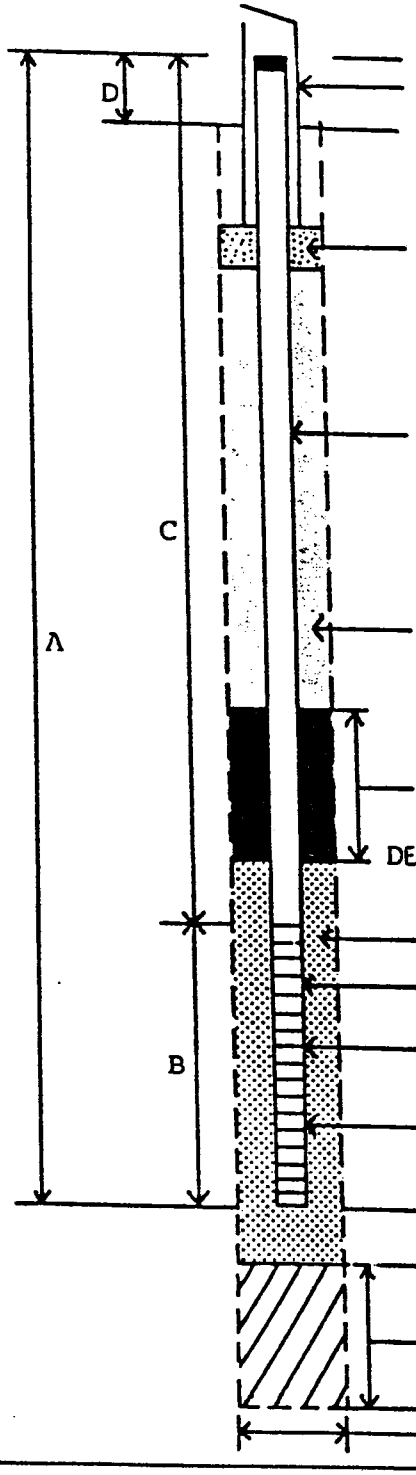
JPB	MDM	8-11-93	C-2373- B

A = total length of well 15.75'
B = length of well screen 10'
C = length of riser pipe 5.75'
D = stick-up at surface 2.11'

Minnesota Unique Well No. 524150

MONITORING WELL MW6
DATE INSTALLED 5-20-93
DRILLER/RIG KS/CME 750
GROUND SURFACE ELEV. 97.12'

WATER LEVELS
94.04' (6-17-93)
92.21' (8-4-93)



ELEVATION OF TOP OF RISER PIPE	99.23'
PROTECTION PIPE	5" diameter steel
THICKNESS AND TYPE OF SURFACE SEAL	2.64' neat cement
DIAMETER AND TYPE OF RISER PIPE	2" PVC
TYPE OF BACKFILL AROUND RISER PIPE	Neat Cement Grout
THICKNESS AND TYPE OF SEAL	0.5' bentonite
DEPTH TO TOP OF FILTER SAND	3.14'
TYPE OF FILTER AROUND SCREEN	#30 Red Flint
TYPE OF WELL SCREEN	Johnson PVC
SLOT SIZES	10 Slot
DIAMETER AND LENGTH OF SCREEN	2" / 10'
DEPTH TO BOTTOM OF MONITORING WELL	13.64'
DEPTH TO BOTTOM OF FILTER SAND	16'
THICKNESS AND TYPE OF SEAL	None
DIAMETER AND DEPTH OF BOREHOLE	8" / 16'

GME CONSULTANTS, INC.
P.O. BOX 250 LAKE SHORE DRIVE
CROSBY, MINNESOTA 56441

Dittmer Oil Company
Fairfax, Minnesota

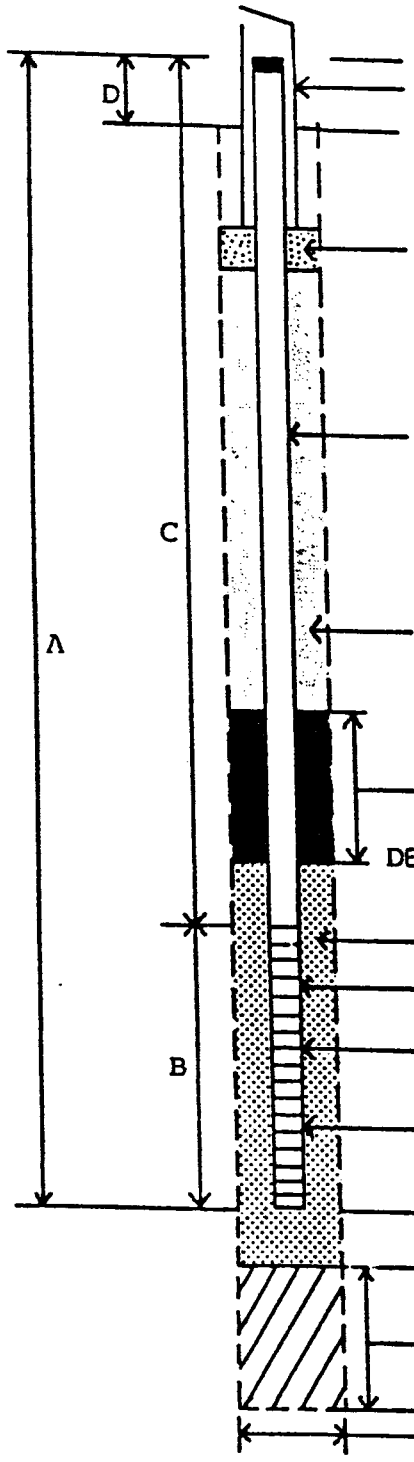
JPB	MDM	8-11-93	C-2373-B

A = total length of well 15'
B = length of well screen 10'
C = length of riser pipe 5'
D = stick-up at surface 1'

MONITORING WELL B7
DATE INSTALLED 5-20-93
DRILLER/RIG KS/CME 750
GROUND SURFACE ELEV. 95.17'

Minnesota Unique Well No. Not applicable (temporary well)

WATER LEVELS
Approximately 4' below grade (5-20-93)



ELEVATION OF TOP OF RISER PIPE	Approximately 96.2'
PROTECTION PIPE	None
THICKNESS AND TYPE OF SURFACE SEAL	None
DIAMETER AND TYPE OF RISER PIPE	2" PVC
TYPE OF BACKFILL AROUND RISER PIPE	None
THICKNESS AND TYPE OF SEAL	None
DEPTH TO TOP OF FILTER SAND	NA
TYPE OF FILTER AROUND SCREEN	Native Soil
TYPE OF WELL SCREEN	Johnson PVC
SLOT SIZES	10 Slot
DIAMETER AND LENGTH OF SCREEN	2" / 10'
DEPTH TO BOTTOM OF MONITORING WELL	15'
DEPTH TO BOTTOM OF FILTER SAND	NA
THICKNESS AND TYPE OF SEAL	None
DIAMETER AND DEPTH OF BOREHOLE	8" / 15'

GME CONSULTANTS, INC.
P.O. BOX 250 LAKE SHORE DRIVE
CROSBY, MINNESOTA 56441

Dittmer Oil Company
Fairfax, Minnesota

JPB	MDM	8-11-93	C-2373-B

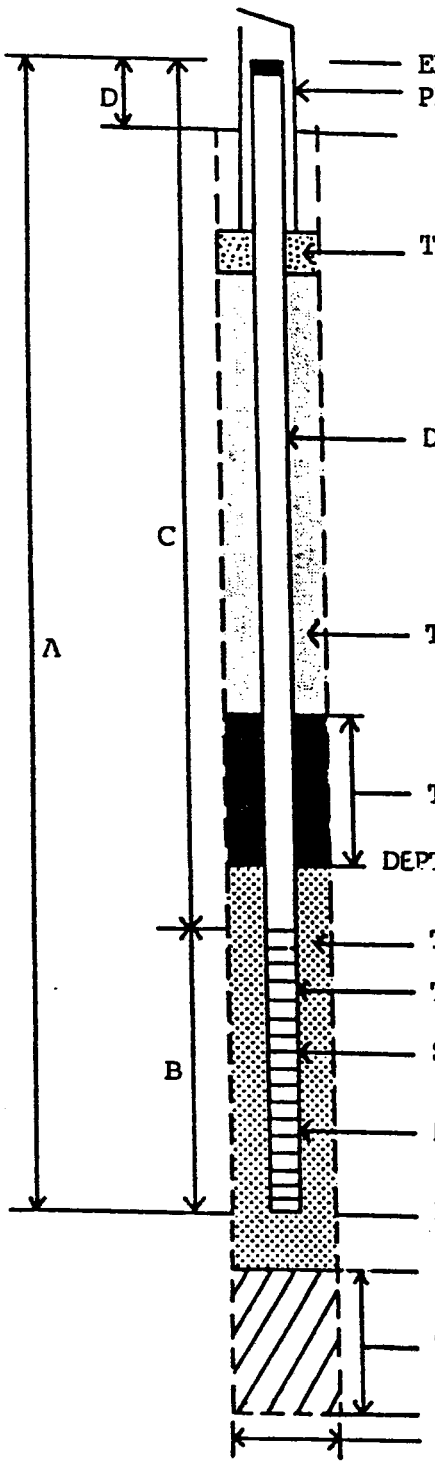
Note: Screen and riser were advanced through hollow stem auger; auger was removed; well was sampled, and screen and riser were removed 5-20-93.

A = total length of well 10'
B = length of well screen 10'
C = length of riser pipe 0'
D = stick-up at surface 1'

MONITORING WELL B12
DATE INSTALLED 8-2-93
DRILLER/RIG KJB/550
GROUND SURFACE ELEV. 95.38'

Minnesota Unique Well No. Not applicable (Temporary well)

WATER LEVELS
Approx. 3 feet below grade (8-2-93)



ELEVATION OF TOP OF RISER PIPE	Approx. 96.4'
PROTECTION PIPE	None
THICKNESS AND TYPE OF SURFACE SEAL	None
DIAMETER AND TYPE OF RISER PIPE	None
TYPE OF BACKFILL AROUND RISER PIPE	None
THICKNESS AND TYPE OF SEAL	None
DEPTH TO TOP OF FILTER SAND	NA
TYPE OF FILTER AROUND SCREEN	Native Soil
TYPE OF WELL SCREEN	Johnson PVC
SLOT SIZES	10 Slot
DIAMETER AND LENGTH OF SCREEN	2" / 10'
DEPTH TO BOTTOM OF MONITORING WELL	9'
DEPTH TO BOTTOM OF FILTER SAND	NA
THICKNESS AND TYPE OF SEAL	None
DIAMETER AND DEPTH OF BOREHOLE	8" / 9'

GME CONSULTANTS, INC.
P.O. BOX 250 LAKE SHORE DRIVE
CROSBY, MINNESOTA 56441

Dittmer Oil Company
Fairfax, Minnesota

JPB	MDM	8-11-93	C-2373-B

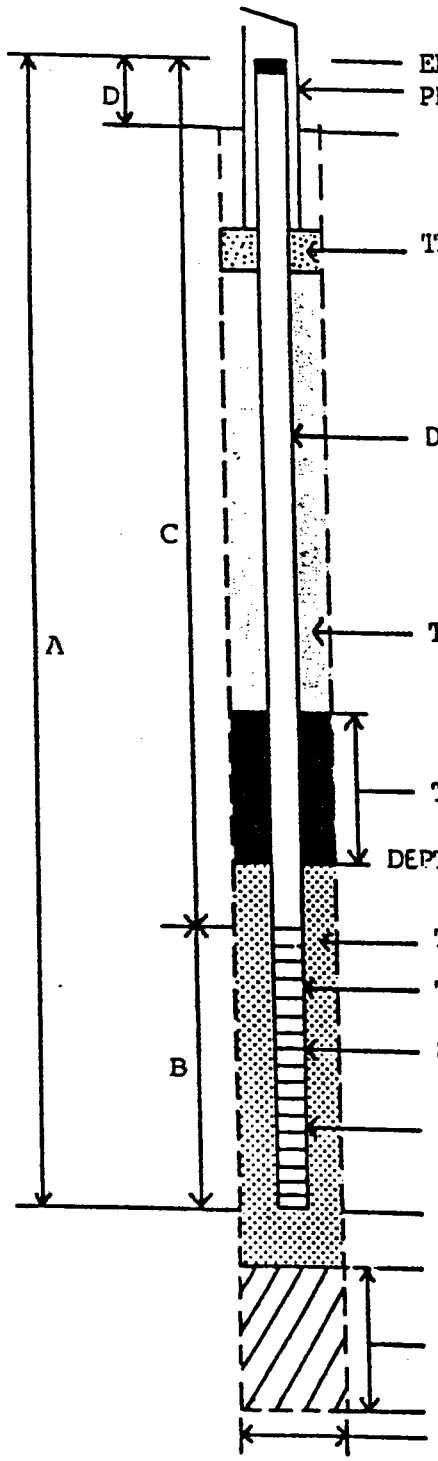
Note: Screen was advanced through hollow stem auger; auger was removed; well was sampled, and screen was removed 8-2-93.

A = total length of well 17.3'
B = length of well screen 10'
C = length of riser pipe 7.3'
D = stick-up at surface 3.07'

Minnesota Unique Well No. 523451

MONITORING WELL MW7
DATE INSTALLED 8-3-93
DRILLER/RIG KJB/550
GROUND SURFACE ELEV. 96.90'

WATER LEVELS
93.58' (8-4-93)



ELEVATION OF TOP OF RISER PIPE	99.97'
PROTECTION PIPE	6" diameter steel
THICKNESS AND TYPE OF SURFACE SEAL	Cement Grout
DIAMETER AND TYPE OF RISER PIPE	2" PVC
TYPE OF BACKFILL AROUND RISER PIPE	Neat Cement Grout
THICKNESS AND TYPE OF SEAL	1" Bentonite
DEPTH TO TOP OF FILTER SAND	4.2'
TYPE OF FILTER AROUND SCREEN	#30 Red Flint
TYPE OF WELL SCREEN	Johnson PVC
SLOT SIZES	10 Slot
DIAMETER AND LENGTH OF SCREEN	2" / 10'
DEPTH TO BOTTOM OF MONITORING WELL	14.23'
DEPTH TO BOTTOM OF FILTER SAND	16'
THICKNESS AND TYPE OF SEAL	NA
DIAMETER AND DEPTH OF BOREHOLE	8" / 16'

GME CONSULTANTS, INC.
P.O. BOX 250 LAKE SHORE DRIVE
CROSBY, MINNESOTA 56441

Dittmer Oil Company
Fairfax, Minnesota

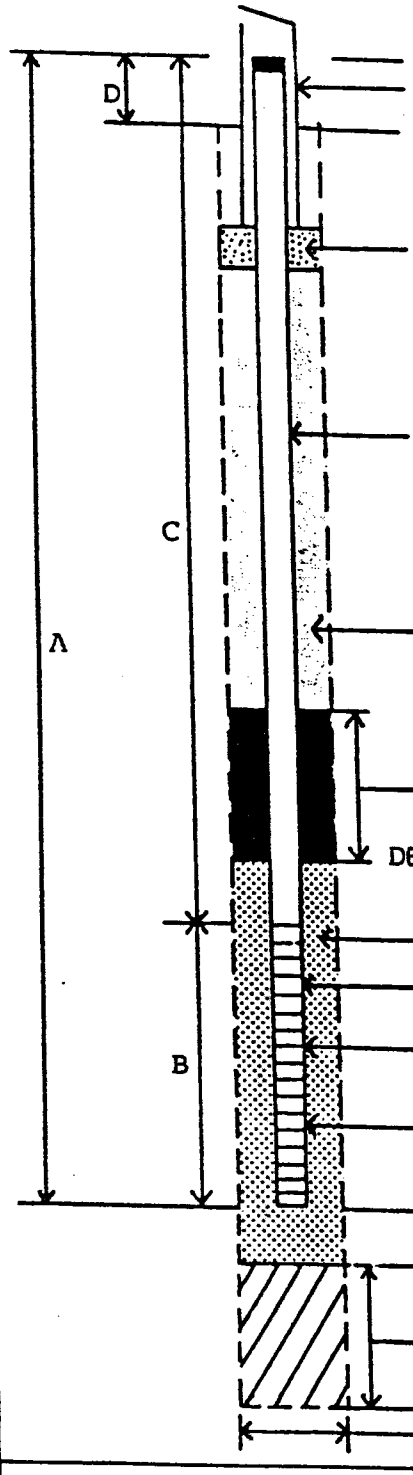
JPB	MDM	8-11-93	C-2373-B

A = total length of well 42.54'
B = length of well screen 5'
C = length of riser pipe 37.54'
D = stick-up at surface 2.54'

Minnesota Unique Well No. 523452

MONITORING WELL MW8
DATE INSTALLED 8-4-93
DRILLER/RIG KJB/550
GROUND SURFACE ELEV. 96.66'

WATER LEVELS



ELEVATION OF TOP OF RISER PIPE PROTECTION PIPE	99.20' 6" diameter steel
THICKNESS AND TYPE OF SURFACE SEAL	32' Neat Cement Grout
DIAMETER AND TYPE OF RISER PIPE	2" PVC
TYPE OF BACKFILL AROUND RISER PIPE	Neat Cement Grout
THICKNESS AND TYPE OF SEAL	2' Bentonite
DEPTH TO TOP OF FILTER SAND	34'
TYPE OF FILTER AROUND SCREEN	#30 Red Flint
TYPE OF WELL SCREEN	Johnson PVC
SLOT SIZES	10 Slot
DIAMETER AND LENGTH OF SCREEN	2" / 5'
DEPTH TO BOTTOM OF MONITORING WELL	40.0'
DEPTH TO BOTTOM OF FILTER SAND	40.0'
THICKNESS AND TYPE OF SEAL	None
DIAMETER AND DEPTH OF BOREHOLE	12" / 20' ; 8" / 20-40'

GME CONSULTANTS, INC.
P.O. BOX 250 LAKE SHORE DRIVE
CROSBY, MINNESOTA 56441

Dittmer Oil Company
Fairfax, Minnesota

JPB	MDM	8-11-93	C-2373-B

112-32-8adbba

205520

FREDERICKSON'S, INC.

Phone (612) 587-3111
HUTCHINSON, MINNESOTA 55350

OK

Fairfax Q.

elev. 1043±

Owner Name Fairfax Grain & Supply Co. Telephone Date

City Fairfax 55332 County Renville State Minnesota Section 8 Township Cairo

Location 94-C

If occupied by renter, list name

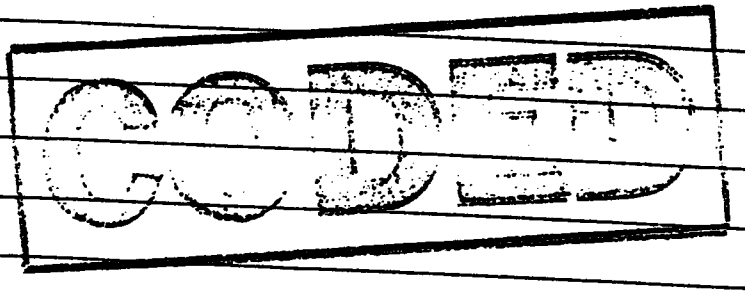
Change of ownership, name

Well diameter inside 5" Depth of well 186' Screen diameter 4" Length 8'

Screen slot 12 Screen fitting turned coupling, lead packer Material stainless steel

Static level 45' Pumping level 140' G. P. M. tested 15 With what? air

Additional information pertaining to well



Driller Raymond O. Nass Date completed February 24, 1964

Type of pump submersible Make Berkeley Model 4AM11 Serial No.

Size of motor ½ h.p. Voltage 230 Pump installed by Don Brown

Length of drop pipe 126' Size and type material of drop pipe 1" galv. Total pump setting

Cylinder size Type Pump rod length Rod size

Size of tank Air charging system

Pit Frost proof house Pitless unit size 4" Pitless make Duplex

Pitless type Pitless bury depth

Additional information pertaining to pump and system

Date installed May 22, 1973 Installed by Frederickson's Inc.

Pulled: Mar 25 '80 (285 pipe)

Frederickson's, Inc.

Hutchinson, Minnesota • West Fargo, North Dakota

d for Fairfax Grain & Supply Coop.

Hole No. 2 Well No.

te

nship

Length 8'

al

With what?

FORMATIONS PASSED THROUGH

Kind of Formation	Color of Formation	Started at What Depth	Ended at What Depth	Total Thickness of Formation
p Soil QUUU SOIL, ORGD	Black	0	2	2
lay QTUU CLAY	Yellow	2	17	15
lay QTUU CLAY	Blue	17	55	38
lay, Sandy QFUU CLAY, SAND	Blue	55	77	22
and, Dirty QFUU SAND, SILT	Brown	77	80	3
lay, Sandy QFUU CLAY, SAND	Blue	80	136	56
lay, Soft & Sandy QFUU CLAY, SAND	Blue	136	170	34
and, Dirty QFUU SAND, SILT	Blue	170	173	3
and QFUU SAND	Blue	173	186	13
lay QTUU CLAY	Blue	186	1857	
	Aquifer QBOW - QBOW			

Signed Ray Nass Driller

Serial No.

l by

pump setting

linder size Type Pump rod length Rod size

e of tank Air charging system

Frost proof house Pitless unit size Pitless make

tless type Pitless bury depth

ditional information pertaining to pump and system

(94C) 15425

FREDERICKSON'S, INC.

Phone (612) 587-3111
HUTCHINSON, MINNESOTA 55350

112-32 (6,5,4; ok
Can't locate Fairfax

Owner Name Fairfax Grain & Supply Co. Telephone Date

City Fairfax County Renville State Minnesota Section 5-8 Township Cairo

55332

Location 112-32-8 AAA ADB

ELEV 1042 ± 5

If occupied by renter, list name

Change of ownership, name

Well diameter inside 5" Depth of well 183' Screen diameter 4" Length 4'

Screen slot 18 Screen fittings coupling Material Everdur

Static level 42' Pumping level 120' G. P. M. tested 5 With what? air

Additional information pertaining to well 5" well with hanging shoe for 4" screen

CODED

Driller Clarence Pulkrabek Date completed July 21, 1961

Type of pump submersible Make Berkeley Model 4SOL10 Serial No. 6155572

Size of motor ½ h.p. Voltage 230 Pump installed by James Pessek

Length of drop pipe 126' Size and type material of drop pipe 1" galv. Total pump setting 132'

Cylinder size Type Pump rod length Rod size

Size of tank 120 gallon Air charging system Perma Pressure

Pit Frost proof house Pitless unit size 6" Pitless make Duplex

Pitless type submersible Pitless bury depth 6'

Additional information pertaining to pump and system

Date installed August 3, 1961 Installed by Frederickson's Inc.

215425

Frederickson's, Inc.

Hutchinson, Minnesota

led for Fairfax Grain and Supply Coop. e 6-22-61

t Hole No. 1 Well No. 1 ship

FORMATIONS PASSED THROUGH

Kind of Formation	Color of Formation	Started at What Depth	Ended at What Depth	Total Thickness of Formation
Topsoil QUUU SOIL QRCD	black	G.L.	2'	2'
Clay QTUV CLAY	yellow	2'	23'	21'
Clay QTUV CLAY	blue	23'	109'	86'
Clay, soft QTUV CLAY	blue & brown	109'	162'	53'
Clay, hard QTUV CLAY	blue	162'	168'	6'
Sand, clean QFUV SAND	colored	168'	172'	4'
Clay QTUV CLAY	blue	172'	173'	1'
Sand QFUV SAND	brown	173'	183'	10'
ay QTUV CLAY	blue	183'	192'	9'
Aquifer QBOW-QBOW			B/BD	

CODED

Length 4"

Jackson Evelun

With what? Conf

4" screen

erial No.

by Frederickson's Inc

Signed Clarence Pulkrabek Driller

pump setting 132

Rod size

Size of tank 120 gal [illegible] tank Air charging system

it Frost proof house Pitless unit size 6" Pitless make Duplex

Pitless type Sub Pitless bury depth 6'

Additional information pertaining to pump and system

Tim & Bill

WRD Exp. (M)
April 1965

U. S. DEPT. OF THE INTERIOR
GEOLOGICAL SURVEY

Well No. 112-32-8bad

OK

WELL SCHEDULE

WATER RESOURCES DIVISION

MASTER CARD

Report: Jerabek Source of data: Thiel Date: 5Feb68 Map: Fairfax 7½ 6 5

State: Minnesota 2 7 County (or town): Renville Supplemental number: 1

Latitude: 4 4 3 1 3 4 N Longitude: 9 4 4 3 0 0 degrees min sec

Location: 2 T 112 N R 32 W Sec 8bad.1 S & M

Other number:

Local well number: 1 1 2 3 2 8 B A D

Owner or name: Fairfax Flour Mill

Local use: FLOUR MILL Address: Fairfax

Owner or name: N

Ownership: (C) County, (F) Fed Gov't, (M) City, (O) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, Power, (E) Fire, (F) Dom, (H) Irr, (I) Med, (M) Ind, (N) P S, (P) Rec, (S) Stock, (T) Insctt, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desalnother, (Z) Other C

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, Recharge, (T) Test, (U) Unused, (W) Withdrawl, (X) Waste, (Z) Destroyed W

DATA AVAILABLE: Well data Freq. W/L meas.: Field aquifer char.

Hyd. lab. data:

Qual. water data: type: Pumpage inventory: no, yes period:

Freq. sampling:

Aperture cards: D

Log data: Thiel log

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: ft 2 3 8 Meas. Est. Thiel accuracy 6

Depth cased: (first perf.) ft Casing type: Diam. in

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., screen, (S) sd. pt., (T) shored, (X) open hole, (Z) other

Method Drilled: (A) air rot, (B) bored, (C) cable, (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other

Date Drilled: Pump intake setting: ft

Driller: name address

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple, (cent.), (M) multiple, (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turn, (Z) other Deep Shallow

Power (type): diesel, elec, gas, gasoline, hand, nat gas, LP gas, wind; H.P. Trans. or meter no.

Descrip. MP ft above below LSD, Alt. MP 4

Alt. LSD: 1 0 4 0 Accuracy: (source) Fairfax 7½ Accuracy: Method determined

Water Level ft above below MP; Ft above below LSD Yield: gpm Pumping Period hrs

Date meas: Accuracy:

Drawdown: ft

QUALITY OF WATER DATA: Iron ppm Sulfate ppm Chloride ppm Hard. ppm Date Sampled

Sp. Cond.: K x 10^6 Temp. °F

Taste, color, etc.

Well No.

Well No.

HYDROGEOLOGIC CARD

1 2 Section:

D 28R Subbasin: 3

Type of well site: depression, hilltop, sink, swamp, undulating, valley flat F

MAJOR AQUIFER: system series Z weathered PE aquifer, formation, group 08

Lithology: weathered granite ZH Origin: 7 Aquifer Thickness: 36 ft

36 Length of well ft Depth to top of: ft 202

MINOR AQUIFER: system series aquifer, formation, group

Lithology: Origin: Aquifer Thickness: ft

Length of well ft Depth to top of: ft

Intervals Screened:

Depth to consolidated rock: Source of data:

Depth to basement: decomp granite 202 Source of data: Thiel D

Surficial material: 7T Infiltration characteristics: 3

Coefficient Trans: Coefficient Storage:

Coefficient Perm: gpm/ft; Number of geologic cards:

yellow boulder clay	0-26
blue boulder clay	26-185
sand	185-186
blue boulder clay	186-202
white clay & decomp granite	202-238

No Log

GPO 857-700

HYDROGEOLOGIC SETTING AND GROUND WATER CONTAMINATION WORKSHEET
Fact Sheet #24
Minnesota Pollution Control Agency
LUST Cleanup Program
April 1993

Complete this worksheet for all sites with ground water contamination. The worksheet has several purposes. It summarizes remedial investigation (RI) results and conclusions for use by Minnesota Pollution Control Agency (MPCA) staff when reviewing the site to determine whether corrective action will be required to remediate ground water contamination. It also provides supplementary information on investigation, design and reporting requirements (presented in **bold type**) for sites with groundwater contamination. Review this worksheet and all other relevant MPCA documents when developing RI work plans to ensure the investigation meets all RI requirements.

Base answers to the following questions on the results of the ground water receptor survey, RI activities, and published geologic literature. Answer the questions in the space provided, and attach additional sheets if necessary.

Include this worksheet as an appendix to the RI/corrective action design (CAD) report. RI/CAD reports submitted without this worksheet or with an incomplete worksheet will be rejected as inadequate.

LEAK # 00001940
SITE NAME Dittmer Oil Company
SITE LOCATION Fairfax, Minnesota

1. Geology. Describe the geologic units in which ground water has been impacted by the petroleum release, the thickness, and estimated lateral extent of the impacted unit.

Geologic description: Glacial till. Fractured silty clay to approximately 20' below grade and then gray nonfractured silty clay with some sand seams.

Thickness of impacted unit: Approximately 200'

Estimated lateral extent: Miles in all directions

2. Aquifer parameters. At all sites with ground water monitoring wells, include an estimate of hydraulic conductivity, and provide estimates of the ground water velocity in the impacted unit. Explain how you arrived at these estimates. Also provided estimated values for porosity, flow direction, and horizontal and vertical gradients.

K = 0.022 ft/min measured porosity = .311 dh/dl = 0.011 ft/ft
V = ~1 ft/day flow direction: S-SE dv/dl = _____

3. Maximum concentrations (on-site). Please list the following maximum contaminant concentrations (ppb) for contaminants detected on-site:

Benzene 11300 (Well No. MW2, Date 6-3-93)

Total Hydrocarbons 55440 (GRO) (Well No. MW2, Date 6-17-93)

4. Maximum concentrations (off-site). Please list the following maximum contaminant concentrations (ppb) for contaminants detected off-site:

Benzene was "masked"

Benzene Ethylbenzene 5.83 (Well No. B7, Date 5-20-93)

Total Hydrocarbons 960 (GRO) (Well No. B7, Date 5-20-93)

5. Drinking water criteria. Do contaminant concentrations for any compound exceed the Recommended Allowable Limits (RALs), at or beyond the site boundaries? (Yes/No).....[Yes]

Compound Benzene (Well No. MW2, Date _____)

6. Source. Do sources of contamination (including contaminated soil) remain at the site? (Yes/No).....[Yes]
If Yes, briefly describe. Likely, some contaminated soil.

7. Municipal water supply available. Is municipal water supply available at the site and within one mile downgradient of the site? (Yes/No).....[No]
Municipal water is available at site, but not one mile downgradient.

8. Drinking water wells. Are there presently any drinking water wells which use the impacted aquifer located within one half mile downgradient of the site or one mile downgradient of the site if the aquifer material is fractured? (Yes/No).....[No]
Available well logs show wells screened at approximately 180'.

9. Water Development. Are there any plans for ground water development in the impacted aquifer within one half mile downgradient of the site, or one mile downgradient of the site if the aquifer material is fractured? (Yes/No).....[Unknown]

If you answered No to questions 8 **AND** 9, please skip to question 10 and continue.

If you answered Yes to question 8 **OR** 9, **AND** Yes to question 5, corrective action will likely be required to remediate ground water contamination at the site. The RI report should include a proposed corrective action design to meet the following cleanup goal and compliance point.

Cleanup goal:	The RALs for volatile organic compounds (VOCs) and 1 part per million total hydrocarbons. Collect free product where technically feasible.
Compliance point:	At and beyond the site boundaries.

At some LUST sites corrective actions may not be technically capable of achieving remediation to RALs. For a discussion of the options which should be considered when designing corrective actions for sites of this type please se "LUST Program Cleanup Strategy" (fact sheet #16).

10. Are there nonpotable water supply wells which use the impacted unit within one-half mile downgradient of the site?
(Yes/No).....[Unknown]

11. Does the plume currently discharge to surface water?
(Yes/No).....[No]
If yes, what is the estimated width of the plume at the shore of the surface water body, and what are the estimated concentrations of the following contaminants at the shore of the surface water body: (The estimation method should be described in the text of the RI report.)

Benzene_____, Ethylbenzene_____, Toluene_____, Xylenes_____, Total Hydrocarbons_____

If the answer to question number 11 is yes, determine and report the use category of the surface water body, in accordance with Minn. Rules ch. 7050. Call_____ for help.

12. Does the plume have a projected point of entry to surface water? (Yes/No).....[No]
If yes, what is the distance from the downgradient edge of the plume to the surface water body?

If you answered yes to question 12, the RI report should characterize the hydrogeologic conditions and land use between the site and the surface water body, and should assess the potential for the plume to discharge to surface water and the likelihood of future ground water use in the vicinity of the plume.

13. If the impacted unit a bedrock aquifer? (Yes/No)....[No]

14. Has contamination from the site impacted a quaternary surficial or buried aquifer that is presently used as a drinking water aquifer **anywhere within two miles** of the site? (Yes/No).....[No]

15. Uppermost drinking water aquifer.

geologic description Sand

depth to top Approximately 180'

water level

karst? (yes/no).....[No]

sole source? (yes/no).....[No]

16. Confining unit. Is there a confining unit between the impacted unit and the uppermost drinking water aquifer? (Yes/No).....[Yes]

If yes: thickness Approximately 180'

extent Miles

formation name or material description
Glacial till (silty clay)

17. Are there any abandoned wells within approximately 1,000 feet downgradient of the site? (Yes/No).....[Unknown]

If yes, describe:

18. List other site specific conditions which increase the risk of cross contamination from the impacted unit to a drinking water aquifer.

Fractures and sand seams in the till.

19. Based on the answers to questions 14 through 17 and any other site specific information available, summarize and assess the risk of cross contamination from the impacted unit to the uppermost drinking water aquifer.

The risk to wells screened 180 feet below grade would seem to be low, if the wells are properly grouted and cased.