

HYDROCARBON RECOVERY EVALUATION/
HYDROGEOLOGIC INVESTIGATION

R.K. MILES, INC.
MANCHESTER CENTER, VERMONT

SUBMITTED TO:

R.K. MILES, INC.
MANCHESTER CENTER, VERMONT

SUBMITTED BY:

GROUNDWATER TECHNOLOGY
DIVISION OF OIL RECOVERY SYSTEMS, INC.
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JUNE 85

PREPARED BY:


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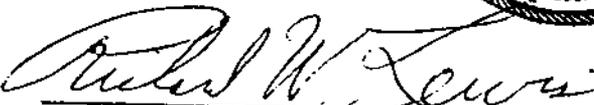

Richard W. Lewis, P.G.
Principal Hydrogeologist



TABLE OF CONTENTS

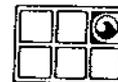
	Page
EXECUTIVE SUMMARY	1
INTRODUCTION	3
Sequence of Events	3
INVESTIGATIVE METHODS	5
Monitoring Well Installation	5
Monitoring Well Gaugings	5
Aquifer Pumping Test	7
Water Quality Sampling Procedure	8
SYNOPSIS AND INVESTIGATIVE FINDINGS	8
Geology	8
Well Monitoring Results	9
Aquifer and Well Characteristics	9
Natural Groundwater Flow	11
Recovery Well Effectiveness	11
Water Quality Results	12
Recovered Product Estimate	12
CONCLUSIONS AND RECOMMENDATIONS	13

LIST OF FIGURES

Figure 1 Site Location Map	2
Figure 2 Site Map	6
Figure 3 Groundwater Contours	10

APPENDICES

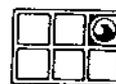
Appendix A Drilling Logs
Appendix B Well Data Monitoring Forms
Appendix C Laboratory Reports



EXECUTIVE SUMMARY

Groundwater Technology (GT), a Division of Oil Recovery Systems, Inc., (ORS) was retained by R.K. Miles, Inc. on March 22, 1985 to evaluate and proceed with the hydrocarbon recovery/hydrogeologic investigation in progress at the R.K. Miles lumber yard on Depot Street in Manchester, Vermont. The site is located approximately 400 feet upgradient of the Battenkill River (see Site Location Map).

The recovery project is in response to an estimated 1800 gallon underground #2 fuel oil leak which was detected on January 23, 1985. The oil recovery project has been in progress since January 24, 1985. An on-site hydrogeologic investigation was conducted by Groundwater Technology on March 25 and 26, 1985. Findings revealed no free-floating hydrocarbons in the monitoring wells on-site. Recovery well #1 was pumped continuously for 6 weeks and did not produce any free-floating hydrocarbons. Groundwater Technology installed four additional monitoring wells on May 8, 1985. No free-floating hydrocarbons were detected in these wells. At that time, Groundwater Technology deactivated the recovery program and initiated a phase of monthly well monitoring and sampling. Water quality results from sampling conducted on May 9, 1985 reveal relatively low levels of total dissolved hydrocarbons in the groundwater beneath the site.



INTRODUCTION

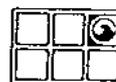
Groundwater Technology was retained by R.K. Miles to perform the following tasks:

- Continue the operation of an existing oil recovery system.
- Evaluate the effectiveness of the existing recovery system.
- Conduct a hydrogeologic investigation to determine the properties of the groundwater aquifer beneath the site. Assess the areal extent of free-floating and dissolved hydrocarbons.

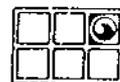
The following report details our investigative methods and findings.

Sequence of Events

- January 23 Fuel oil was detected floating on the groundwater table during the excavation and relocation of an underground storage tank. Approximately 1800 gallons of #2 fuel oil was discovered missing from the heating oil tank.
- January 24 Domermuth Petroleum Maintenance Corporation installed a culvert oil recovery well adjacent to the spill location.
- February 1 10 cubic yards of contaminated soil were removed from the site.
- February 13 Four - 2" diameter groundwater monitoring wells (B-1 through B-4) were installed on-site. (Only B-1 and B-2 still exist)



- Early March Two additional culvert recovery wells (R-2 and R-3) were installed. Twenty-five cubic yards of oily dirt were hauled from the site. Monitoring wells B-3 and B-4 were destroyed during construction.
- March 22 Groundwater Technology was retained to proceed with the oil recovery/hydrogeologic investigation project.
- March 25 & 26 Groundwater Technology conducted its initial site investigation. Only one well (R-3) showed evidence of free-floating petroleum (.01 feet). A pumping system was installed in R-1. An aquifer pumping test was conducted. Water samples were collected.
- March 25 - Maintained a continuous drawdown of 2.5 feet in
 May 8 R-1. No free-floating petroleum accumulated in the well.
- May 8 Installed four additional monitoring wells to be used for monthly water quality monitoring. No free-floating petroleum was detected in the nine wells on-site. The recovery system was deactivated.
- May 9 Initiated a monthly water quality monitoring program.



INVESTIGATIVE METHODS

Monitoring Well Installation

Groundwater Technology supervised the installation of four additional monitoring wells numbered MW-1 through MW-4 (see Site Map) on May 8, 1985. The wells were installed to establish points for water quality monitoring, the direction of groundwater flow and the geologic profile beneath the site. Drilling logs for these wells are included as Appendix A of this report. The monitoring wells were installed to a depth of 13 feet below ground surface with the well screen extending from 3 to 13 feet. The well screen is 2-inch diameter schedule 40 PVC. The slot openings are .020 inches. The annular space between the well screen and the borehole was filled with a filter sand pack. A bentonite seal was installed around the upper two feet of the casing to prevent surface waters from infiltrating the well. Road boxes were installed and cemented into place to cover and protect the wells from traffic. The wells were developed by surging and bailing to remove the fine material from the surrounding formation. The developing procedure creates better continuity between the well and the surrounding aquifer.

Monitoring Well Gaugings

Groundwater Technology monitored wells R-1, R-2, R-3, B-1 and B-2 on March 25, 1985 (see Site Map for their locations). These wells, with the addition of MW-1 through MW-4, were monitored again on May 9, 1985. Well monitoring consists of measuring the depth to oil and/or water to a reference elevation, using an ORS Interface Probe. This probe can accurately detect as little as one-eighth of an inch of floating hydrocarbons on the water table. Results are also confirmed visually using a surface sampling device. Well gaugings are used to determine both the thickness of free-floating petroleum on the water table and groundwater elevations. Well monitoring data is included as Appendix B of this report.

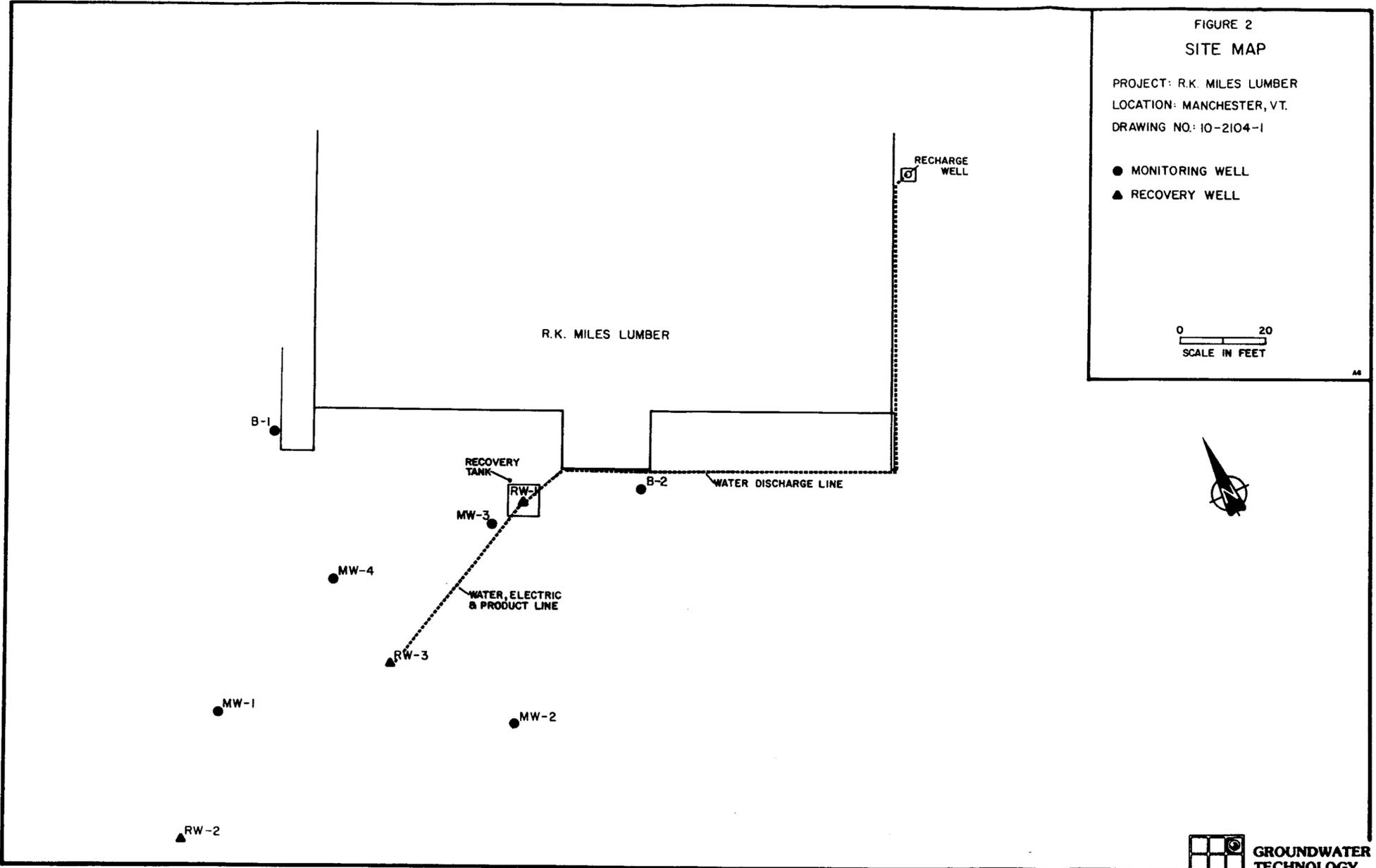


FIGURE 2
SITE MAP

PROJECT: R.K. MILES LUMBER
LOCATION: MANCHESTER, VT.
DRAWING NO.: 10-2104-1

- MONITORING WELL
- ▲ RECOVERY WELL

0 20
SCALE IN FEET



Aquifer Pumping Test

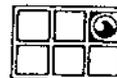
Groundwater Technology conducted a short term aquifer pumping test on March 26, 1985. Recovery Well #1 was pumped at a constant rate of 32 gallons per minute (gpm) for 100 minutes. Drawdown was systematically measured in R-1, R-2, R-3, B-1 and B-2 with an ORS Interface Probe. Results of the pumping test were used to determine well and aquifer characteristics. These properties are defined as follows:

Transmissivity: (T) in (gpd/ft) is the capacity of an aquifer to transmit groundwater. Defined as the rate at which water will flow through a vertical strip of the aquifer one foot wide under a hydraulic gradient of 1.00 (ft/ft).

Storativity: (S) is defined as the volume of water released from the aquifer per unit surface area of the aquifer per unit drop in head. (dimensionless)

Well Efficiency: The efficiency at which the well transmits water. Is equal to the theoretical drawdown divided by the actual drawdown times 100. (dimensionless)

Hydraulic Conductivity: (k) in (ft/day) is the quantity of water that will flow through a unit cross-sectional area of the aquifer per unit of time under a hydraulic gradient of 1.00. Hydraulic Conductivity equals Transmissivity divided by the saturated thickness of the aquifer.



Water Quality Sampling Procedure

Groundwater Technology has sampled the groundwater from the R.K. Miles wells on March 26 and May 9, 1985. The samples were refrigerated and sent to Groundwater Technology Laboratory where they were analyzed for volatile aromatics; specifically, the volatile compounds include benzene, toluene, ethyl benzene, xylenes, C4-C12 aliphatic hydrocarbons and miscellaneous C8-C12 aromatics.

Samples are collected using a bailer which is first cleansed with a solvent and then rinsed with distilled water. Before sampling, the monitoring well is purged of at least three well volumes to remove stagnant water. Purging brings fresh groundwater into the well which is representative of the water in the formation. The sample is placed in a Volatile Organic Analysis (VOA) vial and sealed with a teflon septum to prevent contact with air.

SYNOPSIS AND INVESTIGATIVE FINDINGS

Geology

The geologic profile beneath the R.K. Miles site consists of stream deposits ranging from coarse gravel zones to fine sand and silts. In general, brown, fine to medium sand with some gravel extends from zero to 10 feet below grade. At 10 feet the sandy material grades into a dense, fine sand with a significant silt content. A clay confining layer was found in MW-3 at a depth of 11 feet. The MW-1 borehole was drilled to a depth of 20 feet without encountering a clay confining layer. This indicates that the clay layer sampled in MW-3 is not continuous beneath the site. Drilling at MW-4 revealed brown, medium to fine sand with gravel and a trace of clay to a depth of approximately 10 feet at which point fine to coarse sand and gravel was encountered. The various non-continuous materials found beneath the site are typical of stream deposits.



Well Monitoring Results

Results from the March 25th gaugings indicate that the natural groundwater flow beneath the site is moving in a westward direction and recharging the Battenkill River (SG-2). One-hundredth of a foot of hydrocarbon was detected in well R-3. It cannot be concluded that the one-hundredth of a foot of oil detected in R-3 is representative of the aquifer since the slots in the well did not extend above the water table. Free-floating hydrocarbon was not detected in any of the 4 remaining wells.

The site was monitored again on May 9, 1985 following the installation of wells MW-1 through MW-4 on May 8. Groundwater contours calculated from these gaugings are shown in Figure 3. On May 9, 1985 the groundwater elevation had decreased enough so that the slots in R-3 were now extended above the water table. A slight sheen of oil was noted in R-3. Free-floating hydrocarbon was not detected in any of the remaining wells.

Aquifer and Well Characteristics

Based on the pump test data collected on March 26, 1985, the aquifer beneath the site was determined by Groundwater Technology to have the following hydraulic properties:

Transmissivity	= 34,760 gpd/ft
Storativity	= .08
Hydraulic Conductivity	= 465 ft/day

Well efficiency is dependent on the design of the well. A properly designed well is generally 60 to 90 percent efficient. The Well R-1 was determined to be 30% efficient. This relative inefficiency limits the flow of water into the recovery well thus decreasing the well's capture zone.

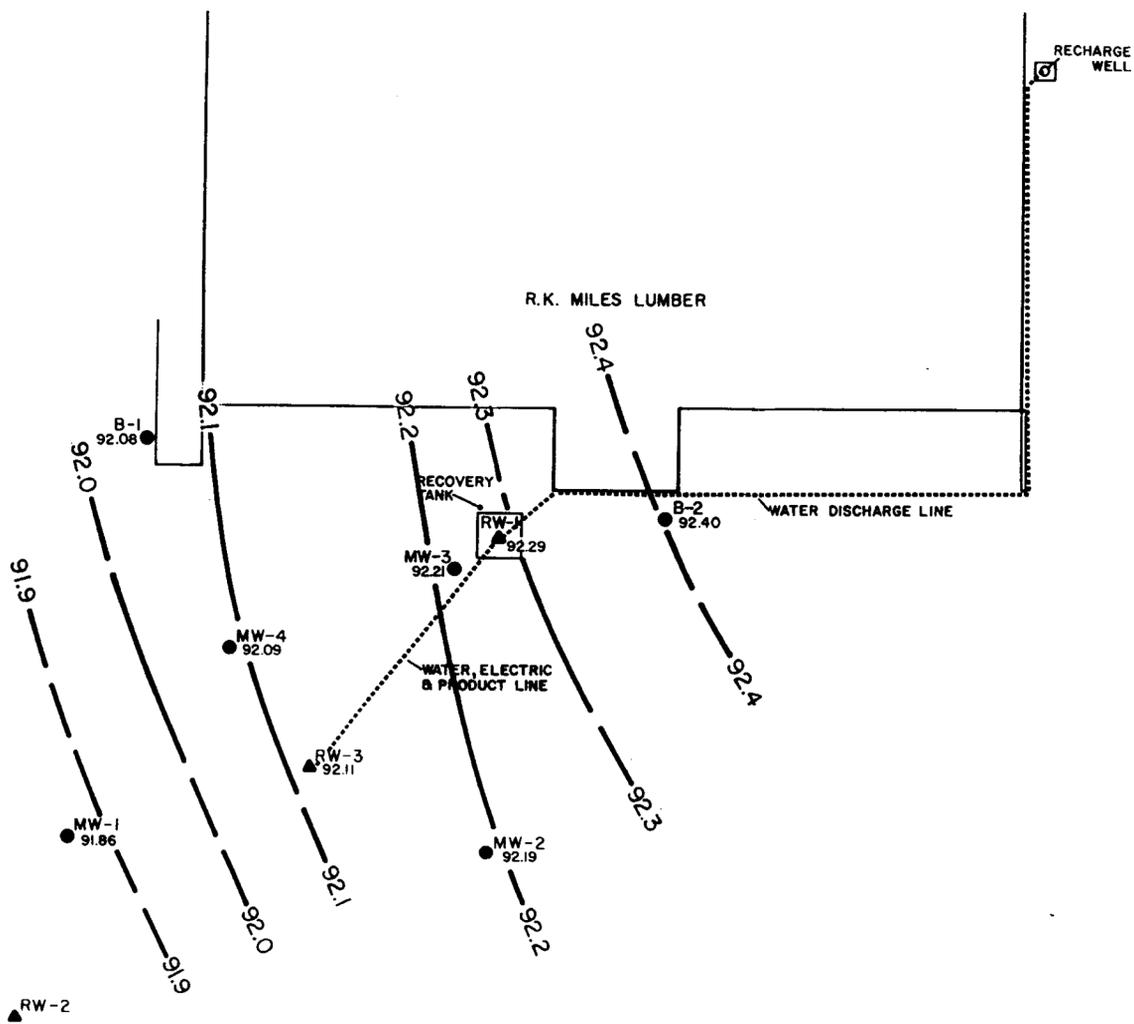


FIGURE 3
GROUNDWATER CONTOUR MAP

PROJECT: R.K. MILES LUMBER
 LOCATION: MANCHESTER, VT.
 DRAWING NO.: IO-2104-2
 MONITORING DATE: 5-9-85

● MONITORING WELL
 ▲ RECOVERY WELL
 WELL IDENTIFICATION
 EX: MW-1 - WELL I.D.
 91.86 - WATER TABLE ELEV. (FT)

CONTOUR INTERVALS AS SHOWN - IN FEET



Natural Groundwater Flow

Based on groundwater contours (Figure 3) it is apparent that groundwater is flowing in a westward direction towards the Battenkill River. The rate of groundwater flow can be calculated using the equation $V = K \frac{dh}{dl}$

where V = Darcy Velocity

K = Hydraulic Conductivity = 465 ft/day

$$\frac{dh}{dl} = \text{Hydraulic Gradient} = \frac{.5\text{ft}}{105\text{ft}} = .0048$$

Solving the above equation yields a natural average flow velocity of 2.2 ft/day. In summary, groundwater flow beneath the site is to the west at a rate of 2.2 ft/day.

Recovery Well Effectiveness

A crucial factor in evaluation of any recovery well is over what area are contaminants being drawn in, or how much of the area of contamination is being contained by pumping the well.

Groundwater Technology pumped R-1 at a rate of 20 gpm for a period of six weeks. During this period no free-floating hydrocarbon accumulated in the well. The downgradient capture zone of the well is calculated using the equation:

$$\text{Stagnation Point} = \frac{Q}{2(3.14)hV}$$

The Stagnation Point is the furthest point downgradient of the well where water flows back towards the well.

and Q = pumping rate = 3850 ft³/day
 h = saturated thickness = 10 ft
 V = Darcy Velocity = 2.2 ft/day



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Solving this equation gives a downgradient stagnation point of 56 feet. In a direction parallel to natural groundwater contours, the recovery well can capture water at a distance 3.14 times the downgradient stagnation distance. This gives a cross gradient capture zone radius of 176 feet for Well R-1. Any contamination upgradient of the well would naturally flow into the well.

Water Quality Results

Water quality results (enclosed as Appendix C) indicate that the highest levels of total dissolved hydrocarbons exist in the vicinity surrounding the spill. Insignificant levels of the benzene, toluene, ethyl benzene, and total xylene constituents were detected on both sampling occasions. The more significant concentrations of dissolved hydrocarbons are the C4 - C12 aliphatics and miscellaneous C8 - C12 aromatics. These results are typical for #2 fuel oil. The increase in total dissolved hydrocarbons in the vicinity of the spill, from 441 ppb (R-1) on March 26, 1985 to 3780 ppb (MW-3) on May 9, 1985 may be a result of a rise in the water table elevation. The Water Table Depression Pump in R-1 was deactivated on May 8 resulting in an approximate 2 foot increase in water elevation at the well. As the water table rose it may have saturated contaminated soil resulting in higher concentrations of dissolved hydrocarbons in the groundwater.

Recovered Product Estimate

While it is known that approximately 1800 gallons of #2 fuel oil was lost it is not known exactly how much petroleum product has been recovered. A regular inventory of recovered fuel oil was not kept. Documentation from Domermuth Petroleum Maintenance Corporation, dated April 15, 1985, indicates that a total of 3,600 gallons of liquid was hauled from the site. Domermuth Corporation is certain that one shipment totaling 300 gallons was "virtually 100% #2 fuel oil". Of the remaining 3,300 gallons,



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Domermuth estimates that 220 gallons was petroleum and 3080 gallons water. Domermuth also estimates that 100 gallons of fuel oil was contained in the 35 cubic yards of soil excavated from the site. This brings the total estimate of recovered product to 620 gallons.

CONCLUSIONS AND RECOMMENDATIONS

Groundwater Technology believes that the inadequate inventory of recovered fuel oil makes it an impossible task to estimate the quantity of oil which may still be in the ground. Future action should be based on what is found in the monitoring wells.

It is doubtful that any #2 fuel oil migrated off site. The installation of a pumping/recovery well within days of the discovered spill would have contained the migration of petroleum. Capture zone calculations show that if 2.5 feet of drawdown was maintained in R-1, the well would capture petroleum products up to 56 feet downgradient and 176 feet either side of the well.

As of May 9, 1985 no free-floating petroleum was present in the monitoring wells on-site. Total dissolved hydrocarbons ranged from 44 ppb (MW-2) to 3780 ppb (MW-3). The majority of the dissolved constituents are the C4 - C12 aliphatic hydrocarbons and the miscellaneous C8 - C12 aromatics. Very little benzene, toluene, ethyl benzene or xylene was detected in the water.

Groundwater flow beneath the site is in a westward direction and recharging the Battenkill River. The dissolved hydrocarbons in the groundwater will gradually discharge into the Battenkill River. However, the tremendous dilution effect of the Battenkill River will reduce the dissolved hydrocarbon concentration to an undetectable level. No private water wells exist between the R.K. Miles Site and the Battenkill River.



Groundwater Technology recommends continued monthly monitoring of the six on-site monitoring wells. The Battenkill River should also be sampled downstream of the site to determine any effects to the river. Further action should be based on the water quality results.



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A P P E N D I X A

DRILLING LOGS



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Well Number MW 1

Drilling Log

Project R. K. MILES LUMBER Owner _____
 Location Manchester, VT. Project Number 10-2104
 Date Drilled 5-8-85 Total Depth of Hole 20' Diameter .6"
 Surface Elevation _____ Water Level, Initial _____ 24-hrs. _____
 Screen: Dia. 2" Length 10' Slot Size .020"
 Casing: Dia. 2" Length 3' Type PVC
 Drilling Company Gap Mnt. Drilling Method Hollow Stem Auger
 Driller John Holeman Log by G. Robinson

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		ROAD BOX			
1		BETONITE SEAL			
2		CASING			
3					
4					
5		NATURAL BACKFILL	S-1		5.0-5.5' Fine to coarse sand with angular rock, some silt. Sample was wet. No petro odor.
6					
7		SCREEN			
8					
9					
10			S-2		10.0-11.5' Brown silt with fine sand and some clay. Some angular rock. No petro odor.
11					
12			S-3		11.5-13.0' - Large boulders and 6" cobbles.
13					
14					
15					
16					
17					
18					
19			S-4		18.5-20.0' - Silt and fine sand, very uniform and dense. Trace clay.
20					
21					
22					
23					
24					
25					

Note: Water at @ 5.0'.



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Well Number MW-2

Drilling Log

Project R.K. MILES LUMBER Owner _____

Location Manchester, VT. Project Number 10-2104

Date Drilled 5-8-85 Total Depth of Hole 15.0' Diameter 6"

Surface Elevation _____ Water Level, Initial 24-hrs.

Screen: Dia. 2" Length 10' Slot Size .020"

Casing: Dia. 2" Length 3' Type PVC

Drilling Company Gap Mnt. Drilling Method Air Rotary

Driller John Holeman Log by G. Robinson

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0					
1		ROAD BOX			
2		BETONITE			
3		CASING			
4					
5		GRADE #3 SAND PACK			
6		SCREEN			
7					
8					
9			S-1		8.0-9.0' - Brown fine to medium sand with silt. Some clay, pebbles and cobbles. No petro odor.
10					@10.0' - 1/2"-3/4" stone with sand and silt(brown) blowing out of hole.
11					
12					
13					@13.0' - Brown silt and fine sand blowing out of hole.
14					
15					
16					
17					
18					
19					
20					Note: Water @ 7.0-8.0'.



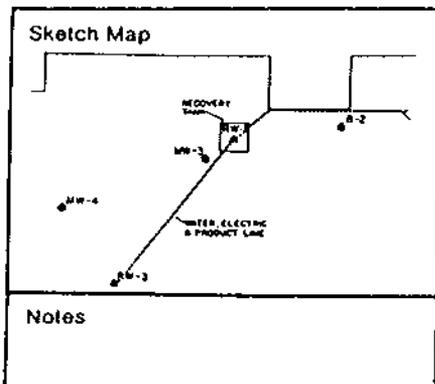
GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc.

MW-3

Drilling Log

Project R.K. Miles Lumber Owner _____
 Location Manchester, Vermont Project Number 10-2104
 Date Drilled 5-8-85 Total Depth of Hole 13.0' Diameter 6.0"
 Surface Elevation _____ Water Level, Initial _____ 24-hrs. _____
 Screen: Dia. 2.0" Length 10.0' Slot Size .020"
 Casing: Dia. 2.0" Length 3.0' Type PVC
 Drilling Company Gap Mnt. Drilling Method Air Rotary
 Driller John Holeman Log by Gary Robinson



Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)	
0		ROAD BOX			0.0-6.0 - Brown medium sand with silt and trace clay.	
1		BENTONITE SEAL				
2		CASING				
3						
4		GRADE #3 SAND PACK				
5						
6		SCREEN				
7			S-1			6.0-7.5 - Brown medium to fine sand. Some silt, trace clay and cobbles. Dry, no odor.
8						9.0' - Petro odor from hole.
9						
10						
11						
12			S-2			11.0-12.5' - Grey to brown silty clay; well graded confining layer.
13						
14						
15						



GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc.

Well Number MW-4

Drilling Log

Project R.K. Miles Lumber Owner _____

Location Manchester, VT Project Number 10-2104

Date Drilled 5-8-85 Total Depth of Hole 13.0' Diameter 6.0"

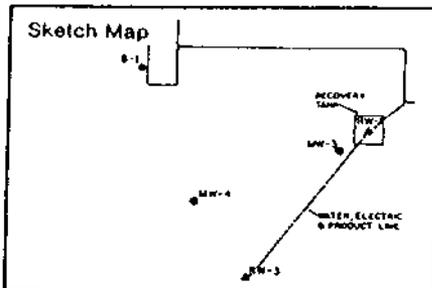
Surface Elevation _____ Water Level, Initial _____ 24-hrs. _____

Screen: Dia. 2.0" Length 10.0' Slot Size .020"

Casing: Dia. 2.0" Length 3.0' Type PVC

Drilling Company Gap Mnt. Drilling Method Air Rotary

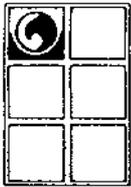
Driller John Holeman Log by Gary Robinson



Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		ROAD BOX			
1		CASING			
2		BEUTONITE SEAL			
3		NATURAL BACKFILL			
4					
5					
6		GRADE #30 SAND PACK	S-1		5.0-6.5' - Brown medium to fine sand and silt with gravel and trace of clay. No petro odor. Moist soil.
7		SCREEN			
8					
9					
10					@ 10.0' - Rocky layer, no sample taken.
11					11.0-13.0' - Fine to coarse sand and coarse gravel, some silt.
12					
13					
14					
15					

A P P E N D I X B
WELL DATA MONITORING FORMS



GROUNDWATER TECHNOLOGY

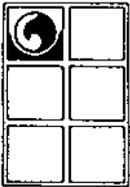
Division of Oil Recovery Systems, Inc.

WELL DATA MONITORING FORM

Project: R.K. Miles Lumber # 10-2104
Location: Manchester, Vt.
Date: 5-9-85 Time: 8:00 AM
Operator: G. Robinson
Method: Electronic Interface Probe
Equipment # 2P

Well ID	WELL DEPTH	T.O.C. ELEV	DEPTH to		PETRO THICK	PETRO GRAV	HYDRO EQUIV	CORR	
			WATER	PETRO				DTW	WAT EL
B-1	10.79	99.99	7.91	7.91	0.00	0.0	0.000	7.91	92.08
B-2	11.92	102.33	9.93	9.93	0.00	0.0	0.000	9.93	92.40
R-1	9.75	99.09	6.80	6.80	0.00	0.0	0.000	6.80	92.29
R-2	8.92	99.18	7.24	7.24	0.00	0.0	0.000	7.24	91.94
R-3	6.17	96.13	4.02	4.02	0.00	0.0	0.000	4.02	92.11
SG-1		93.25	2.00	2.00	0.00	0.0	0.000	2.00	91.25
SG-2		90.94				0.0			
SG-3		89.36	0.63	0.63	0.00	0.0	0.000	0.63	88.73
MW-1	13.00	98.27	6.41	6.41	0.00	0.0	0.000	6.41	91.86
MW-2	13.00	98.29	6.10	6.10	0.00	0.0	0.000	6.10	92.19
MW-3	13.00	98.64	6.43	6.43	0.00	0.0	0.000	6.43	92.21
MW-4	13.00	98.63	6.54	6.54	0.00	0.0	0.000	6.54	92.09

Comments: Sheen noted in R-3. T.O.C. of R-2 may be incorrect due to damage to pipe.



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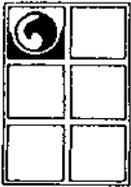
Division of Oil Recovery Systems, Inc.

WELL DATA MONITORING FORM

Project: R.K. Miles Lumber # 10-2104
Location: Manchester, Vt.
Date: 3-26-85 Time:
Operator: G. Robinson
Method: Electronic Interface Probe
Equipment #0002

Well ID	WELL DEPTH	T.O.C. ELEV	DEPTH		PETRO THICK	PETRO GRAV	HYDRO EQUIV	CORR DTW	CORR WAT EL
			to WATER	to PETRO					
B-1		99.99	7.26	7.26	0.00	0.0	0.000	7.26	92.73
B-2		102.33	9.54	9.54	0.00	0.0	0.000	9.54	92.79
R-1		99.09	6.32	6.32	0.00	0.0	0.000	6.32	92.77
R-2		99.18	6.79	6.79	0.00	0.0	0.000	6.79	92.39
R-3		96.13	3.46	3.45	0.01	0.88	0.009	3.45	92.68
SG-1		93.25	2.00	2.00	0.00	0.0	0.000	2.00	91.25
SG-2		90.94	1.21	1.21	0.00	0.0	0.000	1.21	89.73

Comments:



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WELL DATA MONITORING FORM

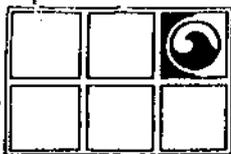
Project: R.K. Miles Lumber # 10-2104
Location: Manchester, Vt.
Date: 3-25-85 Time:
Operator: R. McIntosh
Method: Electronic Interface Probe
Equipment #0002

Well ID	WELL DEPTH	T.O.C. ELEV	DEPTH		PETRO THICK	PETRO GRAY	HYDRO EQUIV	CORR	
			to WATER	to PETRO				DTW	WAT EL
B-1	10.79	99.99	7.20	7.20	0.00	0.0	0.000	7.20	92.79
B-2	11.92	102.33	9.43	9.43	0.00	0.0	0.000	9.43	92.90
R-1	9.75	99.09	6.27	6.27	0.00	0.0	0.000	6.27	92.82
R-2	8.92	99.18	6.75	6.75	0.00	0.0	0.000	6.75	92.43
R-3	6.17	96.13	3.40	3.39	0.01	0.88	0.009	3.39	92.74

Comments:

A P P E N D I X C

LABORATORY REPORTS



GROUNDWATER TECHNOLOGY LABORATORY

ANALYTICAL & CONSULTING SERVICES
Division of Oil Recovery Systems, Inc.
4 Mill St., Greenville, NH 03048
Tel: (603) 878-2500

Consulting Offices:

Needham, MA — Redondo Beach, CA
Chadds Ford, PA — Concord, CA
Novi, MI

5/30/85

Report No. 10-2104-2

Submitted to:

Rich McIntosh
Groundwater Technology
1420 Providence Highway, Suite 128
Norwood, MA 02062

Sample Identification:

The attached report covers water samples # 15797-15801 taken by Gary Robinson using 40 ml septum-capped glass vials at site # 10-2104, Manchester, Vermont.

Method:

Analysis was performed for volatile hydrocarbons by purge and trap gas chromatography with flame ionization detection as per EPA Method 602. Quantification was performed on a very polar open tubular fused silica capillary column which fractionates aliphatics (up to C12) away from the volatile aromatics. Qualitative confirmation was performed for all samples on a dissimilar column. Chromatographic conditions are referenced in GTL Method Code 103. Hexane and ortho xylene are used as calibration standards for the aliphatic hydrocarbons and miscellaneous aromatics, respectively.

Minimum Detection Limit (MDL) at 5 times background is 0.5 ppb for all parameters. The level for reliable quantitation for the summed groups such as aliphatics is 20 ppb. Recognizable traces below this limit are referenced as a presence of trace quantities in the footnotes. Samples diluted in order to maintain the calibrated range are so indicated by a footnote giving the factor by which the MDL is raised.

Sampling and sample handling and preservation are specified by this laboratory to be as per EPA Method 602. Any irregularities are referenced in the attached quality assurance report.

Results:

Results are reported in ppb (ug/l).

Prepared by:

Eileen Foley
Analytical Program Manager

J. Pushee
Analyst

HYDROCARBONS IN WATER $\mu\text{g/L}$ (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12		MISC. AROMATICS		TOTAL
								ALIPHATIC HYDROCARBONS	CB - C12	CB - C12	AROMATICS	
15797	MW-1	5/9/85	5/14/85	3	5	ND	4	433	ND	ND	445	
15798	MW-2	5/9/85	5/14/85	ND	ND	ND	ND	44	ND	ND	44	
15799	MW-3	5/9/85	5/15/85	ND	ND	2	27	266	3480	3780	*5	
15800	MW-4	5/9/85	5/15/85	ND	ND	ND	4	125	417	546	*5	
15801	DD	5/9/85	5/15/85	ND	ND	ND	ND	ND	46	46		

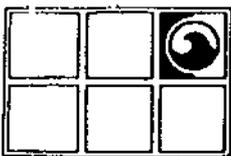
***NOTES:**

5 = Several uncategorized compounds were present at concentrations less than 200 ppb based on hexane's response factor.

MW = Monitoring Well
DD = Drainage Ditch

REPORT NO. 10-2104-2





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Quality Assurance Documentation

Statement of Sample Integrity:

The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Quality Assurance Specifications:

The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

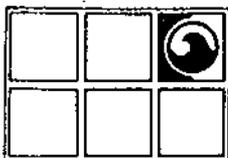
Certification:

The data in this report has been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb
Technical Director

APR 10 1985



GROUNDWATER TECHNOLOGY LABORATORY

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Novi, MI

4/5/85

Report No. 10-2104-1

Submitted to:

Rick McIntosh

Groundwater Technology

1420 Providence Highway, Suite 128

Norwood, MA. 02062

The attached report covers water samples 14793-14797 taken by Gary Robinson at site 10-2104, Manchester Center, Vermont and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst S.E.B.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER $\mu\text{g/L}$ (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12		MISC.		TOTAL
								ALIPHATIC HYDROCARBONS	AROMATICS C8-C12			
14793	B-1	3/26/85	4/4/85	ND	ND	ND	ND	TRACE	ND	ND	TRACE	
14794	B-2	3/26/85	4/4/85	14	ND	ND	ND	21	ND	ND	35 *1	
14795	R-1	3/26/85	4/4/85	ND	5	ND	92	25	319	ND	441	
14796	R-2	3/26/85	4/4/85	ND	ND	ND	ND	TRACE	ND	ND	TRACE	
14797	D-D	3/3/26	4/4/85	ND	ND	ND	ND	TRACE	ND	ND	TRACE	

***NOTES:**

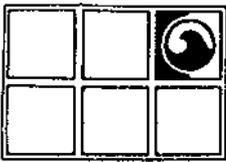
TRACE = COMPOUNDS DETECTED BUT BELOW LEVEL FOR RELIABLE QUANTITATION.
 ND = NONE DETECTED.

1 = METHANE DETECTED AT 10-100 PPB.

Report No. 10-2104-1



GROUNDWATER TECHNOLOGY LABORATORY
 4 MILL STREET, GREENVILLE, NEW HAMPSHIRE 03048



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Quality Assurance Specifications:

The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:

The data in this report has been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb
Technical Director