



## State of Vermont

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Department of Environmental Conservation  
State Geologist  
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Department of Environmental Conservation  
Waste Management Division  
103 South Main Street/West Office  
Waterbury, Vermont 05671-0404  
(802) 241-3888  
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February 23, 1999

Ken Arthur  
Irving Oil  
15 Main Street  
Derby Line, Vermont 05830

RE: Petroleum Contamination at Derby Line Mainway  
Derby Line, Vermont  
SMS Site # 98-2581

Dear Mr. Arthur:

The Sites Management Section (SMS) has received the Underground Storage Tank (UST) closure report which outlines the subsurface conditions for the above referenced site. The fieldwork was conducted by Johnson Company on January 4, 1999. The report is dated January 6, 1999 and summarizes the degree and extent of contamination encountered. The USTs removed include:

- UST #1 - 10,000 gallon gasoline UST
- UST #2 - 10,000 gallon gasoline UST
- UST #3 - 4,000 gallon gasoline UST

During the site activities, screened soils had concentrations up to 499 parts per million (ppm) as measured by a photoionization detector (PID). The peak PID readings were measured at depths of 10 to 14 feet below ground surface (fbgs) in the excavation. The limits of soil contamination were not defined. All soil was used for backfill at the conclusion of the UST removal program.

Site soils consisted of primarily medium to coarse sand. Groundwater was not encountered at a (maximum) depth of approximately 14 fbgs.

The Derby Line Mainway was not reported to have been inspected for sensitive receptors. The possible receptors potentially affected include groundwater, basements of adjacent buildings, utilities, nearby surface water, and public or private drinking water wells.

Based on the report information, the SMS has determined additional work is necessary to determine the severity of contamination. Due to possible contamination to nearby receptors, the SMS requests that Irving Oil retain the services of a qualified environmental consultant to perform the following:

- Further define the degree and extent of contamination to the soil.
- If appropriate, determine if the airspace beneath the site and site adjacent building(s) (e.g. basements) has been impacted by the release using a PID. Wall and floor construction and susceptibility to vapor migration should be noted. PID measurements should be made in cracks and/or joints likely impacted. If the airspace has been impacted, SMS requests confirmatory sampling and laboratory analyses be performed using EPA Method TO-2.
- Determine the degree and extent of contamination, if any, to groundwater. A sufficient number of

monitoring sites should be installed to adequately define the severity of site contamination. Analyze groundwater samples for BTEX and MTBE. At sites proximal to water supply sources, determine the hydrologic relationship of the contaminated area to the water supply source. Pumping influences should be considered in the evaluation.

- Assess the potential for contaminant impact on sensitive receptors. Base this update on all available information and include basements of adjacent buildings, nearby surface water, any proximal drinking water sources, wetlands, sensitive ecologic areas, outdoor or indoor air, sewers, or utility corridors. Sample and analyze any at-risk water supplies for BTEX, TPH and MTBE compounds.
- Determine the need for long-term treatment and/or monitoring that addresses groundwater contamination.
- Submit a summary report that outlines the work performed, as well as provides conclusions and recommendations. As appropriate include analytical data; a site map showing the location of any potential sensitive receptors, stockpiled soils and monitoring or sample locations; an area map; detailed well logs; and a groundwater contour map.
- With the Workplan or Expressway form, please submit a site location map at an approximate scale of 1:24000 showing the location of the site. Please include a scale, a north arrow, the SMS site number, and a citation of the source map. The purpose of this map is to enable the SMS to enter the site location into a Geographical Information Systems database.

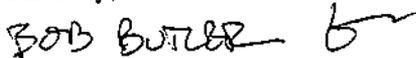
Please have your consultant submit a preliminary work plan and cost estimate or a site investigation expressway notification form within fifteen days of your receipt of this letter, so it may be approved prior to the initiation of onsite work. Enclosed please find a list of consultants who perform this type of work as well as the brochure "*Selecting Your UST Cleanup Contractor*," which will help you in choosing an environmental consultant.

Based on current information, the underground storage tanks at Derby Line Mainway are eligible for participation in the Petroleum Cleanup Fund (PCF). You must provide written proof to the SMS that you hold no other applicable insurance in order to receive reimbursement from the PCF. The owner or permittee must pay for the removal and/or repair of the failed tank(s), and for the initial \$10,000.00 of the cleanup. The fund will reimburse the tank owner or permittee for additional eligible cleanup costs of up to \$1 million. All expenditures must be pre-approved by the Agency or performed in accordance with the "*Site Investigation Guidance*" expressway program. Please refer to the enclosed guidance document titled, "*Procedures for Reimbursement from the Petroleum Cleanup Fund*" for additional information concerning the PCF.

The Secretary of the Agency of Natural Resources reserves the right to seek cost recovery of fund monies spent at the Derby Line Mainway site if the Secretary concludes that Irving Oil is in significant violation of the Vermont Underground Storage Tank Regulations or the Underground Storage Tank statute (10 V.S.A., Chapter 59).

We realize this may be a lot to absorb and respond to. We are here to help make this process as effective and uncomplicated as possible. Please review the enclosed documents and call me with any questions you may have. I can be reached at (802) 241-3876.

Sincerely,



Chuck Schwer, Supervisor  
Sites Management Section

Enclosures (3)

cc: Derby Line Selectboard w/o enclosure  
Derby Line Health Officer w/o enclosure  
DEC Regional Office w/o enclosure (transmitted electronically) ✓  
Amy Alexander, Johnson Company w/o enclosure (transmitted electronically) ✓

CS:rgb

JUN 24 1999

June 22, 1999

Mr. Chuck Schwer  
Waste Management Division  
Vermont Department of Environmental Conservation  
103 South Main Street/West Building  
Waterbury, Vermont 05671-0404

Re: Report of Investigation of Petroleum Contamination at Derby Line Mainway  
SMS Site # 98-2581; JCO# 1-0913-3  
Latitude 45° 0' 14"N; Longitude 72° 06' 02"E  
JCO # 1-0913-3

Dear Chuck:

In accordance with the approved April 6, 1999 Work Plan the investigation of the Derby Line Mainway petroleum release site (the Site) has been completed. The on-site portion of the work was conducted on May 18, 1999. A report of the investigation is attached.

Please call with any questions you may have concerning this Site. We look forward to your response to this report.

Respectfully Submitted,  
THE JOHNSON COMPANY, INC.

By:



Don Maynard, P.E., C.P.G.

Senior Geologist/Engineer

cc: Gerry Lemire, Irving Oil Corporation

Reviewed By: j-b  
I:\PROJECTS\1-0913-3\INVSTRPT.DFT June 9, 1999

Phase (check one)	Type (check one)
<input type="checkbox"/> Initial Site Investigation <input type="checkbox"/> Corrective Action Feasibility Investigation <input type="checkbox"/> Corrective Action Plan <input type="checkbox"/> Corrective Action Summary Report <input type="checkbox"/> Operations & Monitoring Report	<input type="checkbox"/> Work Scope <input type="checkbox"/> Technical Report <input type="checkbox"/> PCF Reimbursement Request <input type="checkbox"/> General Correspondence

**Report of Investigation  
of Petroleum Contamination**

**Derby Line Mainway  
Derby Line, Vermont**

**SMS Site # 98-2581**

**Prepared for:  
Irving Oil Corporation  
700 Maine Ave.  
Bangor, Maine 04401  
Contact: Gerry Lemire  
(207) 989-6010**

**Prepared By:  
The Johnson Company, Inc.  
100 State Street, Suite 600  
Montpelier, Vermont 05602  
Contact: Joel Behrsing, P.E.  
(802) 229-4600**

**June 22, 1999**

## EXECUTIVE SUMMARY

The Johnson Company performed a site investigation at the Derby Line Mainway, 15 Main Street, Derby Line, Vermont. One purpose of the investigation was to evaluate the magnitude of petroleum contamination found on the Site during a UST closure in January 1999. The second purpose was to identify and qualitatively evaluate potential receptors of the contamination.

Soil contamination was measured with a photoionization detector (PID) with headspace concentrations between 10 and 546 parts per million by volume (ppmV). The depth of soil contamination above 10 ppmV appears to be limited to between six and 18 feet below ground surface (fbgs). The contaminated area is below and downgradient of the former gasoline underground storage tank (UST) "A". The source of contamination appears to be leaks from the UST "A" or its associated piping.

Vermont Groundwater Enforcement Standards (VGES) were exceeded by orders of magnitude near the former UST and at the downgradient property line for the following compounds: methyl-tert-butyl ether (MTBE), benzene, 1,2,5-trimethylbenzene, and 1,2,4-trimethylbenzene. Reported concentrations of toluene, xylenes, ethylbenzene, and naphthalene also exceeded VGES, but only in the sample collected near the former UST, and not in the downgradient well. No non-aqueous phase liquids (NAPLs) were observed in the temporary monitoring wells. Groundwater contamination above VGES combined with soil headspace concentrations above 10 ppmV suggests that the area of contaminated media is at least 2,500 square feet and comprises a volume of more than 850 cubic yards.

The atmosphere in two buildings in the vicinity of the contaminated soils and groundwater was checked with a (PID) on May 18, 1999. No elevated readings were detected. The cellars of these buildings were above groundwater on May 18, 1999. However, they are potential receptors of petroleum vapors and infiltrating dissolved contamination during seasonal high groundwater conditions.

The vicinity of the Site is served by municipal water via a 10 inch diameter water main. There are no reported public water sources at risk of contamination from the Site. There is one private water supply well reportedly located approximately 1/4 mile from the observed groundwater contamination. Its reported location is not downgradient of the Site.

The municipal sewer which serves the vicinity of the Site has a 12 foot deep manhole in the midst of the observed subsurface contamination. This manhole had a PID headspace of 3 ppmV on May 18, 1999. The bottom of the manhole was above the groundwater level on May 18. However, the sewer system is a potential receptor of petroleum vapors and infiltrating dissolved contamination during seasonal high groundwater conditions.

No wetlands or surface waters appear to be threatened by the observed contamination. Physical contact with contaminated soils is unlikely except during excavation greater than three feet deep.

The installation of four permanent groundwater monitoring wells, and the performance of two confirmatory soil borings, is recommended. Three rounds of monitoring of three downgradient monitoring wells and one on-site well is recommended to evaluate the extent, migration, and degradation of the contaminant plume. Monitoring of the air quality in the two nearby residences and in the sewer manhole is also recommended.

## TABLE OF CONTENTS

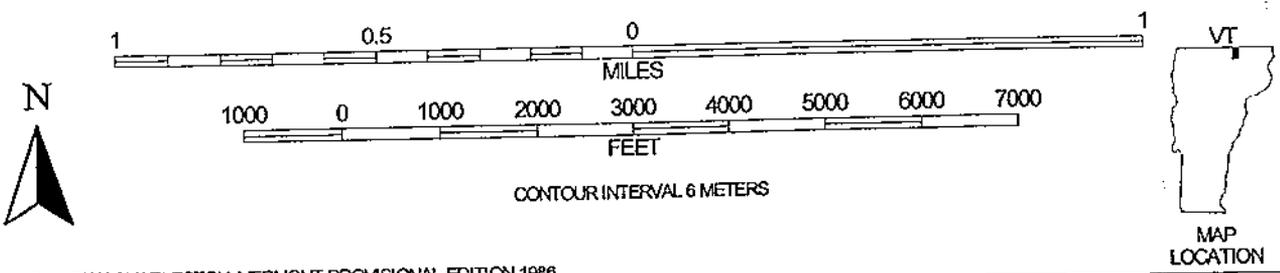
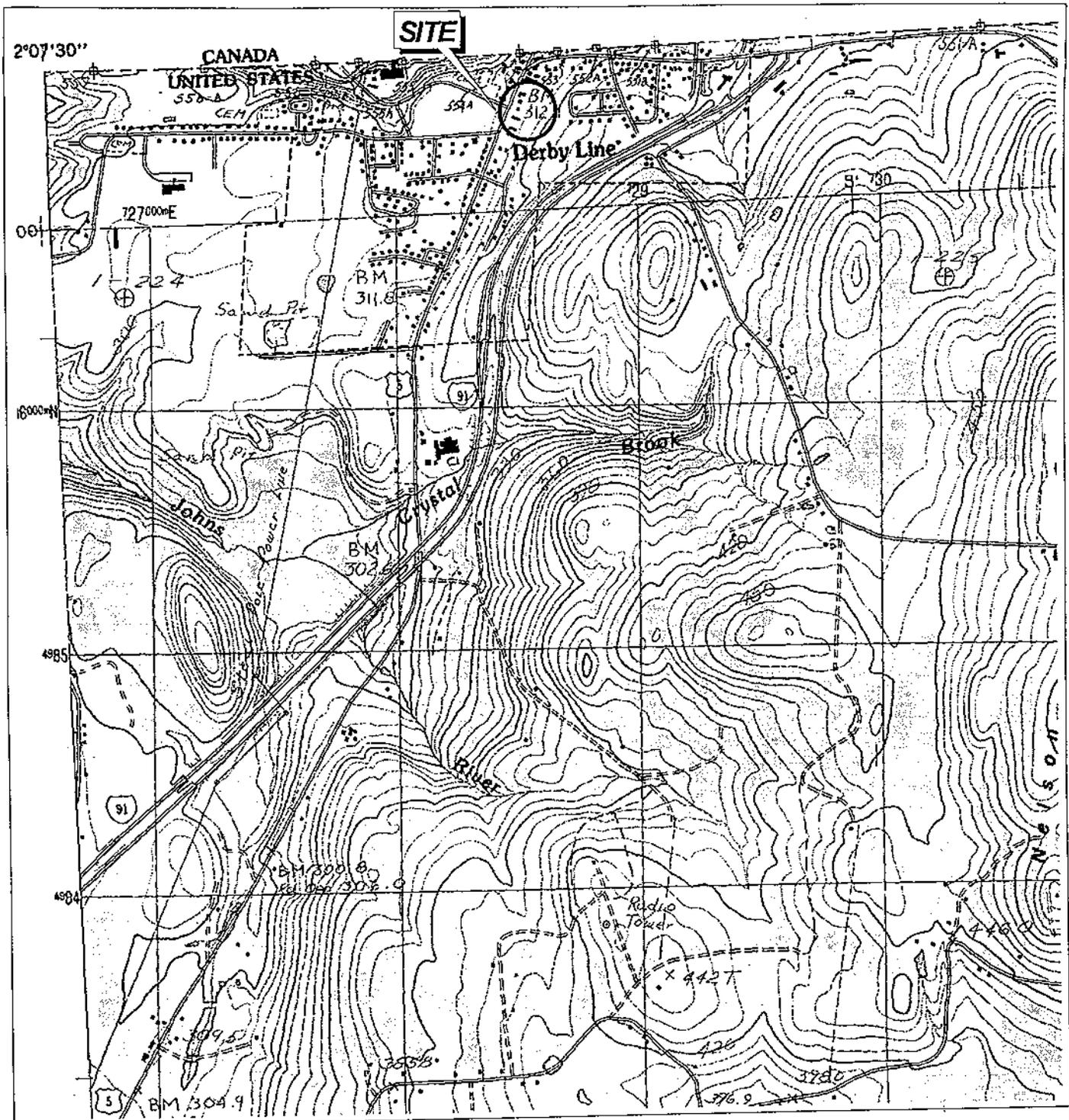
EXECUTIVE SUMMARY .....	i
1.0 INTRODUCTION .....	1
2.0 SITE INVESTIGATION .....	4
2.1 HISTORICAL BACKGROUND .....	4
2.1.1 <u>Local Water Supply Wells</u> .....	4
2.1.2 <u>National Wetland Inventory</u> .....	4
2.2 SOIL AND GROUNDWATER INVESTIGATION .....	4
2.2.1. <u>Soil Coring/Overburden Characterization</u> .....	4
2.2.2 <u>Temporary Monitoring Well Installation</u> .....	8
2.2.3 <u>Groundwater Sampling and Analysis</u> .....	9
2.3 RECEPTOR SURVEY .....	11
3.0 ANALYTICAL RESULTS .....	13
4.0 CONCLUSIONS AND RECOMMENDATIONS .....	16

## 1.0 INTRODUCTION

The Derby Line Mainway, located at 15 Main Street, Derby Line, Vermont, (see Figure 1), currently is undergoing an investigation to evaluate the extent and magnitude of petroleum contamination found on the Site during a underground storage tank (UST) closure on January 4 and 5, 1999. The Site includes an approximately 0.29 acre parcel of land, with an 1,600 square foot building housing the retail store and retail gasoline sales counter (see Figure 2). The building has a concrete slab floor and is a single story.

Three gasoline USTs were closed at the Site on January 4 and 5, 1999 (Vermont UST Facility Number 1944). Soil contamination documented by photoionization detector (PID) headspace readings in excess of 10 parts per million by volume (ppmV) was observed in the excavation during the closure of UST "A". The USTs had been in use since their installation in 1984 until December 21, 1998. The USTs have been replaced by new tanks located on the adjoining property, 13 Main Street. Both properties are owned by Irving Oil Corporation.

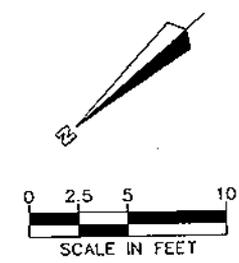
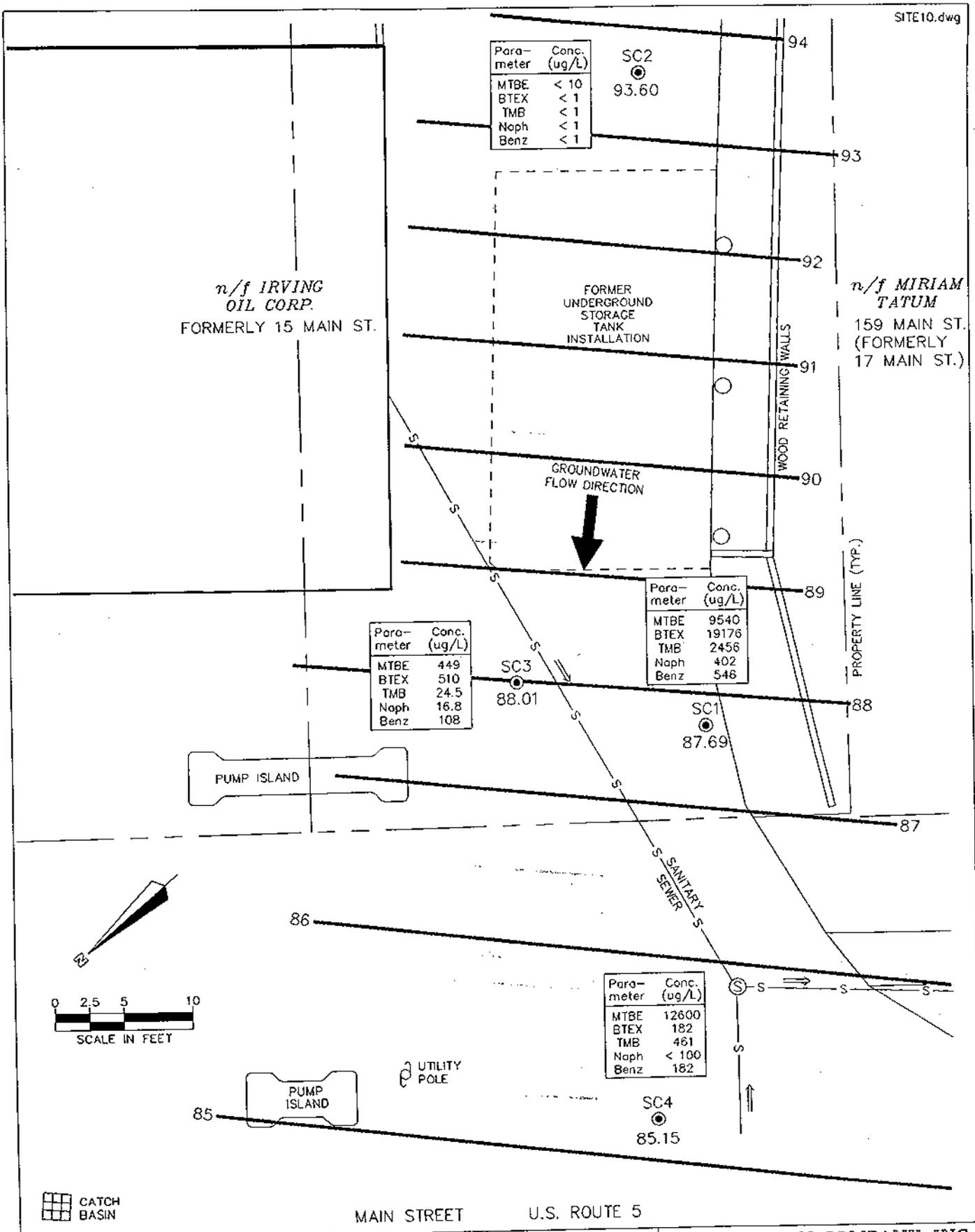
Because of the noted contamination; and the need for further information regarding the degree of contamination, and potential for impact to sensitive receptors, the Waste Management Division's Site Management Section (SMS) requested a site investigation be performed to investigate the contamination source. A site investigation commenced on May 18, 1999, in accordance with The Johnson Company's work plan, dated April 6, 1999 and approved by the SMS in a letter dated April 27, 1999.



BASE MAP: WEST CHARLESTON, VERMONT PROVISIONAL EDITION 1986

**FIGURE 1: SITE LOCATION MAP**  
**IRVING OIL DERBY LINE MAINWAY**  
**SMS # 98-2581**  
**DERBY, VERMONT**

**THE JOHNSON COMPANY, INC.**  
 Environmental Sciences and Engineering  
 100 STATE STREET  
 MONTPELIER, VT 05602



**FIGURE 2: MAP OF RELATIVE GROUNDWATER ELEVATION ON 5/18/99 IRVING OIL CORP., DERBY LINE, VERMONT**

**THE JOHNSON COMPANY, INC.**  
 Environmental Sciences and Engineering  
 100 STATE STREET MONTPELIER, VT 05602  
 DATE: 6/10/99 PROJECT: 1-0913-3  
 DRAWN BY: TJK *TJK* SCALE: 1"=10'

## 2.0 SITE INVESTIGATION

The on-site investigation consisted of the following tasks:

- 1) A historical background search of the Site including review of local water supply well data and National Wetland information.
- 2) Soil coring, soil screening for volatile organic compound (VOC) vapors, temporary monitoring well installation, and groundwater sampling and analysis for petroleum-related aromatic hydrocarbons at locations hydraulically upgradient and downgradient of the suspected contamination source area.
- 3) A receptor survey, which included identification and analysis of potential sensitive receptors (nearby basements, subsurface utilities and sewers, and water supply wells ( Figure 3)) and a qualitative determination of the risk to those receptors.

### 2.1 HISTORICAL BACKGROUND

#### 2.1.1 Local Water Supply Wells

A review of the Water Supply Maps dating from 1974-1998, in the area around the Site indicates that approximately 17 private drinking water wells exist within one mile of the Site. In addition, the data indicate that 2 drinking water well exists within ½-mile of the Site, and one well, drilled in 1979 for a Mr. Butters (Vermont Well ID #206) is possibly located within 1,000 feet of the Site. Because of their reported locations and observed groundwater flow directions, these wells do not appear to be at risk from contamination on the Site.

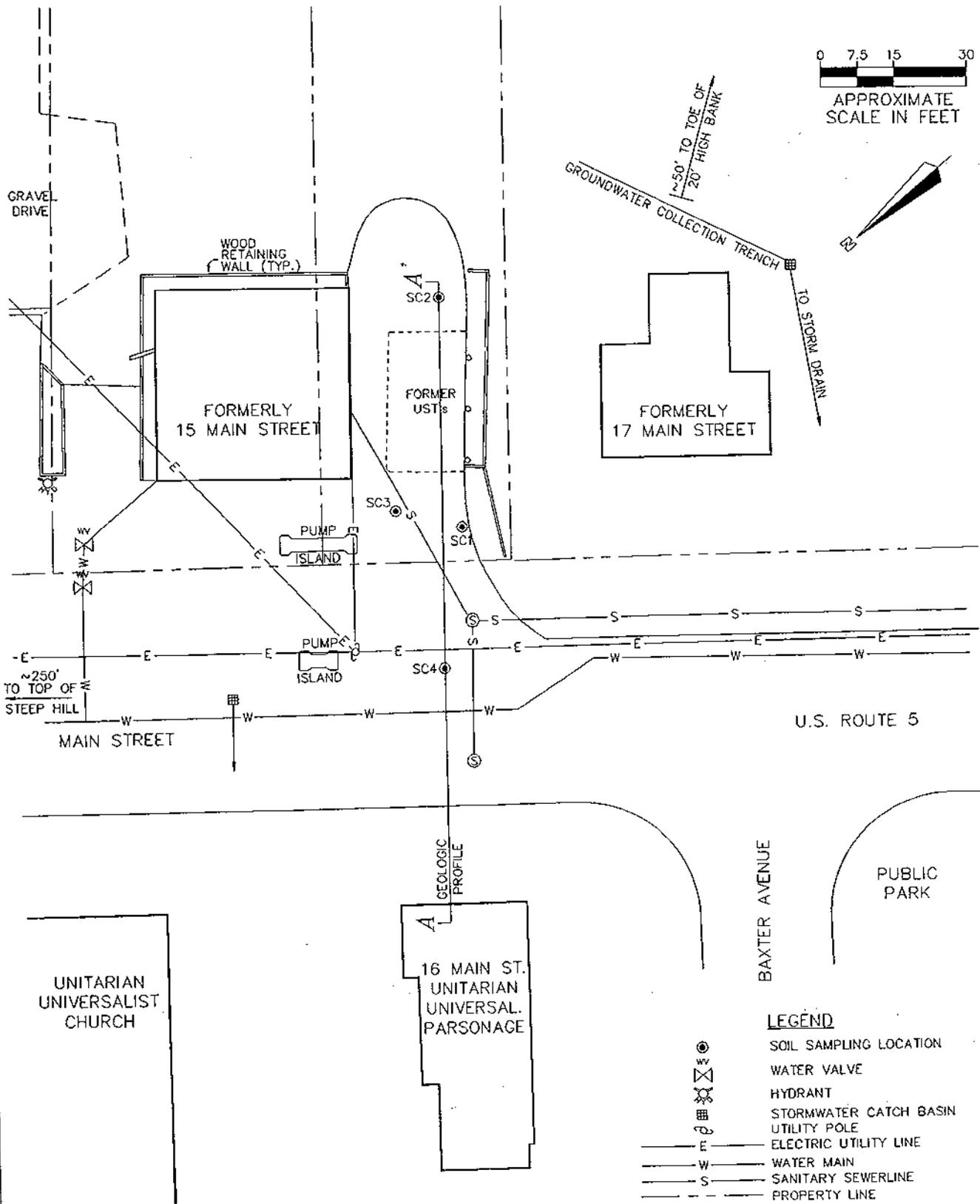
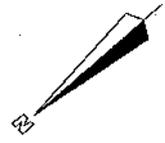
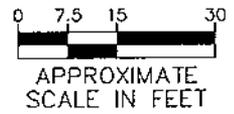
#### 2.1.2 National Wetland Inventory

The National Wetland Inventory map for this area was reviewed to determine if significant wetlands are mapped near the project area. The closest mapped wetlands unit is greater than 1,000 feet from the Site and is a riverine wetland unit (R3OWH) mapped along the international boundary with Canada. These data suggest that no mapped wetlands will be measurably affected by the observed contamination.

### 2.2 SOIL AND GROUNDWATER INVESTIGATION

#### 2.2.1 Soil Coring/Overburden Characterization

Soil cores were advanced utilizing Adams Engineering's (Underhill, Vermont) drilling platform. Soil cores were collected at four locations (Figure 2), in plastic liners inside five foot



- LEGEND**
- SOIL SAMPLING LOCATION
  - ⊗ WATER VALVE
  - ⊗ HYDRANT
  - ⊗ STORMWATER CATCH BASIN
  - ⊗ UTILITY POLE
  - E— ELECTRIC UTILITY LINE
  - W— WATER MAIN
  - S— SANITARY SEWERLINE
  - - - PROPERTY LINE

**FIGURE 3**  
**VICINITY MAP**  
**IRVING OIL CORP., DERBY LINE, VERMONT**

**THE JOHNSON COMPANY, INC.**  
*Environmental Sciences and Engineering*  
 100 STATE STREET MONTPELIER, VT 05602  
 DATE: 6/10/99 PROJECT: 1-0913-3  
 DRAWN BY: TJK SCALE: 1"=30'

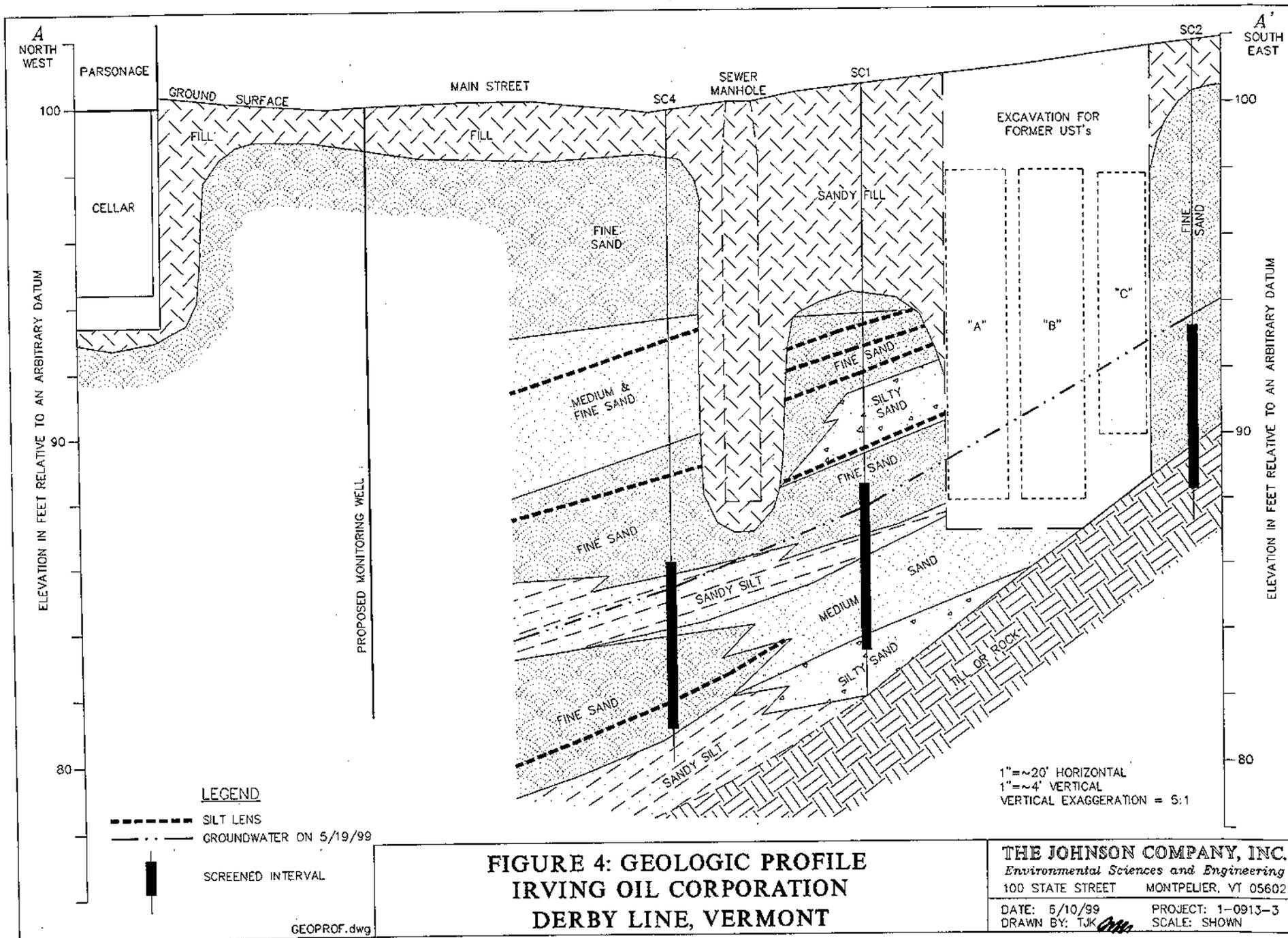
core barrels, by means of a vibratory coring tool. Temporary groundwater monitoring wells, stratigraphic analysis, and PID reading information for the soil cores is presented in the coring logs (Attachment 1). A geologic profile of the subsurface is presented as Figure 4. The profile runs parallel to groundwater flow.

The soils at the ground surface of the site are fill. They vary considerably, both laterally, and with depth. They likely include crushed stone below paved portions, and surrounding underground structures such as manholes and utility pipes. Generally the fill soils observed in the soil cores contain sand and gravel. Some areas contain silt as well. The thickness of the fill varies from less than two feet to 14 feet (see geologic profile, Figure 4).

The native soils beneath the fill are complexly bedded sands with numerous silt horizons. They are likely the result of lacustrine deposition in a glacial lake. Generally (although with several exceptions) the soils coarsen upwards and towards the southeast. Preferential pathways for contaminant migration are present in these soils. This preferential migration is shown in SC-4 (Attachment 1) by the isolated peak 258 ppmV headspace reading in a two inch thick coarse sand layer at 16.5 fbs.

The silt layers prevalent in the soils generally are between two and six inches thick. These layers likely serve as aquitards to contaminant migration. While they do not appear to have prevented the vertical migration of contamination near the source (probably due to numerous penetrations by historical excavations), they may serve to vertically isolate the dissolved groundwater contamination downgradient. They probably also act to retard the vertical migration of vapors, thereby providing some measure of protection to potential vapor receptors. In addition, they would likely cause marked interference and reductions in efficiency if vapor extraction were used as a remedial action technology.

A glacial silt till was identified at the base of SC-2. It is likely that this unit extends under most or all of the Site. The hydraulic conductivity in this unit is likely to be low relative to the overlying sands.



At each of the four core locations, soils were extracted from the core barrel for screening for VOCs using a Thermo Environmental Model 580B Organic Vapor Meter PID equipped with a 10.6 eV lamp. The PID was calibrated the same day, prior to use with 97 parts per million (ppm) isobutylene calibration gas. Soil screening was accomplished by placing a soil subsample into a resealable plastic bag, massaging the bag, letting the soil sit for several minutes, and then inserting the PID wand into the bag and recording the highest reading.

The peak recorded PID soil headspace reading at the Site was 546 ppmV at approximately eight fbgs in SC-3. The readings are consistent with those measured in January 1999 during the UST closure. The vertical extent of elevated soil headspace PID readings is shown on Figure 5. PID readings above 10 ppmV are generally limited to a depth of 6 to 18 feet below ground surface (fbgs). They are also limited to 4-5 feet above or below the groundwater level recorded on May 19, 1999 (see Figure 5). Although there has probably been some vertical migration due to vapor transport and dispersion, this 8-10 foot spread likely represents the difference between seasonal high, and seasonal low groundwater levels. Note that the municipal sewer manhole is located within the area of elevated soil PID readings. Note also, that the parsonage cellar is well above the anticipated elevation of the plume at that location.

### 2.2.2 Temporary Monitoring Well Installation

Adams Engineering installed temporary groundwater monitoring wells at four locations to varied depths. The screened intervals in these wells generally straddled the water table. The wells were installed for groundwater elevation measurements and for groundwater sampling. Details of the well construction are provided in Attachment 1.

The water level in each well was measured from the top of casing with an accuracy of plus or minus 0.01 foot. The top-of-casing relative elevation of each well was surveyed using an autolevel to the nearest 0.01 foot. No non-aqueous phase liquids (NAPL) were detected in any of the wells. A groundwater contour map was prepared from this data and is included as Figure 2. The groundwater flow direction in the surficial aquifer is towards the west-northwest, towards

Main Street. The temporary wells were positioned to characterize the soil and groundwater quality at the hydraulically upgradient (SC-2) and downgradient (SC-1, SC-3, and SC-4) portions of the Site.

The measured groundwater gradient was approximately 0.12 feet/foot below the former USTs. The gradient decreases below Main Street to approximately 0.06 feet/foot. The horizontal hydraulic conductivity of the saturated medium and fine sands downgradient of the former USTs is likely to be on the order of 0.05-5 feet per day (fpd). The porosity is likely to be approximately 35%. The distance from UST "A" to the downgradient property line well SC-4 is approximately 41 feet. Assuming no retardation in MTBE transport because of the probable low organic carbon content of the soils, the travel time for MTBE to reach SC-4 can be estimated using Darcy's equation as follows:

$$T \sim D * \Theta / K * I$$

Where:

T = MTBE travel time in days

D = 41 feet, distance from UST "A" to SC-4

$\Theta$  = 35%, porosity

K = 1 fpd, hydraulic conductivity

I = 0.06 ft/ft, hydraulic gradient

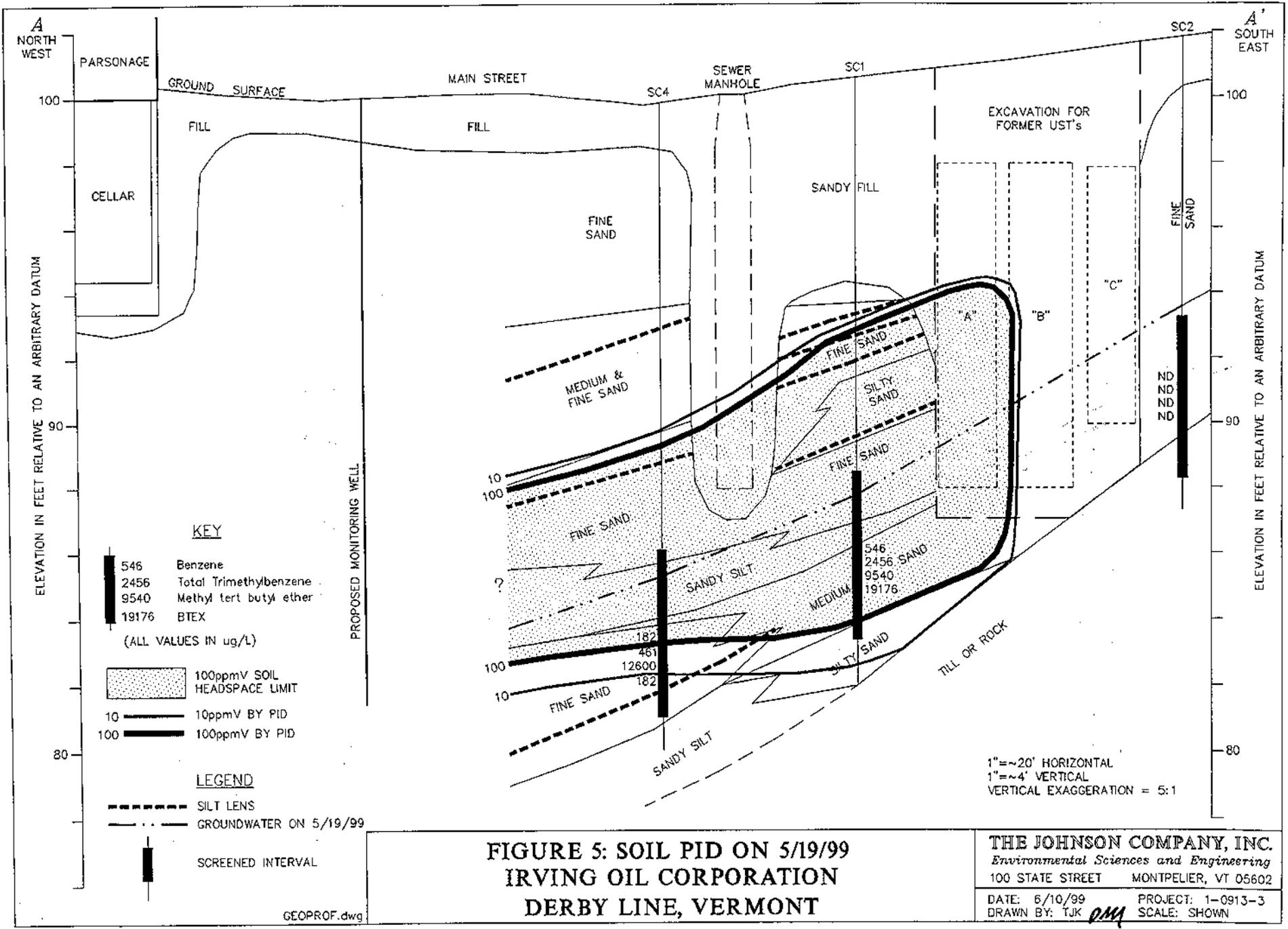
$$T \sim 41\text{ft} * 0.35 / 1\text{fpd} * 0.06\text{ft/ft}$$

$$t \sim 239 \text{ days} \sim \text{eight months}$$

Given the variability of the subsurface stratigraphy, MTBE may migrate to SC-4 within 12 days along highly conductive coarse sand stringers. Similarly, migration may take longer than three years through the fine grained silty sand units. Other compounds are likely to migrate less rapidly than MTBE due to bio-chemical retardation and sorption.

### 2.2.3 Groundwater Sampling and Analysis

Groundwater sampling occurred during the investigation on May 18, 1999. Each of the four temporary wells was purged using a low-discharge peristaltic pump and dedicated



polyethylene tubing before water samples were collected. Water samples were collected by disconnecting the pump, and siphoning the water in the tubing into 40 mL VOA vials preserved with hydrochloric acid. The water samples were named in relation to the soil core location name from which they were taken: sample WQ-1 from location SC-1, WQ-2 from SC-2, etc. After sample collection, each of the temporary wells was removed and the resultant boreholes were filled with bentonite and native fill materials.

Following collection the samples were immediately placed on ice for preservation, and transported under Chain of Custody procedures to the laboratory for analysis. The analysis run on each sample was EPA Method 8021B. The analyses were performed by Endyne Laboratories of Williston, Vermont. The report of the analyses is included as Attachment 2. A discussion of the results is included in Section 3.

A duplicate sample was collected from monitoring well at SC-4. This sample was labeled GW-5. A comparison of the reported analytical results of GW-5 and its duplicate GW-4 show acceptable repeatability for methyl-tert-butyl ether (MTBE). The relative percent difference (RPD) between the duplicate samples for MTBE was 1.6%. However, the RPD for 1,2,4 trimethylbenzene was 37%, indicating poor reproducibility in either the sampling or the analysis procedures.

### **2.3 RECEPTOR SURVEY**

There are no recorded drinking water wells located on the Site property or the neighboring properties. Review of maps from 1974 to 1998, from the State of Vermont Water Supply Division indicates that the nearest drinking water well is approximately 1/4-mile northeast from the Site. For this reason, and because groundwater flow has been shown to be towards the west-northwest, there appears to be no impact to drinking water wells from the Site.

The nearest mapped wetland is a riverine unit located approximately 1/4-mile northwest of the Site. Because of the distance to this wetlands, it is not considered at risk of contamination from the Site.

With the exception of an anomalous reading in the near surface fill at SC-3, the observed soil contamination with PID headspace readings above 10 ppmV is greater than three feet below ground surface. The evidence also indicates that the depth to contamination increases to more than six feet bgs downgradient of the Site. Therefore, physical contact with contaminated soils or groundwater is unlikely to occur except for isolated cases of excavation for utilities or foundations.

Potential sensitive receptors to vapor impacts include near-by residences. The basement of the neighboring property towards the northwest (16 Main Street on Figure 3), the parsonage owned by the Unitarian Universalist Church, was screened for VOC's using a Thermo Environmental Model 580B Organic Vapor Meter PID on the day of the site investigation. The PID registered zero ppmV, which is a background reading. The building was built in 1830. The basement has a poured concrete floor and concrete walls on the southeast and southwest walls. The northeast and northwest walls are constructed of field stone with concrete grout in the interstices. The concrete floor ends approximately one foot from the northeast wall, leaving an earthen trench. The trench was dry. No groundwater collection sump pump was observed. Behind the parsonage, further downgradient, is a graveyard.

The basement of the neighboring property towards the southeast (17 Main Street on Figure 3), owned by Miriam Tatum (802-766-8810), was also screened for VOC's using a PID on the day of the site investigation. The building was built in 1987. The basement has a poured concrete floor and concrete walls. There are sewer and water entrances in the basement floor which have soil exposed in the openings. The PID in the basement breathing zone registered 0.4-0.6 parts per million. The PID registered 0.2 ppmV at the water and sewer entrances. The outside background PID reading was 0.9-1.1 ppmV. No groundwater collection sump is present.

Potential migration pathways for vapors include municipal sewer lines. There are buried sewer and water lines that run on the southeast side of Main Street (see Figure 3). The water main is a pressurized 10 inch pipe, and, in the absence of NAPL, is not considered at risk of

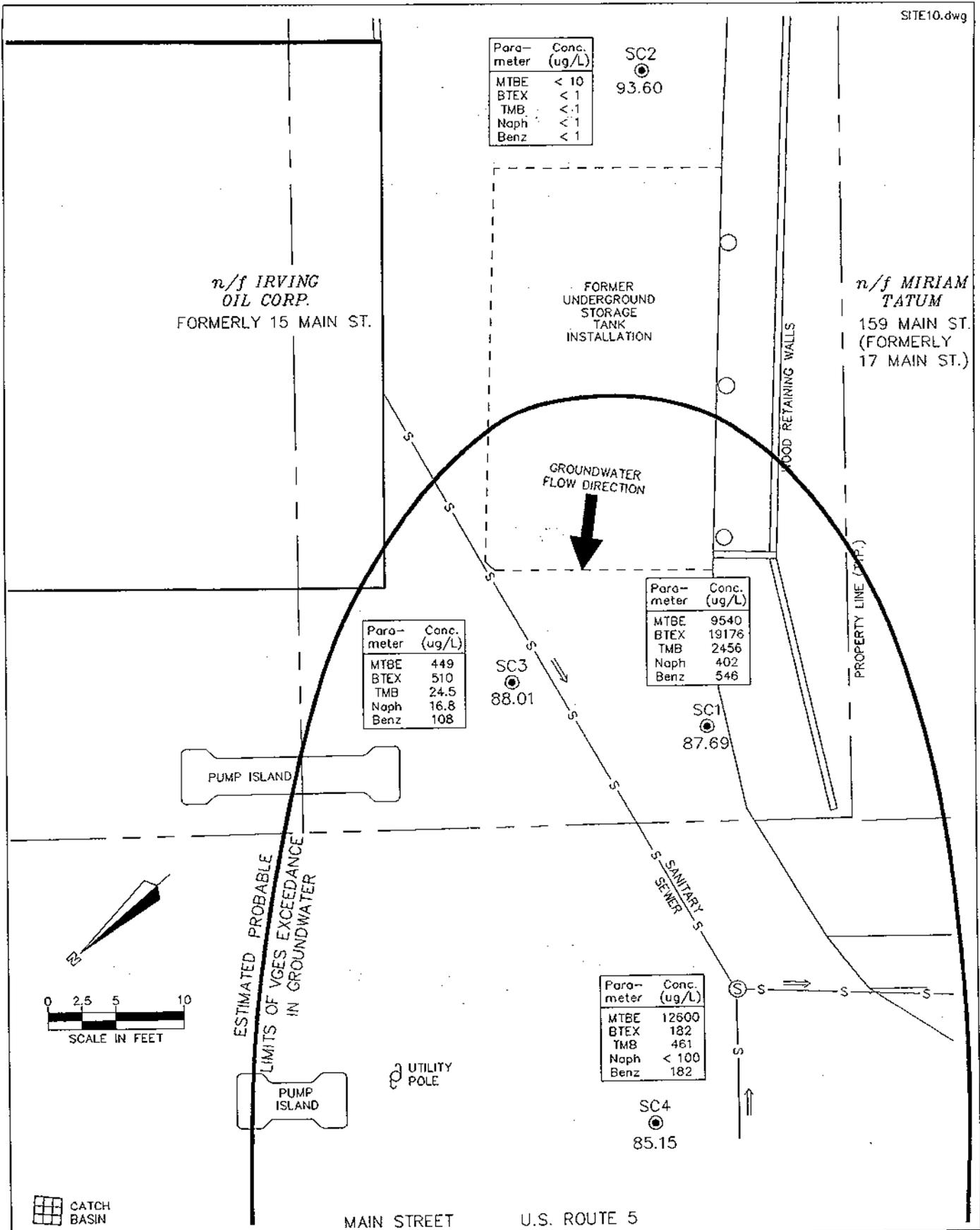
contamination from the petroleum release. The municipal sewer includes a manhole located in the middle of the contaminant plume. It is located near soil core SC-4 (see Figures 2 and 3). This manhole is 12 feet deep. A measurement of 3.4 ppmV was recorded with the PID headspace in the manhole on May 19. This reading may or may not be related to petroleum contamination. On May 19 the bottom of the manhole was approximately 1-2 feet above the groundwater level. It is very likely that the manhole base is below groundwater during seasonal high groundwater levels. It is possible that petroleum vapors or contaminated groundwater may enter the manhole at certain times of the year. This could result in the concentration of petroleum vapors within the municipal sewer to explosive levels. The sewer lines could also act as preferential pathways for vapor migration.

### 3.0 ANALYTICAL RESULTS

A total of five groundwater samples (including a duplicate) were analyzed using EPA Method 8021B for volatile organic compounds (VOCs). The laboratory analytical results for the groundwater samples collected from the temporary monitoring wells are summarized on Table 2, and on the geologic profile in Figure 5 and in Figure 6.

A line representing the estimated probable lateral limit of Vermont Groundwater Enforcement Standards (VGES) exceedances is included in Figure 6. This line is based upon an assumption of log-normal decreases in contaminant concentration with distance traveled in a direction normal to groundwater flow.

No VOCs were detected in the well upgradient of the former USTs, SC-2. Vermont Groundwater Enforcement Standards were exceeded by orders of magnitude at SC-1 and SC-3 located downgradient and near the former USTs and also at SC-4 near the downgradient property line. VGES exceedances at these three locations were reported for the following compounds: methyl-tert-butyl ether (MTBE), benzene, 1,2,5-trimethylbenzene, and 1,2,4-trimethylbenzene.



**FIGURE 6: MAP OF CONTAMINATION IN GROUNDWATER ON 5/18/99**  
**IRVING OIL CORP., DERBY LINE, VERMONT**

**THE JOHNSON COMPANY, INC.**  
*Environmental Sciences and Engineering*  
 100 STATE STREET MONTPELIER, VT 05602  
 DATE: 6/10/99 PROJECT: 1-0913-3  
 DRAWN BY: TJK *DM* SCALE: 1"=10'

Reported concentrations of toluene, xylenes, ethylbenzene, and naphthalene also exceeded VGES, but only in the sample collected near the former UST at SC-1, and not in the downgradient well, SC-4.

Concentrations of MTBE were significantly higher in the downgradient property line well SC-4 than in the well closer to the former USTs, SC-1. This may be because SC-1 is not in the center of the plume. However, given that the concentrations of other contaminants are higher in SC-1, and that MTBE is the most mobile of the contaminants, it is more likely that the MTBE plume has migrated away from the source area near the USTs since the cessation of the release in December, 1998. If this is true, decreasing concentrations of contaminants would be expected in future near the USTs. Increasing concentrations downgradient of contaminants other than MTBE could also be expected as the slug of contaminated groundwater passes by.

Table 2 Summary of Groundwater Analytical Results of Samples collected May 18, 1999 and analyzed by EPA Method 8021B					
Compound	Concentration in ug/L				
Sample ID	GW-1	GW-2	GW-3	GW-4	VGES
MTBE	9540	< 10	449	12400 (12600)	40
Benzene	546	< 1	108	< 200 (182)	5
Toluene	6900	< 1	187	< 200 (< 100)	1000
Ethylbenzene	1130	< 1	41.1	< 200 (< 100)	700
Xylenes	10600	< 1	174	< 200 (< 100)	10000
1,3,5 TMB	606	< 1	TBQ <10	< 200 (125)	4
1,2,4 TMB	1850	< 1	24.5	230 (336)	5
Naphthalene	402	< 1	16.8	< 200 (< 100)	20

Notes:  
 MTBE is the acronym for methyl-tert-butyl ether  
 TMB is the acronym for trimethyl benzene  
 TBQ indicates compound was detected at concentrations below the quantitation limit  
 All analysis performed by Endyne Laboratories of Williston, Vermont  
 Values in parenthesis are those from the duplicate sample, GW-5

## 4.0 CONCLUSIONS AND RECOMMENDATIONS

### CONCLUSIONS

Based on the limited investigation by The Johnson Company at the Site, and findings from lab analysis, it appears that the probable source of contamination is the former UST "A" and/or its associated piping. The contaminant distribution suggests that it is likely a subsurface release from UST "A" is the source of the contamination. Other conclusions are presented below.

- There was no indication of *light non-aqueous phase liquids* (LNAPL) present during the Site investigation.
- At least 2,500 square feet, and more than 850 cubic yards, of groundwater and soils are likely contaminated above 10 ppmV by PID headspace measurements and above Vermont Groundwater Enforcement Standards for one or more compounds.
- PID readings above 10 ppmV are generally limited to a depth of 6 to 18 feet below ground surface (fbgs). The peak PID reading was 546 ppmV. The elevated readings are limited to four to five feet above or below the groundwater level recorded on May 19, 1999. Decreasing PID readings to levels below 10 PPMV were noted in soil core locations SC-1 (near the USTs) and in SC-4 (near the downgradient property line).
- Subsurface soils consist of complexly bedded sands and silts dipping towards the northwest. A glacial silt till and refusal during coring were encountered at depths of 13 to 19 feet. The surface of the till or rock apparently dips towards the northwest.
- Groundwater was encountered between eight and 15 feet below ground surface. The depth to groundwater increases towards the west-northwest. Groundwater is flowing towards the west-northwest with a gradient of 0.06-0.12 feet/foot. There is evidence that groundwater levels may vary four to five feet upwards and downwards from the levels measured on May 18, 1999.
- Vermont Groundwater Enforcement Standards (VGES) were exceeded by orders of

magnitude in groundwater near the former UST for the following compounds: methyl-tert-butyl ether (MTBE), benzene, ethylbenzene, toluene, xylenes, 1,2,5-trimethylbenzene, 1,2,4-trimethylbenzene, and naphthalene.

- Vermont Groundwater Enforcement Standards (VGES) were exceeded by orders of magnitude in groundwater near the downgradient property line for the following compounds: methyl-tert-butyl ether (MTBE), benzene, 1,2,5-trimethylbenzene, and 1,2,4-trimethylbenzene.
- The nearest drinking water well is reportedly approximately 1/4-mile northeast from the Site. For this reason, and because groundwater flow has been shown to be towards the west-northwest, there appears to be no impact to drinking water wells from the Site.
- The two nearest residences, 16 and 17 Main Street have basements which contain openings to the underlying soils. The elevations of the basement floors were above groundwater levels at the time of the investigation. No elevated PID readings were detected in either building on May 18, 1999.
- There is a sewer manhole located on the Site which is 12 feet depth, and which is located within the area of soil and groundwater contamination. A 3 ppmV PID reading of the air in the manhole was measured on May 18, 1999. The bottom of the manhole was approximately two feet above the groundwater table at the time of the investigation.
- Physical contact with the contaminated media is unlikely except for construction workers during excavation over three feet deep.
- No wetlands, surface water, or other sensitive receptors not listed above appear to be at risk from the observed contamination.

## RECOMMENDATIONS

Based on the data collected during this investigation, and State of Vermont regulations, several possible alternative for corrective action for the Site were reviewed.

### Excavation

Excavation of the contaminated media, combined with off-site disposal was considered as

a possible corrective action. The goals of such an action would be to remove the grossly contaminated soils which form a secondary source for continued groundwater contamination. On-site treatment of contaminated soils is not feasible due to the limited size of the Site, and the ongoing presence of the public at the convenience store.

The analytical data and PID headspace measurements in SC-4 indicate that the area downgradient of the Site, below Main Street, is contaminated to a level almost as high as that in the area in the immediate vicinity of the USTs (SC-1). Thus, to remove the contaminated soils and reduce the secondary source it would be necessary to excavate below Main Street as well as on the Irving Oil property. The presence of the 10" water supply force main, and the sewer line would make this difficult to achieve. In addition, the depth of contamination, which reaches 18 feet below ground surface in the area of investigation, and is probably deeper downgradient, makes excavation an unfeasible alternative for this Site.

#### Groundwater Pump and Treat

This technology is generally used to prevent the continued migration of contaminants off-site, and to collect non-aqueous phase liquids (NAPL). Groundwater is collected from a series of wells or trenches, and treated above ground, generally with activated carbon. It can also be used to intercept a dissolved contaminant plume to prevent impacts to sensitive receptors. Given the absence of NAPL at the Site, the existing extent of contamination below Main Street (as described above), and the absence of documented sensitive receptors, groundwater pump and treat technology is not appropriate at this Site.

If impacts to downgradient receptors are demonstrated in the future, for instance if petroleum vapors are detected in the basement of the residence at 16 Main Street, then a series of groundwater extraction wells located on the northwest side of Main Street may be a suitable means for intercepting and collecting the dissolved contamination in groundwater.

### Vapor Extraction and Treatment

Vapor extraction is used to enhance degradation of dissolved contamination and contaminated soils. A vacuum is placed on the soils by a series of vapor point wells. This causes the gasoline to volatilize. The vapors are collected and treated, often with activated carbon or by incineration.

The vapor points must be installed in the unsaturated zone in order to avoid collecting condensate and water as well as vapors. Due to the presence of numerous two to six inch thick silt layers below the groundwater table, but above the majority of the contamination, it is unlikely that vapor extraction by conventional vapor points will remove sufficient vapors to significantly affect the magnitude or extent of contaminated media.

An alternative to conventional vapor points, which may be more effective at this Site, is a vapor trench. This trench would need to be 12 feet deep or more, in order to penetrate and disrupt the impeding silt layers. The trench would be filled with gravel or coarse sand, and a vapor extraction system of lateral pipes would be placed above the seasonal high groundwater level. The effectiveness of such a system would still be considerably less than that of a system in suitable soils without impeding layers, as only contamination in close proximity to the trench would be remediated. This system would be unlikely to prevent continued migration of contaminants towards the northwest and because of its limited effectiveness it is not recommended.

### Sparging combined with Vapor Extraction and Treatment

Sparging is the process of injecting air into the contaminated groundwater to promote volatilization of the contaminants. The vapors are then collected as described above. Sparging may create a mound in the groundwater which can alter the direction of dissolved contaminant transport. At this Site, sparging is likely to spread the contaminant plume parallel to Main Street in both directions. This spread could probably be controlled by appropriate placement of sparge wells within the vapor extraction trench described above, and include sparge wells beyond the

limits of observed contamination. A sparge/vapor extraction trench system placed along the northwest side of main Street may be successful at reducing the concentrations of dissolved contaminants and also reducing the rate of contaminant migration.

If impacts to downgradient receptors are demonstrated in the future, for instance if petroleum vapors are detected in the basement of the residence at 16 Main Street, then additional evaluation of sparging and vapor extraction, as well groundwater pump and treat technologies, should be performed.

#### Long Term Monitoring

As discussed in the conclusions, there are three potential sensitive receptors of the observed contamination: two residential basements may be impacted by vapors during periods of seasonal high groundwater, and the municipal sewer may receive either vapors or infiltrating dissolved contamination during periods of seasonal high groundwater. The Johnson Company recommends monitoring the air quality in these three potential receptors with a photoionization detector during April of 2000, when the next period of seasonal high groundwater levels is expected to occur. This monitoring should be completed prior to determining a long term remedy for the Site. Initiation of corrective actions such as sparging/vapor extraction or groundwater pump and treat are not justified until impacts upon receptors can be demonstrated.

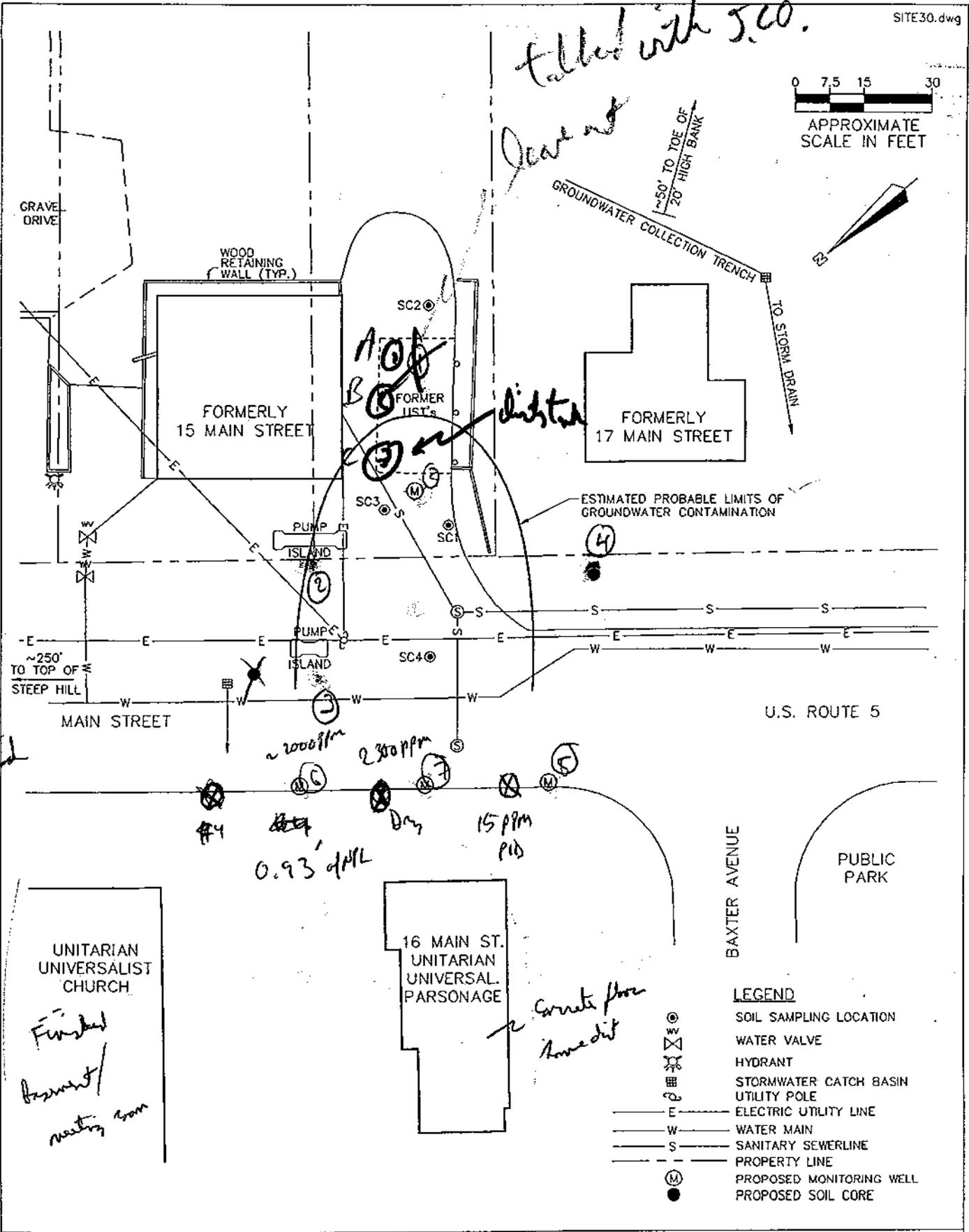
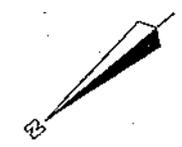
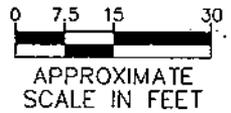
In addition to monitoring air quality, The Johnson Company recommends the collection and PID headspace testing of soil samples at two additional locations. The locations should be outside of, or near the edge of, the contaminant plume and cross-gradient to the direction of groundwater flow (see proposed locations on Figure 7). This placement will confirm the limits of contamination along Main Street in the northeast and southwest directions.

The Johnson Company also recommends the installation and monitoring of four permanent groundwater monitoring wells. The purpose of monitoring these wells will be to delineate the downgradient extent of contamination, and to monitor the concentrations of

contamination in groundwater over time. The recommended locations for the proposed monitoring wells are shown on Figure 7. One well is proposed in the center of the plume, near the former UST locations. This well will be used to evaluate the residual contamination in the source area, and the expected degradation and decline in contaminant levels over time. Three wells are proposed on the northwest side of Main Street. These wells will be used to monitor the migration of the contaminant plume, and to help evaluate the risk to the 16 Main Street residence. One of these wells will be located in the center of the plume, and the other two at the edges. The precise locations of the outside two wells may vary depending upon the results of the soil sampling described above. Continuous soil sampling with PID headspace measurements should be performed during the installation of these three wells. All the wells should be completed with ten foot screens straddling the water table in order to allow monitoring during seasonal high and seasonal low groundwater conditions.

Groundwater monitoring should commence in August or September, 1999, and continue for three events (December or January, and late March or early April). Vapor monitoring of the two residences and the sewer manhole should be performed at the same time. Following this monitoring, the risk to potential receptors can be further evaluated, and the need for active remediation considered.

*talked with JCO.*  
*leave out*



**FIGURE 7: PROPOSED SOIL CORE AND MONITORING WELL LOCATIONS**  
**IRVING OIL CORP., DERBY LINE, VERMONT**

**THE JOHNSON COMPANY, INC.**  
 Environmental Sciences and Engineering  
 100 STATE STREET MONTPELIER, VT 05602

DATE: 6/10/99 PROJECT: 1-0913-3  
 DRAWN BY: TJK DM SCALE: 1"=30'

**Attachment 1**  
**Drilling Log**

The Johnson Company, Inc.  
 Environmental Sciences and Engineering  
 100 State Street  
 Montpelier, Vermont 05602

**DRILLING LOG**  
**WELL # SC-1**

Project: Irving Oil Corp.  
 Location: Derby Line, Vt.  
 Job # 1-0913-3  
 Logged By: DMM  
 Date Drilled: 5/18/99  
 Driller: G. Adams  
 Drill Method: Vibracore

Casing Type: SS  
 Casing Diameter: 1.0 in.  
 Casing Length: 15.0 ft.  
 Screen Type: SS  
 Screen Diameter: 1.0 in.  
 Screen Length: 5.0 ft.  
 Slot Size: 0.010"

Total Pipe: 20.0 ft.  
 Stick Up: 2.8 ft.  
 Total Hole Depth: 18.8 ft.  
 Well Guard Length: 0.0 ft.  
 Initial Water Level: 12.8 ft.  
 Surface Elevation: 100.53  
 T.O.C. Elevation: 103.33

█ = Sampled Interval

Sheet 1 of 1

Depth (feet)	Well Construction	Notes	Geology	PID Reading	Description
5					Core 0-4.6', 3.5' Recovery. 0-16"
4					Dark grey dense silt & fine sand
3					(FS), some gravel (GVL), pebbles.
2					Petroleum odor. Sharp horizontal
1					contact (SHC). 16-33" Brown humid
0					loose fine & medium sand (F&MS).
1				0.4-0.8	1/2" thick grey silt layer at 26".
2					
3				0.4	0-4.6' continued. 33-39" Grey humid
4					loose medium & fine sand (M&FS),
5					trace subangular (SA) pebbles. Fill.
6				0.8-4.0	
7					Core 4.6-9.6'. 48" rec. 0-24" Brown
8				408.	humid medium & coarse sand (M&CS).
9					SHC. (spoil?). 24-35" Grey damp FS,
10		Backfill			little silt. Few brown fine
11				409.-436.	distinct mottles. 1" thick silt
12				185.-348.	layer at base. SHC. Native soils.
13					4.6-9.6' cont. 35-48" Grey damp silt
14					layers (1-2" thick) alternating
15		Screen		352.	with grey humid fine sand layers.
16				43.	Faint petroleum odor and black
17				2.4	staining at 40".
18					
19					Core 9.6-14.6. Recovery 12" M&FS
20					spoil over 42" sample. 12-30" Grey
21					moist loose massive FS some silt.
22					SHC. 30-32" Grey moist dense silt.
23					SHC. 32-37" Brown moist loose FS.
24					SHC. 37-40" Black and grey moist
25					FS, one pebble.
26					
27					9.6-14.6' cont. 40-50" Black and
28					grey, wet, fine sand little silt.
29					SHC. 50-54" Brown fine sand, trace
30					silt. Groundwater @ 14 fbgs.
31					
32					Core 14.6-18.8'. 48" rec. 0-32"
33					Brown wet alternating 3-4" thick
34					layers of medium sand with layers
35					of F&MS. SHC.
36					
37					14.6-18.8' cont. 32-48" Grey wet,
38					fine sand, some silt.
39					
40					Refusal @ 18.8'. GW-1 collected.

The Johnson Company, Inc.  
 Environmental Sciences and Engineering  
 100 State Street  
 Montpelier, Vermont 05602

**DRILLING LOG**  
**WELL # SC-2**

Project: Irving Oil Corp.  
 Location: Derby Line, Vt.  
 Job # 1-0913-3  
 Logged By: DMM  
 Date Drilled: 5/18/99  
 Driller: G. Adams  
 Drill Method: Vibracore

Casing Type: SS  
 Casing Diameter: 1.0 in.  
 Casing Length: 10.0 ft.  
 Screen Type: SS  
 Screen Diameter: 1.0 in.  
 Screen Length: 5.0 ft.  
 Slot Size: 0.010"

Total Pipe: 15.0 ft.  
 Stick Up: 1.3 ft.  
 Total Hole Depth: 14.6 ft.  
 Well Guard Length: 0.0 ft.  
 Initial Water Level: 8.3 ft.  
 Surface Elevation: 101.94  
 T.O.C. Elevation: 103.24

█ = Sampled Interval

Sheet 1 of 1

Depth (feet)	Well Construction	Notes	Geology	PID Reading	Description
0					Core 0-4.6'. Zero recover, pebble in tip.
4.6				1.1	Core 4.6-9.6'. 48" recovery. 0-6" Tan humid loose fine sand (spoil). 6-48" Brown moist to wet, massive, fine sand (FS), trace silt.
8.8		Backfill			
8.8					
9.6				0.6-1.3	Sand heaved in casing to 8.8 fbg. Core 9.6-14.6'. 12" fine sandy silt spoil over 48" rec. 12-48" Brown moist-wet, loose-firm FS. One angular gravel. Sharp horz. contact. 48-60" Grey very dense damp silt, some FS, gravel, pebble (Till). Mottles.
14.6		Screen			TD 14.6'. Water sample GW-2.

The Johnson Company, Inc.  
 Environmental Sciences and Engineering  
 100 State Street  
 Montpelier, Vermont 05602

DRILLING LOG  
 WELL # SC-3

Project: Irving Oil  
 Location: Derby Line, Vt.  
 Job # 1-0913-3  
 Logged By: DMM  
 Date Drilled: 5/18/99  
 Driller: G. Adams  
 Drill Method: Vibracore

Casing Type: SS  
 Casing Diameter: 1.0 in.  
 Casing Length: 10.0 ft.  
 Screen Type: SS  
 Screen Diameter: 1.0 in.  
 Screen Length: 5.0 ft.  
 Slot Size: 0.010"

Total Pipe: 15.0 ft.  
 Stick Up: 1.0 ft.  
 Total Hole Depth: 14.6 ft.  
 Well Guard Length: 0.0 ft.  
 Initial Water Level: 12.5 ft.  
 Surface Elevation: 100.46  
 T.O.C. Elevation: 101.46

■ = Sampled Interval

Sheet 1 of 1

Depth (feet)	Well Construction	Notes	Geology	PID Reading	Description
5					
4					
3					
2					
1					
0				11.7	Core 0-4.6'. 42" recovery. 0-16" Grey loose humid silt, some fine sand (FS), gravel (GVL), pebbles. Fill.
1					
2				4.5-4.7	0-4.6' cont. 16-22" Brown loose humid FS & silt. Sharp horizontal contact (SHC). 22-32" Tan dry loose medium sand (MS). SHC. 1/2" thick firm silt layer @ 32". 32-42" Tan humid loose MS. PID 4.7 ppmV.
3					
4					
5				17.	Core 4.6-9.6'. 10" silt, FS, GVL spoil over 42" recovery. 10-28" Brown humid loose MS & coarse sand (CS), few chunks of silt.
6				331.	
7		Back fill		546.	4.6-9.6 cont. 28-42" Brown/orange dry loose CS and sub-round GVL, little pebble. 3/4" diameter silt chunks.
8					
9					
10				505.	4.6-9.6 cont. 42-52" Grey damp firm FS. 1/2" thick grey laminated silt layers at 45" and 51".
11		Screen		364.-380.	
12					
13					Core 9.6-14.6'. 10" grey loose silt & FS, some GVL spoil over 35" recovery. 10-20" Brown damp horizontally laminated firm fine sand, little silt.
14					
15					9.6-14.6' cont. 20-45" Grey moist firm massive fine sand. Petroleum odor throughout core. TD 14.6'. Water sample GW-3.
16					
17					

The Johnson Company, Inc.  
 Environmental Sciences and Engineering  
 100 State Street  
 Montpelier, Vermont 05602

DRILLING LOG  
 WELL # SC-4

Project: Irving Oil Corp.  
 Location: Derby Line, Vt.  
 Job # 1-0913-3  
 Logged By: DMM  
 Date Drilled: 5/18/99  
 Driller: G. Adams  
 Drill Method: Vibracore

Casing Type: SS  
 Casing Diameter: 1.0 in.  
 Casing Length: 15.0 ft.  
 Screen Type: SS  
 Screen Diameter: 1.0 in.  
 Screen Length: 5.0 ft.  
 Slot Size: 0.010"

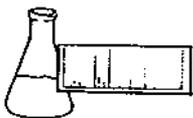
Total Pipe: 20.0 ft.  
 Stick Up: 1.1 ft.  
 Total Hole Depth: 19.9 ft.  
 Well Guard Length: 0.0 ft.  
 Initial Water Level: 14.5 ft.  
 Surface Elevation: 99.68  
 T.O.C. Elevation: 100.78

█ = Sampled Interval

Sheet 1 of 1

Depth (feet)	Well Construction	Notes	Geology	PID Reading	Description
5					
4					
3					
2					
1					
0					
1		Cement			
2				0.4-1.8	Core 0.5-4.8' 30" recovery. 0-5" Grey dry angular gravel (GVL) and fine sand (FS). 5-18" Brown loose damp FS, some silt, GVL. Fill. Sharp horizontal contact (SHC). 18-29" Tan damp loose FS & medium sand (MS), trace GVL. SHC. 29-30" Brown damp FS.
3					
4					
5					
6					
7		Backfill		1.0-1.3	Core 4.8-9.6' 6" loose silt & FS, some GVL spoil over 46" recovery. 6-24" Tan damp firm FS, little silt. 1/2" thick MS layer at 13". Mottles 22-24". 24-52" Brown/orange humid massive loose MS&FS. Grey silt and FS layer at 30-32". SHC.
8					
9					
10				3.4	
11				249.	
12					
13					
14					
15					
16		Bentonite		97	Core 9.6-14.9'. 6" grey silt, some FS, GVL spoil over 18" recovery. 6-12" Brown/orange damp loose MS&FS. SHC.
17				258	
18		Screen		7.2-3.6	
19					
20					
21					9.6-14.9' cont. 12-24" Grey damp firm FS. Two 1/4" thick silt laminae. SHC. Faint petroleum odor.
22					
23					
24					
25					Core 14.9-19.9'. 54" recovery. 0-16" Grey moist dense massive silt and FS. SHC.
26					
27					
28					
29					14.9-19.9' cont. 16-18" Grey wet coarse sand. SHC. Very strong petroleum odor.
30					
31					
32					
33					14.9-19.9' cont. 18-40" Grey saturated loose FS. SHC. 40-42" Grey damp very dense silt & one GVL. 42-52" Grey/orange moist-wet FS. SHC. 52-54" Grey dense damp silt & FS. TD 19.9' Water samples GW-4 and GW-5 (blind duplicate).
34					
35					
36					
37					
38					
39					
40					

**Attachment 2**  
**Analytical Reports**



**ENDYNE, INC.**

Laboratory Services

32 James Brown Drive  
Williston, Vermont 05495  
(802) 879-4333  
FAX 879-7103

1-0913-3

DMM

REPORT OF LABORATORY ANALYSIS

CLIENT: The Johnson Company, Inc.  
PROJECT NAME: 1-0913-3/Derby Line  
REPORT DATE: May 27, 1999  
DATE SAMPLED: May 18, 1999

ORDER ID: 2403  
REF.#: 138,692 - 138,696

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. Chain of custody indicated sample preservation with HCl.

All samples were prepared and analyzed by requirements outlined in the referenced method and within the specified holding times. All instrumentation was calibrated with the appropriate frequency and verified by the requirements outlined in the referenced method. Blank contamination was not observed at levels affecting the analytical results.

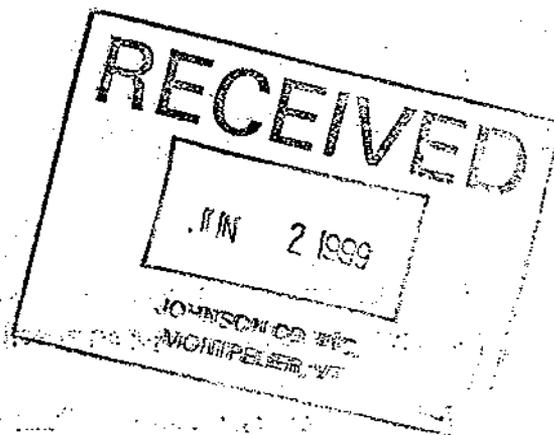
Analytical method precision and accuracy was monitored by laboratory control standards which included matrix spike, duplicate and quality control analyses. These standards were determined to be within established laboratory method acceptance limits.

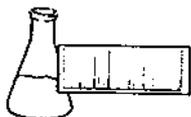
Individual sample performance was monitored by the addition of surrogate analytes to each sample. All surrogate recovery data was determined to be within laboratory QA/QC guidelines unless otherwise noted.

Reviewed by,

Harry B. Locker, Ph.D.  
Laboratory Director

enclosures





**ENDYNE, INC.**

Laboratory Services

32 James Brown Drive  
Williston, Vermont 05495  
(802) 879-4333  
FAX 879-7103

**EPA METHOD 8021B--PURGEABLE AROMATICS**

CLIENT: The Johnson Company, Inc.  
PROJECT NAME: 1-0913-3/Derby Line  
CLIENT PROJ. #: NI

DATE RECEIVED: May 19, 1999  
REPORT DATE: May 27, 1999  
ORDER ID: 2403

Ref. #:	138,692	138,693	138,694	138,695	138,696
Site:	GW 1	GW 2	GW 3	GW 4	GW 5
Date Sampled:	5/18/99	5/18/99	5/18/99	5/18/99	5/18/99
Time Sampled:	10:00	11:55	2:08	4:30	2:30
Sampler:	DM	DM	DM	DM	DM
Date Analyzed:	5/27/99	5/27/99	5/27/99	5/27/99	5/27/99
UIP Count:	>10	0	>10	>10	>10
Dil. Factor (%):	1	100	10	0.5	1
Surr % Rec. (%):	102	95	85	96	92
Parameter	Conc. (ug/L)				
MTBE	9,540.	<10	449.	12,400.	12,600.
Benzene	546.	<1	108.	<200	182.
Toluene	6,900.	<1	187.	<200	<100
Ethylbenzene	1,130.	<1	41.1	<200	<100
Xylenes	10,600.	<1	174.	<200	<100
1,3,5 Trimethyl Benzene	606.	<1	TBQ <10	<200	125.
1,2,4 Trimethyl Benzene	1,850.	<1	24.5	230.	336.
Naphthalene	402.	<1	16.8	<200	<100

*Duplicate GW4 V. E.*

*40  
5  
1000  
700  
1000  
4  
5  
20*

Note: UIP = Unidentified Peaks TBQ = Trace Below Quantitation NI = Not Indicated

CHAIN-OF-CUSTODY RECORD

COC tape # 193A 25072

Project Name: 1-0913-3	Reporting Address: The Johnson Co. 100 State St. Montpelier, VT	Billing Address: Same
Site Location: Derby Line, VT	Company: The Johnson Co.	Sampler Name: DON MAYNARD
Endyne Project Number: 2403	Contact Name/Phone #: Don Maynard 229-4600	Phone #: 802-229-4600

Lab #	Sample Location	Matrix	G R A B	C O M P	Date/Time	Sample Containers		Field Results/Remarks	Analysis Required	Sample Preservation	Rush
						No.	Type/Size				
138692	G-W1	H2O	✓		5-18-99	2	ADML VOA	PID ~ 400	8021B	HCL	
138693	G-W2		✓		10:00	2	ADML VOA	PID ~ 5	BTEX LITRE		
138694	G-W3				11:55			PID ~ 250			
138695	G-W4				14:08			PID ~ 7			
138696	G-W5		✓	✓	16:30			PID ~ 300			
					14:30						

Relinquished by: Signature <i>[Signature]</i>	Received by: Signature <i>[Signature]</i>	Date/Time 5-19-99 12:45
Relinquished by: Signature <i>[Signature]</i>	Received by: Signature <i>[Signature]</i>	Date/Time 5/19/99 2:25pm

New York State Project: Yes  No

Requested Analyses											
1	pH	6	TKN	11	Total Solids	16	Metals (Specify)	21	EPA 624	26	EPA 8270 B/N or Acid
2	Chloride	7	Total P	12	TSS	17	Coliform (Specify)	22	EPA 625 B/N or A	27	EPA 8010/8020
3	Ammonia N	8	Total Diss. P	13	TDS	18	COD	23	EPA 418.1	28	EPA 8080 Pest/PCB
4	Nitrite N	9	BOD <sub>5</sub>	14	Turbidity	19	BTEX	24	EPA 608 Pest/PCB		
5	Nitrate N	10	Alkalinity	15	Conductivity	20	EPA 601/602	25	EPA 8240		
29	TCLP (Specify: volatiles, semi-volatiles, metals, pesticides, herbicides)										
30	Other (Specify):										

**Attachment 3**

**Field Notes**

IRVING MAUNWAY  
DERBY LINE, VT  
Perry Hunt 873-3664  
North Country R.U.  
Elm St. turn @ Fountain

Spring  
Water well "Batters" 1979  
South - 3 no hydrant on left.  
Be onsite 8:00 AM.  
Start Randolph @ 5:30

UTP 0000 07613

606<sup>km</sup> - 1845

125170 - 125235 → 125305  
oneway

1/2 hr Lunch onsite 7:20 offsite 1730

730 calibrate OUM #1  
PID to 97 ppm IB  
reading 97.5 ppm  
BG. 0.0

1-0913-3  
DM # 23 5/18/99

Gerry Lemire  
Melissa Stein

peak 499 ppm @ 10-19 FGLS

G.W. For BTEX/MTBE 8021B  
water supplies BTEX, MTBE, TPH

Notes:

4 GOMs - soils 0-20'  
PID HS on soils

soil samples - 8021B + 8100 TPH GAS  
1 - Hot zone  
2 - Below Hot area "clean"

neighbors basements

May '96 → SPILLS.<sup>2</sup>



DM # 23 5-18-94

SCI

8:30 0-4.6' 3.5' rec.

PIP

0-15"

Dry Dk grey Dense  
SILT + FS, sm gUL, peb  
FILL - gas odor SHC

0.8 ppm

16-33" Brn Hum Loose F+MS SHC

0.4 ppm

1/2" grey SILT layer SHC @ 26"

33-39" Grey Hum Loose  
M+FS, 4TC SA peb.

8:50

4.6-9.6

4' rec.

0.8 ppm

0-24" Brn Hum M+CS SHC  
(spoil?)

4.0 ppm

24-35" Grey Damp

Native FS L+ SILT  
FEW Brn Fin Dist Mett  
1" SILT Lam @ Base SHC

35-48 Grey Damp SILT layers  
1-2" thick alt w/  
Grey hum. Fin sand

4.0 ppm

Exhibit petrol odor +  
Black stains @ 40"

65-75°F 5-10 mph  
1-0913-3 clear.

9:07

9.6-14.6

4.5' rec

0-12" Brn Damp

<sup>Loose</sup> M+FS (spoil?)

16 ppm

SHC

12-30"

Grey moist <sup>Loose</sup> mabb F6 BINGLT  
(pet. odor) SHC  
(throughout)

409 ppm

30-40"

2" Grey moist SILT Dense SHC

DM 436

4.12 ppm

5" Brn moist Loose FS SHC

40-50"

3" Black moist FS - <sup>sm</sup> peb. SHC

DM 185

4.36 ppm

BLK + Grey wet FS, Light SHC

50-54"

Brn FS FINE SILT,

soil sample 348 ppm

6" water in hole -

SCI - two VOAS

9:25 ALT ROCK @ 18.8 TD

14.6-18.8'

48" rec Petrol. odor.

0-32"

Brn wet alt. 3-4"  
MS and F+M6 layers SHC

0-18"

352 ppm

32-48" Grey wet FS, sm SILT  
to damp.

18-40"

43 ppm

TD 18.8'

40-48"

2.4 ppm

sample @ 18.6-18.8  
OR VOAS 80218  
SCI - 18.8  
9:15

DUM #23

SL1

ψ 9:37 15.88 BTOC

5d. 2.8

5' 55 screen 1" OD  
~20' T.P.

sample by peristaltic pump

1 gal purged @ 9:57

1.3 gal @ 1000

collect two vials

sample GWT for 8021B

ψ 10:05 15.64'

sheen on GW in well

1' Bent in Bottom -  
MATE BF TO GS

5-18-99

1-0913-3

MINIAM TATAIN.

Home - 766-8810

17 Main St.

(New address 159 main)

BG 0.9-1.1 ppm

Built in 1987

concrete

on public  
water.

Breathing zone basement

0.4-0.6 ppm

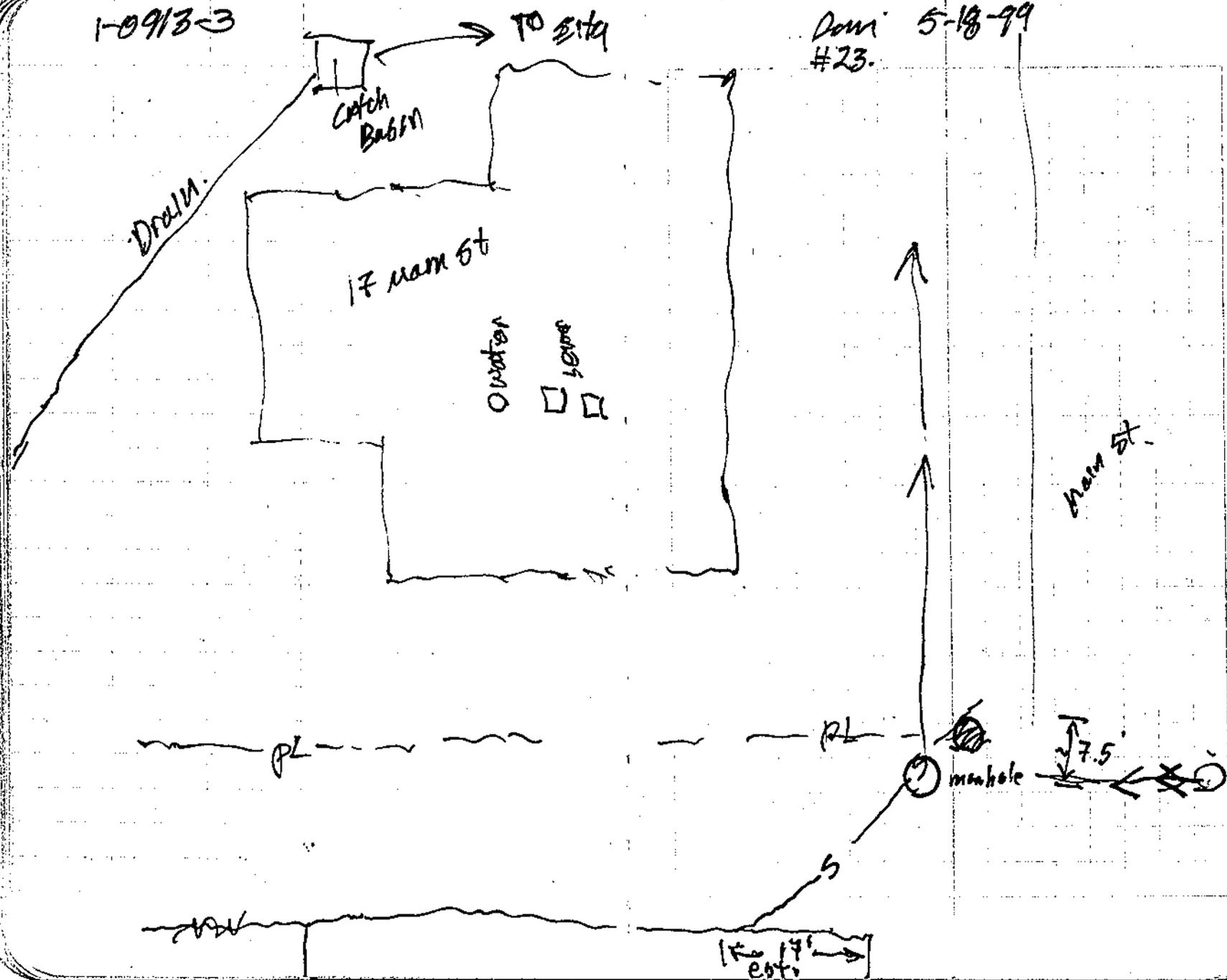
0.2 @ sewer +

to be  
used as  
an office

water entrances  
in basement

1-0913-3

Down 5-18-99  
#23.



Elev. Survey Station / Reading	Rel. Elev.	TOP SU Elev.	6.5 Depth Elev. TO PKL	Depth	Elev. PKL
CTR sewer manhole	8.74	100.			
Inst. Elev = 108.74					
TOP pipe SC1	5.41	103.33 ✓	2.8	18.8	
Sewer MH	8.73				
TOP pipe SC2	5.50	103.24 ✓	13'	12.6	
Sewer MH	8.75				
TOP pipe SC3	7.28	101.46 ✓	1.0	NR	
Sewer MH	8.74				
TOP pipe SCA	7.96	-100.78 ✓			
TOP TB42 Concrete Send-East pump Island	7.43	101.31			

6.5. SU	TOPE	SC1	GWL	15.64	Elev
100.5	2.8	103.33			87.69 ✓
101.99	1.3	103.24		9.64 ✓	93.60 ✓
100.46	1.0	101.46		13.45 ✓	88.01 ✓
99.68	1.1	<del>101.31</del>		16.32 ?	<del>84.99</del>
		100.78		~15.63 ✓	85.15

DVM 23 5-18-99 1-0913-3

"Friendly" house

#16 Main St

10:45 NO-one home

FD. Furnace

Unitarian Universalist Parsonage

Built 1830 Cellars

concrete FLOOR+WALLS 6' FBGS

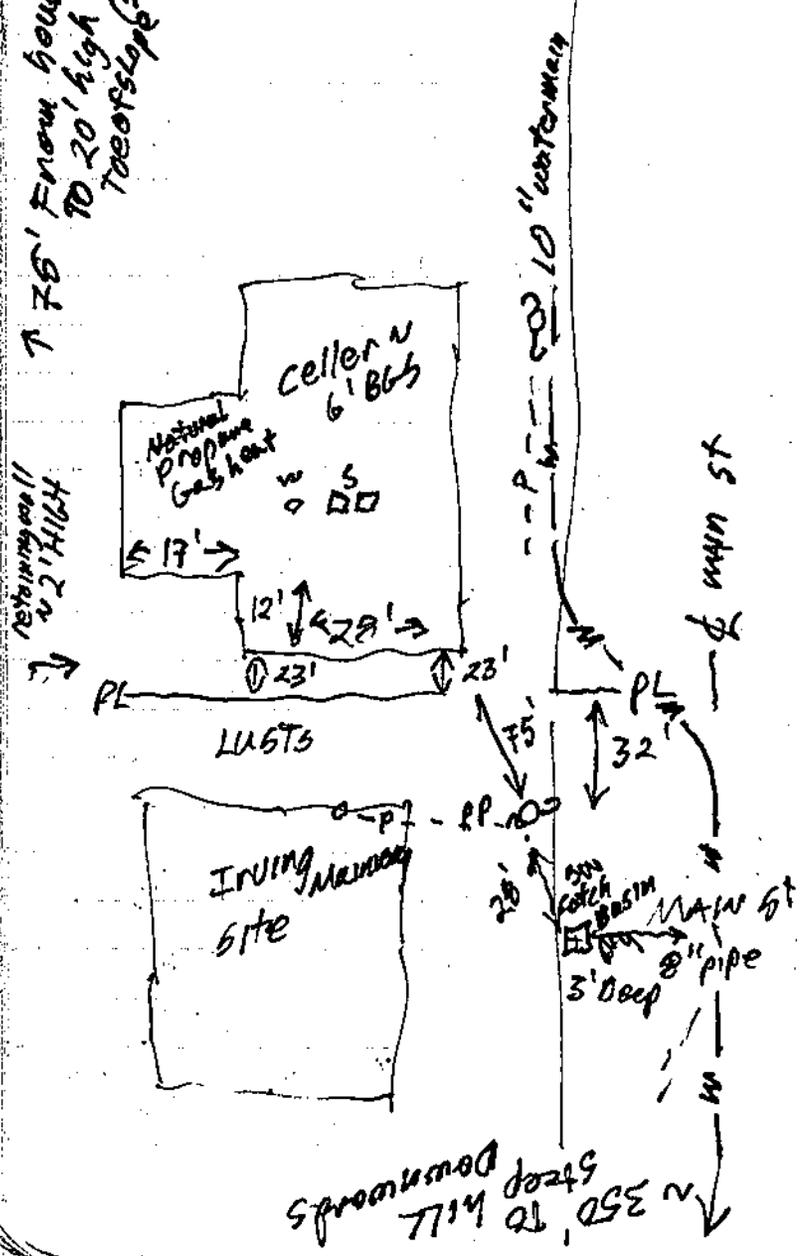
Next to church further NORTH  
ZEM @ trench-boils (Locked)

AAVI NOMMICK

ZEM @ water + sewer  
NA FBGS

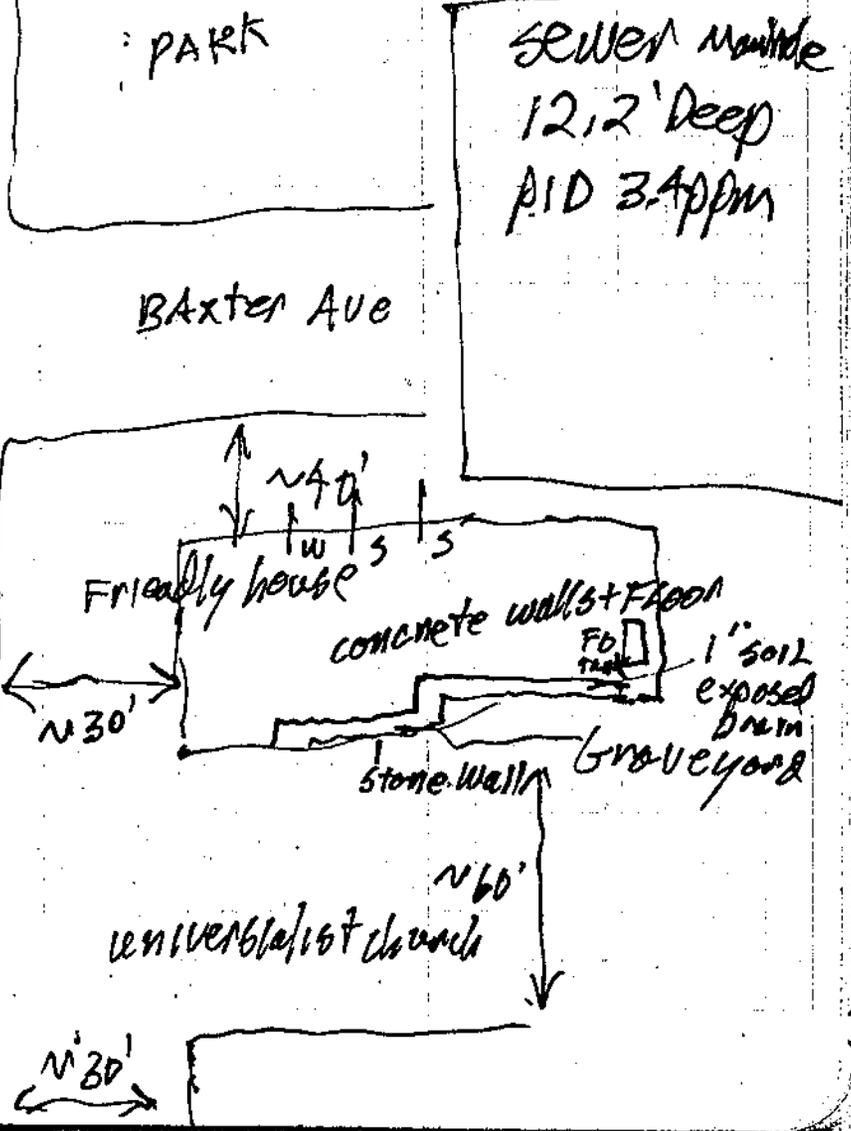
75' From house  
to 20' high Bank  
Toe of slope (30%)

5-18-99  
DWM # 23



prominent  
steps  
downwards  
of 350' N

SC1 → SC3 12'  
SC3 → BLDG COR 12'  
SC1 → SC2 ~ 49'  
SC2 + SC3 in straight line from p.p.  
(SC3 ~ 1' south of line)



5-18-99 1-0913-3 Wm #23  
BL-PID 0.2-0.9 ppm  
SC2 0-5.6' pebble in tip.  
zero recovery

4.6-9.6 3.5' rec

16:10

1.1 ppm 0-6" tan hum loose  
SHC FS (spoiled)

6-18"

1.1 ppm

18-48"

1.1 ppm

6"-48"

Brn moist to wet mass  
FS, trc SHC

9.6-14.6 TD sand heaved/loosed  
60" recovery TO 8.8'

0-12" Brn Damp SILT + FS Dense  
SM GUL (spoiled) SHC

12"-20"

20"-48"

0-12"  
1.3 ppm

12-24"  
0.9 ppm

24-48"  
0.6 ppm

0.6 ppm

48-60"  
0.9 ppm

Brn sat Very Loose  
FS

Brn moist-wet - Firm  
FS trc org gUL (one)  
SHC

Grey V. Dense Damp SILT  
SM FS, SR gUL, peb (TILL)  
Com Fine org prim. matt.

installed 15' ss well with  
5' screen.

TO ~ 13.8'

1.3' stick up.

1' Bent  
then  
NATIVE  
TO SURF.

start purge ~ 11:45

1 gal @ 11:50

0.5 gal 11:50-11:53

sample G102

@ 11:55

FOR 8021B

UP 9.69 @ 11:59

UP 9.64 12:20

SC3 - 12:50  
0-4.6' 42" rec

11.7 0-16" Grey Loose Hum  
ppm silt, sm FS, gUL, peb FILL  
SHL

PID } 16-42" Brn Loose Hum  
22" FG + GLT SHL

4.5 } 22-32 Tan Dry Loose MS  
ppm FIRM SHL

1/2" Grey Dump silt @ 32" str

PIB  
4.7 32-42" tan Hum Loose MS.  
ppm

13:05 4.6-9.6 Light  
52" rec. 0-10" Grey loose Hum silt: SFS, peb  
31 ppm (spoil) GUL

17.0 ppm 10-29" Brn Hum m+CS loose  
Fow 1" chunks silt GL

331 ppm 28-42" Brn/Orange Dry Loose  
CS + SR GUL, w/ peb  
3/4" Black silt chunks

546 42-52" Grey Dump FIRM  
ppm FS,  
1/2" Grey Lam silt Lays @ 45+51"

5-18-99 DUM 23  
1-0913-3

core 9.6-14.6 +5" rec  
Petrol odor

441 0-10" Grey Loose silt + FS  
ppm sm gUL, peb (spoil)

10" 505 ppm 10-20" Brn Dump Hum, Lam  
20" FS LIT + GLT

364 ppm 20"-45" Grey moist FIRM  
32" mass FS  
380 ppm

46"

TD 14.6'

↳ BTopipe 13.45

SU 1.0'

15' ss well w/ 5' screen

Purge 13:47 - 13:50 - 1/2 gal  
pumped Dry

recovered + pumped Dry 1111

Total purge = 1/2 gal. Footnotes

sample G-03 8021B

@ 14:08

NATIVE TO CAMP

SL4

0.5 4.85' (0-0.5 Asphalt  
30" rel

0-5" Grey Dry ang GUL + FS  
SHC

5-18" Brn Loose Damp

1.8 ppm FS, 6m silt, gul fill  
SHC

18-29" Tan Damp Loose

0.4 ppm F + M sand trc gul  
SHC

29-30" Brn Damp FS

14:55 4.85' 9.6' 52" rel

0-6" Grey Dry Loose silt + FS  
sm ang gul, peb (spoil)  
SHC

6-24" Tan Damp Firm

1.3 ppm FS, Lot silt  
one 1/2" ms Lay @ 13" SHC

24-52" Bright brg med mot. 2224"  
Brn/orange Flamed Loose

1.0

Med + FS mass  
one 2" Gray silt + FS Layer  
30-32" SHC

1-0913-3 Dm#23

5-10-99

15:15 9.6-14.9' 24" rel

5.4 ppm 0-6" Grey Dense Dry silt,  
sm FS, SR GUL FILL SHC  
(spoil)

3.4 ppm 6-12" Brn/orange Damp  
Loose m + FS SHC

12-24" Grey Damp Firm  
FS, SHC  
Two 1/4" silt Lams  
Faint petrol odor

249 ppm

15:30 14.9-19.9' 54" rel  
TO 19.9'

0-16" Grey moist Dense  
97 ppm massive silt + FS, SHC

16-18" Grey Sat Wet Sand silt  
258 ppm very strong petrol odor

18-40" Grey Sat Loose FS SHC  
7.2 ppm

40-42" Grey Damp Dense silt + GUL  
(Drop stone?)

42-52" Grey moist FS SHC  
+ trace wet  
5248-54 6m Dm Damp silt + FS 9.6 ppm

install 20' ss well  
@ SCA w/ 5' screen  
purge - 15:45 - 16:00  
SU 1.1' NO FLOW

Purge 16:00 - 16:25  
1.6 Gals

Sample G104

@ 16:30  
2 VOLS FOR 802 UB  
SILTY BRN water

1/2 @ 14:36 16.32  
14:42 15.90  
14:52 15.63

Bentonite 10' 18'  
Native to 2.5'  
Cmt to surf.

1-0913-3 Dux #23

5-18-99

Blind  
Duplicate H<sub>2</sub>O sample w/

Fictitious time 14:30 and  
Name GWS was collected  
from GWA

SCA

PPole

○

○

← 18' →

Samples to Engine  
WILHELM, VT  
by common carrier  
COC # 25072  
COC Tape # 113A

CHAIN-OF-CUSTODY RECORD

COC tape # 193A 25072

Project Name: 1-0913-3	Reporting Address: The Johnson Co. 100 State St. Montpelier, VT	Billing Address: Same
Site Location: Derby Line, VT	Company: The Johnson Co. Contact Name/Phone #: Don Maynard 229-4600	Sampler Name: DON MAYNARD 302-229-4600
Endyne Project Number:		

Lab #	Sample Location	Matrix	G R A B	C O M P	Date/Time	Sample Containers		Field Results/Remarks	Analysis Required	Sample Preservation	Rush
						No.	Type/Size				
	GW1	H <sub>2</sub> O	✓		5-18-99 10:00	2	ADMLVX	PID ~400	BOZIB	HCL	
	GW2		✓		11:55	2	ADMLVX	PID ~5	BTEX MTBE		
	GW3				14:08			PID ~250			
	GW4				16:30			PID ~7			
	GW5	↓	↓		14:30	↓	↓	PID ~300	↓	↓	

Relinquished by: Signature <i>[Signature]</i>	Received by: Signature <i>[Signature]</i>	Date/Time 5-19-99 18:45
Relinquished by: Signature	Received by: Signature	Date/Time

New York State Project: Yes \_\_\_ No \_\_\_

Requested Analyses

1	pH	6	TKN	11	Total Solids	16	Metals (Specify)	21	EPA 624	26	EPA 8270 B/N or Acid
2	Chloride	7	Total P	12	TSS	17	Coliform (Specify)	22	EPA 625 B/N or A	27	EPA 8010/8020
3	Ammonia N	8	Total Diss. P <sub>o</sub>	13	TDS	18	COD	23	EPA 418.1	28	EPA 8080 Pest/PCB
4	Nitrite N	9	BOD <sub>5</sub>	14	Turbidity	19	BTEX	24	EPA 608 Pest/PCB		
5	Nitrate N	10	Alkalinity	15	Conductivity	20	EPA 601/602	25	EPA 8240		
29	TCLP (Specify: volatiles, semi-volatiles, metals, pesticides, herbicides)										
30	Other (Specify):										