

Phase (check one)		Type (check one)	
X	Initial Site Investigation		Work Scope
	Corrective Action Feasibility Investigation	X	Technical Report
	Corrective Action Plan		PCF Reimbursement Request
	Corrective Action Summary Report		General Correspondence
	Operations and Monitoring Report		

HYDROGEOLOGIC SUBSURFACE INVESTIGATION
of the
RUSSELL KINAMAN RESIDENCE
22 Wildwood Drive
Essex Junction, Vermont
44°28'53" North, 73°05'35" West

KSKGeoS™ Project #: 98026
DEC Spill #: 98-2508
UST Facility ID #: 1324

Prepared For:

Mr. Russell Kinaman
22 Wildwood Drive
Essex Junction, Vermont 05452

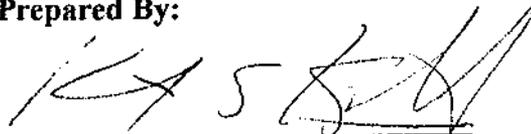
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Submitted by:

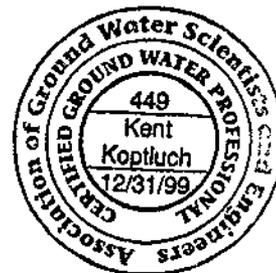
KENT S. KOPTIUCH, Inc.
Geo-Environmental Services
164 Osgood Hill
Essex, Vermont 05452

Date: March 22, 1999

Prepared By:



Kent S. Koptiuch, CGWP #449
President
Principal Hydrogeologist



KSKGeoS™

Environmental Investigations and Remedial Solutions - Call (802) 878-1620

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**EXECUTIVE SUMMARY
HYDROGEOLOGIC SUBSURFACE SITE INVESTIGATION
OF DEC SPILL #98-2508 - THE RUSSELL KINAMAN RESIDENCE
ESSEX JUNCTION, VERMONT**

KENT S. KOPTIUCH, Inc. (KSKGeoS™), under the authorization of Mr. Russell Kinaman, conducted a Phase II subsurface hydrogeologic investigation of his residential property located at 22 Wildwood Drive in Essex Junction, Vermont.

- KSKGeoS™ completed the installation, development, and sampling of four (4) groundwater monitoring wells. Each of the water samples were analyzed under EPA method 8021B for BTEX, trimethylbenzenes, naphthalene, and MTBE (purgeable aromatics), and under EPA modified Method 8015 for total petroleum hydrocarbons (TPH).
- Groundwater exhibits a northeasterly and easterly flow direction across the site. Gradient is approximately 17%. The rate of groundwater travel through the aquifer is approximately 1.2×10^2 gpd/ft².
- No separate-phase petroleum hydrocarbon products were observed during soil sampling, well installation, or groundwater sampling activities.
- Soils screened by PID yielded volatile organic compounds (VOCs) ranging between 0.1 and 0.2 ppm in the MW-1 location.
- Soils screened by PID yielded no detectable VOCs from the MW-2, MW-3, and MW-4 locations.
- The groundwater sample from MW-1 yielded low-level dissolved toluene, xylenes, naphthalene, 1,2,4 Trimethylbenzene, and 1,3,5 Trimethylbenzene at concentrations well under both the Vermont Groundwater Enforcement Standards (GES) and the Vermont Preventive Action Limits.
- The MW-1 ground water sample also yielded results of a trace below the method quantitation limit of 0.1 mg/L as analyzed by EPA modified method 8015 for total petroleum hydrocarbons (TPH).
- Monitoring well MW-2 could not be sampled due to insufficient water volume in the well.
- The MW-3 groundwater sample yielded low-level dissolved xylenes at concentrations well under both the Vermont Groundwater Enforcement Standards (GES) and the Vermont Preventive Action Limits.
- The MW-4 groundwater sample yielded low-level dissolved toluene, xylenes, 1,2,4 Trimethylbenzene, and 1,3,5 Trimethylbenzene at concentrations well under both the Vermont Groundwater Enforcement Standards (GES) and the Vermont Preventive Action Limits.
- The samples from MW-3 and MW-4 yielded no detectable concentrations of TPH.
- The subject site and all surrounding properties are supplied water by the Champlain Water District. There are no known public or private water supply sources within a one-mile radius of the study site.
- Soils and groundwater beneath and down-gradient of the site, an unnamed tributary to the Winooski River, and the Winooski River itself were identified as potential receptors to contaminant impact.
- A review of ANR DEC files revealed one (1) other hazardous site within a 1 mile of the subject site. The Bread and Bottle Citgo (DEC Spill #98-2351) is not hydraulically connected with the Kinaman property.
- The contaminant source at the Site has been mitigated and no immediate threats to human life, health, or safety were identified during the course of this investigation.
- KSKGeoS™ has recommended a Sites Management Activities Completed determination for the Site.

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1	Boring and Well Completion Logs
2	Laboratory Chemical Analytical Results - January 11, 1999 Groundwater Sampling Event

1.0 INTRODUCTION

1.1 Authorization and Site Description

On December 20, 1998, KENT S. KOPTIUCH, Inc. Geo-Environmental Services (KSKGeoS™) was authorized by Mr. Russell Kinaman to conduct a phase II subsurface hydrogeologic investigation of his residential property located at 22 Wildwood Drive in Essex, Vermont. This property is hereafter referred to as the *Site*. KSKGeoS™' investigative workplan was performed with pre-approval of the Vermont Agency of Natural Resources (ANR) Department of Environmental Conservation (DEC) Waste Management Division's Sites Management Section (SMS) as a result of findings presented in KSKGeoS™' Underground Storage Tank closure report of September 15, 1998. SMS approval of the workplan was received via a letter from Mr. Chuck Schwer to Mr. Kinaman (signed in absentia by Mr. Robert Butler), dated December 18, 1998.

The site (Facility ID #1324) is located on the southeast side of Wildwood Drive in the Pinewood Manor subdivision of Essex, Vermont. The area surrounding the site is comprised of wooded, residential, hillside lots. **Figure 1** is a *Site Location Map* depicting the site's relative geographic location and its topographic setting. The site is currently occupied by the Kinaman residence, a two-story, single family home of wood-frame construction on a full, poured-concrete, walk-out basement. The lot size is approximately 1.0 acre and is roughly rectangular in shape.

1.2 Historical Background

According to Mr. Kinaman, the property was initially developed in the early 1970s during the *energy crisis*; as a result, the developer (Marcotte Construction) installed 2,000 gallon fuel oil USTs at many of the properties in the subdivision (KSKGeoS™ has closed six of these 2,000 gallon systems in this neighborhood in the past two years). Mr. Kinaman had his system taken out of service by McEwing Fuels (Essex Junction, Vermont) and replaced with an above-ground tank in his garage in May of 1988, however, the UST was never cleaned or properly closed.

In our Underground Storage Tank Closure Report dated September 15, 1998, KSKGeoS™ noted petroleum impact to back-fill soils peaking at 8 ppm by photoionization detector (PID). Ground water was estimated at 4.75 -feet below grade (BG) during the UST closure. Inspection of the UST following cleaning revealed six (6) pinholes that were allowing groundwater to enter through the side of the tank at a rate of approximately one (1) cup per minute. The accessible piping appeared sound and drained, however, we were not able to remove all of the piping because it ran under the foundation of the house. We closed the UST in-place with flowable concrete fill after pumping and treating approximately 800 gallons of accumulated water in the UST with granular activated carbon (GAC). Forty-five (45) gallons of tank-bottom sludge and sorbents, along with fifty (50) gallons worth of spent GAC, were generated as waste and disposed of under manifest by Heritage Environmental Services of Williston, Vermont.

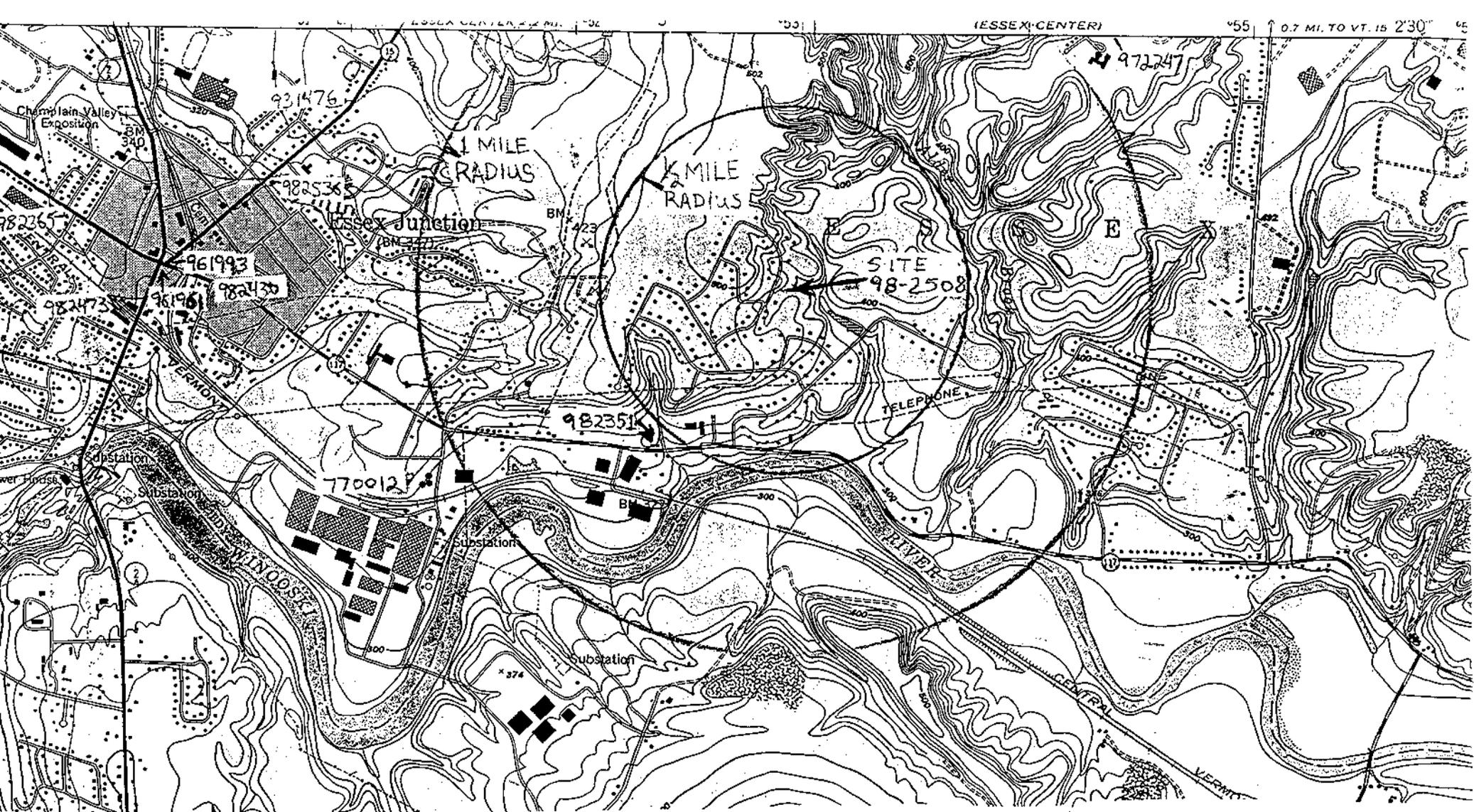
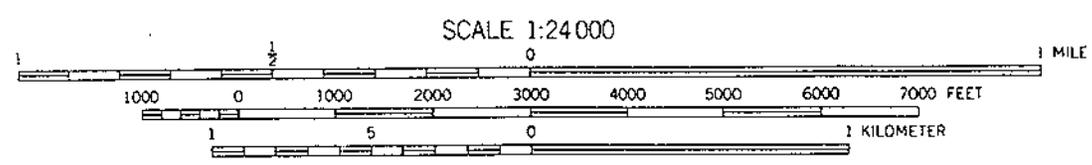


FIGURE 1

ROAD CLASSIFICATION

- Heavy-duty.....
- Medium-duty.....
- Light-duty.....
- Unimproved dirt.....
- Interstate Route
- U. S. Route
- State Route

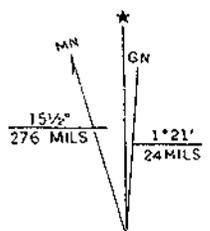


CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ESSEX JUNCTION, VT.
NE/4 BURLINGTON 15' QUADRANGLE
44073-D1-TF-024

1948
PHOTOREVISED 1987
DMA 6372 I NE. SERIES V813



UTM GRID AND 1987 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SITE COORDINATES:
73° 05' 35" W
44° 28' 53" N

LOCATION MAP BY KSK GeoS-12/98

findings and recommendations.

Figure 2 is a site map showing property layout, with groundwater monitoring well locations, and groundwater contours on January 11, 1999.

2.0 INVESTIGATIVE METHODOLOGY

2.1 Soil Boring & Groundwater Monitoring Well Installation

Boring and well installations at the site were completed on January 5, 1999. All monitoring well locations were selected by KSKGeoS™ supervising hydrogeologist Kent Koptiuch. Monitoring well locations were sited to best represent the overburden and groundwater conditions on a site-wide basis. Soil borings and wells were completed by Kent Koptiuch and John Roman of KSKGeoS™.

The wells are constructed of 2" inside-diameter, flush-threaded, PVC screening and casing. Screening is factory-slotted to 0.020' (an equivalent of 0.020 -feet of opening per running foot of screen). The screened interval for each well was determined by Mr. Koptiuch to extend at least five (5) feet above and five (5) feet below the groundwater table, where possible, to allow for seasonal fluctuations.

The annulus of each borehole was then filter-packed with washed, #1 washed sand to a depth at least one (1) foot above the top of the screened interval. A one (1) foot (or greater) hydrated bentonite seal was emplaced above the filter-pack. The remainder of the annular space was then backfilled with clean cuttings from each borehole. The top of each well casing was secured with a PVC slip-cap. All four (4) wells were completed as stick-ups. Boring and well completion logs are included as **Attachment 1**.

Upon completion, each well was developed by repetitive bailing and surging (with the exception of MW-2, which was advanced to refusal on what appeared to be bedrock; no groundwater ever accumulated in this well during any of our site visits). Well top-of-casing elevations were surveyed in on January 5, 1999 by KSKGeoS™ to an assumed datum of 100.00 -feet; The top of the concrete slab in the garage of the Kinaman residence was used as a benchmark.

2.2 Soil Sampling and Field Analysis

Soil boring samples were secured with a six-inch (6") diameter, hand-operated bucket auger. Sampling was conducted at continuous intervals beginning at-grade. All samples were classified using the Unified Soil Classification System. Each soil sample was screened for the presence of VOCs by PID using bagged, head-space methodology. The PID employed was an H-Nu PI-101 with a 10.2 eV lamp. The unit was calibrated on-site for benzene in calibration gas equivalents (CGEs) of 100% isobutylene at 70 parts per million (ppm).

2.3 Groundwater Monitoring, Sampling, and Analysis

On January 11, 1999, an ART optical interface probe, capable of determining groundwater and separate-phase petroleum hydrocarbon product presence and thickness to within 0.01', was utilized to determine the depth to groundwater and petroleum product (if present) in each well. **Table 1** is a summary of groundwater elevations for the January 11, 1999 gauging event.

Water volumes were then calculated for each of the four (4) wells to be sampled, and the equivalent of three (3) well volumes were purged, by bailing, prior to sampling. Groundwater samples, a trip blank, and a field blank were then secured under chain-of-custody protocol.

The sampling bailer was decontaminated between each well utilizing a liquinox-distilled water solution followed by a distilled water rinse. All samples were packed on ice and hand-delivered to Endyne, Inc. Laboratory Services (Endyne) in Williston, Vermont that afternoon. **Table 2** is a summary of the laboratory chemical analytical results for ground water samples obtained on January 11, 1999. The

SUMMARY TABLE 1: GROUNDWATER ELEVATIONS (in feet) - January 11, 1999						
WELL	GRADE	TOP-OF-CASING	SCREENED INTERVAL	DEPTH-TO-BOTTOM (BG)	DEPTH-TO-WATER (from TOC)	GROUNDWATER ELEVATION
MW-1	96.58	97.54	82.54 - 92.54	14.04	9.66	87.88
MW-2	84.25	86.58	76.58 - 81.58	7.67	>10.25	<76.33
MW-3	87.95	89.62	74.80 - 84.80	13.15	11.08	78.54
MW-4	91.04	92.14	82.54 - 87.54	8.50	8.86	83.28

Table 1 Notes:

- 1) Benchmark: Top of concrete slab in garage.

actual laboratory chemical analytical reports prepared by Endyne are included as Attachment 2.

Laboratory chemical analyses was completed by Endyne in accordance with EPA Method 8021b and with modified EPA method 8015. Method 8021b is utilized to determine concentrations of benzene, toluene, ethylbenzene, and total xylene constituents (BTEX); 1,2,4 tri-methylbenzene; 1,3,5 tri-methylbenzene; naphthalene; and methyl tert-butyl ether (MTBE) in micrograms per liter ($\mu\text{g/L}$). The modified EPA Method 8015 is utilized to determine total petroleum hydrocarbon (TPH) concentrations in milligrams per liter (mg/L).

2.4 Potential Receptor Survey

A physical survey was conducted to identify potential receptors, including surface waterbodies, potable water sources, neighboring or on-site basements and/or crawl-spaces, sensitive environmental areas, and likely routes of subsurface contaminant migration.

In addition, a review of the DEC's *Vermont Hazardous Sites List* was completed to identify any known spill sites in close proximity to the study site.

3.0 RESULTS

3.1 Geologic, Overburden Lithologic, Geomorphologic, and Hydrogeologic Summary

The site is located approximately 420-feet above mean sea level in the Town of Essex, Vermont. The topography slopes to the east; surficial drainage at the site flows to the east with a gradient of approximately 18%. Overall regional surficial drainage is generally to the south by means of an unnamed tributary brook to the Winooski River; the Winooski River basin is approximately $\frac{1}{2}$ -mile south of the site. The Winooski River flows into Lake Champlain approximately six (6) miles northwest of the site.

According to the *Surficial Geologic Map of Vermont (1970)*, the site is situated on a dissected plane of deltaic sands associated with the ancient Winooski River's discharge into the Champlain Sea. Stewart (1973) describes the overburden sands as well-drained above the water table and having moderate-to-high groundwater potential below the water table. Soil horizon profiles logged during well installations, revealed medium-to-fine sands to approximately 3.0 -feet BG, overlying silt, silt-clay, and clay horizons that extended to at least 14.0 -feet BG. Groundwater was encountered between 3.0 and 8.0 -feet BG during well installations. During the groundwater sampling event, the water table elevation was gauged at between 7.75 and 9.41 -feet BG.

Bedrock may have been encountered as boring refusal during the installation of MW-2, however, this was not confirmed. According to the *Bedrock Geologic Map of Vermont (1961)*, the underlying bedrock consists of Cheshire Quartzite of lower Cambrian age.

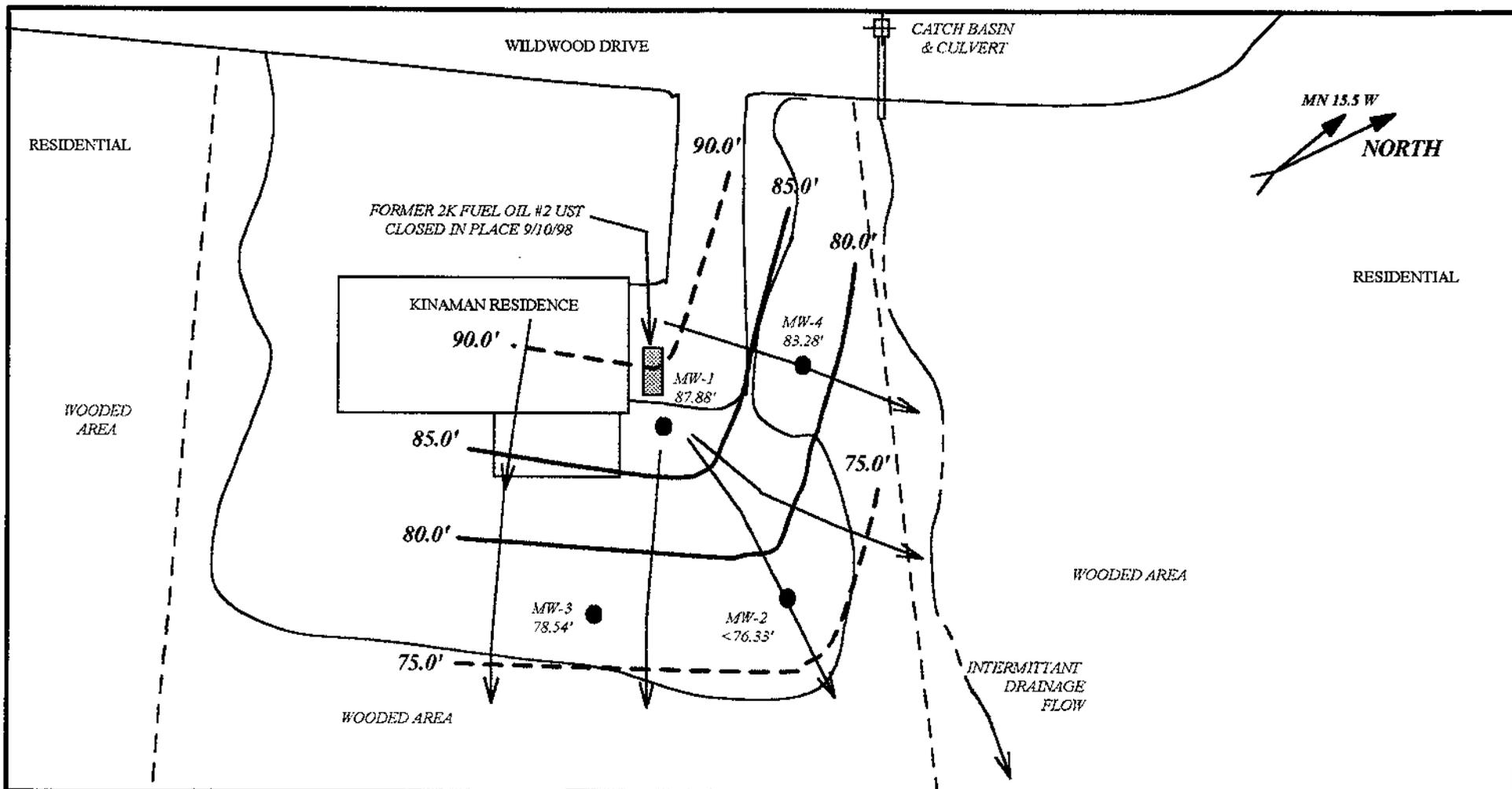


Figure 2

GROUNDWATER CONTOUR MAP WITH FLOW NET PATTERN

LABORATORY CHEMICAL ANALYTICAL RESULTS JANUARY 11, 1999 (Concentrations in ug/L)

NOTE: MW-2 NOT SAMPLED (NS) ON THIS DATE DUE TO INSUFFICIENT WATER VOLUME IN WELL.

ANALYTE	MW-1	MW-2	MW-3	MW-4
TPH	TBQ<100.0	NS	<100.0	<100.0
MTBE	<10.0	NS	<10.0	<10.0
BENZENE	<1.0	NS	<1.0	<1.0
TOLUENE	1.1	NS	<1.0	1.0
ETHYLBENZENE	<1.0	NS	<1.0	<1.0
XYLENES	3.5	NS	1.9	3.3
1,3,5 TRIMETHYL BENZENE	1.2	NS	<1.0	1.2
1,2,4 TRIMETHYL BENZENE	1.9	NS	<1.0	1.7
NAPHTHALENE	4.6	NS	<1.0	<1.0

KENT S. KOPTIUCH, Inc.
Geo-Environmental Services

164 Osgood Hill
Essex, Vermont 05452
802.878.1620

PROJECT DETAIL

PROJECT: KINAMAN RESIDENCE
PROJECT #: 98026
DEC SPILL #: 98-2508
LOCATION: ESSEX JCT., VT
DATE: 1/11/99
DRAWN BY: K. S. KOPTIUCH
SCALE: 1" = 40'

WELL	MTBE µg/L	Benzene µg/L	Toluene µg/L	Ethyl- benzene µg/L	Xylenes µg/L	Total BTEX µg/L	1,3,5 Tri- Methylbenzene µg/L	1,2,4 Tri- Methylbenzene µg/L	Naphthalene µg/L	TPH mg/L
MW-1	<10.0	<1.0	1.1	<1.0	3.5	4.6	1.2	1.9	4.6	TBQ<0.10
MW-2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-3	<10.0	<1.0	<1.0	<1.0	1.9	1.3	<1.0	<1.0	<1.0	<0.10
MW-4	<10.0	<1.0	1.0	<1.0	3.3	4.3	1.2	1.7	<1.0	<0.10

Table 2 Notes:

- 1) Volatiles analyzed by EPA Method 8021B.
- 2) Total Petroleum Hydrocarbons (TPH) analyzed by EPA Method 8015 quantitated based upon the response of gasoline.
- 3) TBQ; Trace Below Quantitation Limit.
- 4) Concentrations in bold type represent levels which exceed Vermont Groundwater Enforcement Standards (VT ANR DEC, November 1997).

Soil samples from MW-1 revealed detectable VOCs by PID of 0.1 ppm in the 3.00' to 3.33' depth and of 0.2 ppm in the 6.67' to 8.33'. The samples secured from borings completed for MW-2, MW-3, and MW-4 yielded no detectable concentrations of VOCs by PID.

3.2 Specific Hydrogeological Characteristics

Groundwater beneath the site was gauged at depths ranging from 7.76 (MW-4) to 9.41 (MW-3) -feet BG on the January 11, 1999 sampling date. Groundwater flow direction is to the northeast and east across the site with an approximate gradient of 17%. An approximate rate-of-travel (V_a) in the overburden aquifer was calculated through the application of Darcy's Law utilizing typical constants for horizontal hydraulic conductivity (K_H) and porosity (n) of the observed aquifer matrix (Driscoll, 1986):

$$V_a = \{[K_H (h_1 - h_2)] \div L\} \div n$$

where $(h_1 - h_2)$ is the difference in hydraulic head, and L is the distance along the flow-path for which the difference in hydraulic head is measured. When all known and assumed aquifer characteristics are entered into the above equation, the resulting rate-of-travel from MW-1 to MW-3 on January 11, 1999 is:

$$V_a = \{[1 \text{ gpd/ft}^2 (87.88' - 78.54')] \div 52.0'\} \div 15\% = 1.2 \times 10^{-2} \text{ gpd/ft}^2$$

Table 1 is the groundwater elevation data calculated from the gauging of the monitoring well network on January 11, 1999. Figure 2 depicts groundwater contours and the flow net pattern of the overburden aquifer based upon this data.

3.3 Groundwater Laboratory Chemical Analytical Results

Actual laboratory chemical analytical results for all analytes are included as Attachment 2 of this report. Table 2 summarizes the results of these analyses. Samples were secured from the three (3) of the four (4) monitoring wells, along with a field blank for quality control purposes. MW-2 was not sampled due to a lack of sufficient water volume in the well.

- The water samples obtained from MW-1 were laboratory analyzed by EPA Method 8021B and found to be below the method detection limits (MDL) for methyl-tert butyl ether (MTBE), benzene, and ethylbenzene. Dissolved toluene was detected at 1.1 µg/L. Total dissolved xylenes were detected at a concentration of 3.5 µg/L. 1,3,5 Trimethyl benzene was detected at 1.2 µg/L. 1,2,4 Trimethyl

benzene was noted at a concentration of 1.9 $\mu\text{g/L}$ and naphthalene was detected at 4.6 $\mu\text{g/L}$. The sample analyzed by modified EPA Method 8015 for total petroleum hydrocarbons (TPH) yielded a trace below the method quantitation limit of 0.10 mg/L.

- The water samples obtained from MW-3 were laboratory analyzed by EPA method 8021B and found to be below the MDL for MTBE, benzene, toluene, ethylbenzene, 1,3,5 trimethyl benzene, 1,2,4 trimethyl benzene, and naphthalene. Total dissolved xylenes were detected at a concentration of 1.9 $\mu\text{g/L}$. The sample analyzed by modified EPA method 8015 for TPH yielded no detectable concentration.
- The water samples obtained from MW-4 were laboratory analyzed by EPA method 8021B and found to be below the MDL for MTBE, benzene, ethylbenzene, and naphthalene. Dissolved toluene was detected at a concentration of 1.0 $\mu\text{g/L}$, while total dissolved xylenes were noted at a concentration of 3.3 $\mu\text{g/L}$. 1,3,5 trimethyl benzene was detected at a dissolved concentration of 1.2 $\mu\text{g/L}$. 1,2,4 trimethyl benzene was detected at a dissolved concentration of 1.7 $\mu\text{g/L}$. The sample analyzed by modified EPA method 8015 for TPH yielded no detectable concentration.
- The trip blank and field blank samples yielded no detectable analyte concentrations above the MDLs.

3.4 Potential Environmental Concerns

3.4.1 Site Specific Concerns

The Kinaman property is located in a strictly residential neighborhood; the through-put of heating fuel in the UST system at the site was ended almost eleven (11) years ago. No mechanical services are performed at the site. The grounds are well-kept. No floor drains were observed. The building basement is of the walk-out type and includes a two (2) car garage.

A small, intermittent drainage flow is located along the northeast property line; this flow eventually enters an unnamed tributary to the Winooski River. The nearest down-gradient residential property is more than $\frac{1}{4}$ -mile southeast through undeveloped woodlands.

The residence, and the entire neighborhood, is provided potable water by the Champlain Water District, and the on-site septic system is cross-gradient of the former UST location.

3.4.2 Surrounding Land Uses

Surrounding land uses were noted as follows:

- North Residential.
- East Undeveloped woodlands.
- South Residential.
- West Residential.

3.4.3 Site Utilities

As noted above, the site is currently supplied potable water by the Champlain Water District. Electrical service is overhead.

3.4.4 Potable Water Sources - 1 Mile Radius of Site

The entire area is serviced by the Champlain Water District. KSKGeoS™ did not identify any public or private water supply sources within a one-mile radius of the site.

3.4.5 Other Identified Sensitive Receptors - 1 Mile Radius of Site

Identified sensitive receptors within a one mile radius of the site that could be subject to potential contaminant impact include:

- Soils and groundwater beneath the site itself.
- An un-named, tributary to the Winooski River approximately 1/8 -mile southeast of the site.
- The Winooski River itself (approximately 1/2 mile south).

3.4.6 Hazardous Sites Review/Identification

A review of the Vermont Hazardous Sites List (Fourth Quarter 1998) yielded the following known, active hazardous waste site(s) within a one -mile radius of the study site:

- **DEC Spill #98-2351;** the *Bread and Bottle Citgo* at 45 River Road (Route 117). UST closure/upgrade activities at this site in 1998 revealed contamination. The site is listed as in need of investigation. This site, and its geographic relationship to the Kinaman site, has been plotted on **Figure 1**. The Bread and Bottle is clearly in a separate sub-drainage basin system from that of the Kinaman residence. No hydraulic connection between the sites is likely.

4.0 FINDINGS

KENT S. KOPTIUCH, Inc. Geo-Environmental Services' phase II subsurface investigation at the Milton Beverage Warehouse property, located on Route 7 in Milton, Vermont yielded the following results and findings:

- The overburden aquifer is comprised of medium-to-fine sands to three (3) -feet BG overlying silt-clay and clay horizons up to 14 -feet BG (bedrock may have been encountered as refusal in MW-2 at 7.67 -feet BG. The groundwater table was noted at a depths ranging from 7.76 to 9.41 -feet BG at the time of this investigation.
- Soil samples secured during the installation of MW-1 yielded VOC concentrations ranging from 0.1 ppm (3.00' to 3.33' BG) to 0.2 ppm (6.67' to 8.33' BG) by PID.
- Soil samples secured during the installation of MW-2, MW-3, and MW-4 yielded no detectable VOC concentrations by PID.
- Groundwater flow conditions in the overburden aquifer exhibit a northeasterly and easterly flow direction across the site. Gradient is approximately 17 % with a rate-of-travel through the overburden aquifer of approximately 1.2×10^2 gpd/ft².
- Laboratory chemical analytical results of the groundwater samples secured from MW-1 yielded very low-level dissolved concentrations of toluene, xylenes, 1,3,5 Trimethyl benzene, 1,2,4 Trimethylbenzene, and naphthalene. None of these analyte concentrations are in excess of the Vermont Groundwater Enforcement Standards (GES) or the Vermont Preventive Action Limits (PAL). TPH was also detected at a trace concentration below the method quantitation limit. No other analytes were detected by the methods used.
- Laboratory chemical analytical results of the groundwater samples secured from MW-3 yielded very low-level dissolved concentrations of total xylenes; well below the GES and the PAL. No other analytes were detected by the methods used.
- Laboratory chemical analytical results of the groundwater samples secured from MW-4 yielded very low-level dissolved concentrations of toluene, xylenes, 1,3,5 Trimethyl benzene, and 1,2,4 Trimethylbenzene. None of these analyte concentrations are in excess of the GES or the PAL. No other analytes were detected by the methods used.

- A review of the VT DEC Hazardous Sites List identified one known sites within a one -mile radius of the study Site; the Bread and Bottle Citgo (DEC Spill #98-2351) is located approximately ½ -mile southwest in a different sub-drainage basin. No hydraulic connection is suspected.
- The study Site, and all surrounding properties are served by a municipal water system. There are no identified wells or surface water sources within a one-mile radius of the Site (either public or private) that are currently in-use.
- The source of low-level dissolved-phase petroleum hydrocarbon contaminant impact to groundwater beneath the Site was the abandoned 2,000 gallon fuel oil UST beneath the Kinaman driveway. This source has been eliminated through proper closure in-place.
- No immediate threats to human life, health, or safety have been identified during the course of this investigation.

5.0 RECOMMENDATIONS

Based upon the findings of this subsurface hydrogeologic investigation, KSKGeoS™ offers the following recommendations for the Russell Kinaman property:

- A Site Management Activity Completed (SMAC) determination should be made for this Site by the Sites Management Section.

6.0 LIMITATIONS

This report is based upon limited physical investigation of the Site and vicinity, samples from a fixed number of groundwater monitoring wells and sampling points, laboratory chemical analyses, and research of materials and files available at the time of the investigation. The findings presented in this report are based only on the observations drawn during this investigation, and upon data provided by others. This report presents a description of the subsurface conditions, in the overburden lithology at each sampling and/or well location, that were prevalent at the time of KSKGeoS™' investigation.

Subsurface conditions can vary significantly over time, particularly with respect to groundwater elevations and groundwater and soil quality. Findings and recommendations presented in this document are applicable only to the facts and conditions described at the time of this investigation.

In performing its professional services, KSKGeoS™ employs the degree of care and skill exercised under similar circumstances by members of the environmental profession practicing in the same or similar locality under similar conditions. The standard of care shall be judged exclusively as of the time these services are rendered, and not according to later standards. KSKGeoS™ makes no express or implied warranty beyond its conformance to this standard.

KSKGeoS™ shall not be responsible for conditions or consequences arising from relevant facts that were concealed, withheld, or not fully disclosed for the preparation of this document. KSKGeoS™ believes that all information contained in this document is factual, but no guarantee is made or implied.

7.0 REFERENCES

- Department of Environmental Conservation, **Chapter 12 - Groundwater Protection Rule and Strategy**, Vermont Agency of Natural Resources, Rule #97-P14, effective November 15, 1997.
- Doll, Charles G., ed., **Centennial Geologic Map of Vermont**, Vermont Geological Survey, Montpelier, VT, 1961.
- Driscoll, Fletcher G., Ph.D., **Groundwater and Wells**, 2nd ed., Johnson Division, St. Paul, MN., 1986.
- Stewart, David P. and Paul MacClintock, **The Surficial Geology and Pleistocene History of Vermont**, Vermont Geological Survey and Water Resources Department, Montpelier, VT, Bulletin No. 31, 1969.
- Koptiuch, Kent S., **Underground Storage Tank Closure Report, Russell Kinaman Residence**, UST Facility ID No. 1324, September 15, 1998, unpublished (on file with the VT ANR DEC SMS, Waterbury, VT).

KSKGeoS™

- Stewart, David P. and Paul MacClintock, **The Surficial Geologic Map of Vermont**, Vermont Geological Survey, Montpelier, VT, 1970.
- Stewart, David P., *Geology for Environmental Planning in the Burlington-Middlebury Region, Vermont*, Vermont Geological Survey and Water Resources Department, Montpelier, Vermont, Environmental Geology No. 3, 1973.
- United States Geological Survey, **Essex Junction Quadrangle, Vermont 7.5 Minute Series (Topographic)**, Reston, VA., Photorevised, 1987.
- Waste Management Division, **Fourth Quarter 1998 Update, Vermont Hazardous Sites List**, Vermont Agency of Natural Resources Department of Environmental Conservation, Waterbury, VT., January 19, 1999.

Attachment 1

Soil Boring and Well Completion Logs

MW-1 CONSTRUCTION DETAIL

Installation Date: January 5, 1999
Drilling Company: KSKGeoS™
Method: Hand Augur: 6" diameter bucket
Supervising Hydrogeologist: Kent Koptiuch, CGWP
Casing: 2" Flush-threaded PVC
Screen: 2" Flush-threaded, 0.020' slot PVC
Grade Elevation: 96.58' (relative to assumed datum of 100.00')
Top-of-Casing Elevation: 97.54' (relative to assumed datum of 100.00')
Screened Interval: 82.54' - 92.54' (relative to assumed datum of 100.00')
Sand Pack: No. 1 washed sand
Sand Pack Interval: 82.54' - 93.54' (relative to assumed datum of 100.00')
Well Seal: Hydrated, granular bentonite (Benseal)
Well Seal Interval: 93.54' - 95.00' (relative to assumed datum of 100.00')
Well Finish: Stick-up. Slip cap on well-head.

MW-1 SOILS LOG

Depth BG	Lithology	VOCs (ppm)
0.00 -	0.50' Frozen, brown, medium SAND.	0.0
0.50 -	1.00' Moist, brown, medium SAND.	0.0
1.00 -	2.50' Moist, pale brown, medium SAND with few Silts.	0.0
2.50 -	3.00' Wet, olive-grey, CLAY with common Silt.	0.0
3.00 -	3.33' Saturated, as above.	0.1
3.33 -	4.00' Moist, grey, CLAY with common Silts.	0.0
4.00 -	4.58' As above.	0.0
4.58 -	6.67' As above.	0.0
6.67 -	8.33' Moist, olive, brown and grey, medium banded, CLAY.	0.2
8.33 -	11.50' Wet, light olive-brown, CLAY.	0.0
11.50 -	13.40' Saturated, as above.	0.0
13.40 -	14.00' Saturated, olive CLAY.	0.0
14.00'	End-of-Boring.	

MW-2 CONSTRUCTION DETAIL

Installation Date: January 5, 1999
Drilling Company: KSKGeoS™
Method: Hand Augur: 6" diameter bucket
Supervising Hydrogeologist: Kent Koptiuch, CGWP
Casing: 2" Flush-threaded PVC
Screen: 2" Flush-threaded, 0.020' slot PVC
Grade Elevation: 84.25' (relative to assumed datum of 100.00')
Top-of-Casing Elevation: 86.58' (relative to assumed datum of 100.00')
Screened Interval: 76.58' - 81.58' (relative to assumed datum of 100.00')
Sand Pack: No. 1 washed sand
Sand Pack Interval: 76.58' - 83.00' (relative to assumed datum of 100.00')
Well Seal: Hydrated, granular bentonite (Benseal)
Well Seal Interval: 83.00' - 84.00' (relative to assumed datum of 100.00')
Well Finish: Stick-up. Slip cap on well-head.

MW-2 SOILS LOG

<u>Depth BG</u>	<u>Lithology</u>	<u>VOCs (ppm)</u>
0.00 - 1.00'	Moist, brown, SILT-LOAM.	0.0
1.00 - 1.50'	Moist, olive-brown, SILT with little fine Sand, slightly plastic, non-sticky.	0.0
1.50 - 2.00'	Moist, grey, CLAY with common Silts, slightly plastic, slightly sticky, organic odor.	0.0
2.00 - 4.67'	Moist, grey-brown, CLAY with common Silts, non-plastic, slightly sticky.	0.0
4.67 - 6.15'	Wet, as above.	0.0
6.15 - 6.50'	Wet, grey-brown, CLAY with common Silts and common Sands	0.0
6.50 - 7.45'	Dry, grey-brown mix of SILT, CLAY, fine SANDS and medium GRAVELS (Till), very dense.	0.0
7.45 - 7.67'	Moist, as above.	0.0
7.67'	Refusal on large stone - possibly bedrock. End-of-Boring.	

MW-3 CONSTRUCTION DETAIL

Installation Date: January 5, 1999
Drilling Company: KSKGeoS™
Method: Hand Augur: 6" diameter bucket
Supervising Hydrogeologist: Kent Koptiuch, CGWP
Casing: 2" Flush-threaded PVC
Screen: 2" Flush-threaded, 0.020' slot PVC
Grade Elevation: 87.95' (relative to assumed datum of 100.00')
Top-of-Casing Elevation: 89.62' (relative to assumed datum of 100.00')
Screened Interval: 74.80' - 84.80' (relative to assumed datum of 100.00')
Sand Pack: No. 1 washed sand
Sand Pack Interval: 74.80' - 86.00' (relative to assumed datum of 100.00')
Well Seal: Hydrated, granular bentonite (Benseal)
Well Seal Interval: 86.00' - 87.00' (relative to assumed datum of 100.00')
Well Finish: Stick-up. Slip cap on well-head.

MW-3 SOILS LOG

Depth BG	Lithology	VOCs (ppm)
0.00 - 1.00'	Dry, pale brown, medium SAND.	0.0
1.00 - 1.80'	Dry, pale brown, medium SAND with few Silts.	0.0
1.80 - 2.67'	Dry, grey-brown, very fine SAND with few Silts, fine platy, very friable.	0.0
2.67 - 3.00'	Dry, grey-brown, SILT with common fine Sand, coarse platy, very friable.	0.0
3.00 - 4.00'	Moist, grey-brown, SILT with common Clay, coarse platy, slightly plastic, non-sticky.	0.0
4.00 - 6.00'	Moist, finely inter-bedded grey and brown CLAY horizons.	0.0
6.00 - 9.05'	Wet, as above.	0.0
9.05 - 13.15'	Saturated, as above.	0.0
13.15'	End-of-Boring.	

MW-4 CONSTRUCTION DETAIL

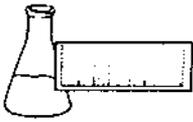
Installation Date: January 5, 1999
Drilling Company: KSKGeoS™
Method: Hand Augur: 6" diameter bucket
Supervising Hydrogeologist: Kent Koptiuch, CGWP
Casing: 2" Flush-threaded PVC
Screen: 2" Flush-threaded, 0.020' slot PVC
Grade Elevation: 91.04' (relative to assumed datum of 100.00')
Top-of-Casing Elevation: 92.14' (relative to assumed datum of 100.00')
Screened Interval: 82.54' - 87.54' (relative to assumed datum of 100.00')
Sand Pack: No. 1 washed sand
Sand Pack Interval: 82.54' - 88.75' (relative to assumed datum of 100.00')
Well Seal: Hydrated, granular bentonite (Benseal)
Well Seal Interval: 88.75' - 89.75' (relative to assumed datum of 100.00')
Well Finish: Stick-up. Slip cap on well-head.

MW-4 SOILS LOG

<u>Depth BG</u>	<u>Lithology</u>	<u>VOCs (ppm)</u>
0.00 - 0.37'	Frozen, dark brown, SILT-LOAM.	0.0
0.37 - 1.00'	Dry, pale brown, medium SAND with few Silts.	0.0
1.00 - 1.50'	Dry, pale-brown, fine SAND with few Silts, fine platy, very friable.	0.0
1.50 - 3.37'	Dry, grey-to-light red CLAY with common Silt, coarse platy, firm.	0.0
3.37 - 4.80'	Moist, grey, Clay with common Silt, coarse blocky, very firm.	0.0
4.80 - 6.50'	Moist, finely inter-bedded grey and brown CLAY horizons with little Silts and few fine Gravels, very dense.	0.0
6.50 - 7.50'	Wet, olive, CLAY with common Silts and few very fine pale brown Sands, plastic, slightly sticky.	0.0
7.50 - 8.50'	Saturated, as above.	0.0
8.50'	End-of-Boring.	

Attachment 2

**Laboratory Chemical Analytical Results:
January 11, 1999 Groundwater Sampling Event**



ENDYNE, INC.

Laboratory Services

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

REPORT OF LABORATORY ANALYSIS

Received 1/29/99

CLIENT: KSK GeoEnvironmental Services, Inc. PROJECT CODE: 1013
PROJECT NAME: Kinaman Residence REF.#: 133,626 - 133,630
REPORT DATE: January 14, 1999
DATE SAMPLED: January 11, 1999
Revised Report: 1/26/99

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.

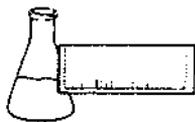
Analytical method precision and accuracy was monitored by laboratory control standards which included matrix spike, duplicate and quality control analyses. These standards were determined to be within established laboratory method acceptance limits.

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: KSK GeoEnvironmental Services, Inc.

DATE RECEIVED: January 11, 1999

PROJECT NAME: Kinaman Residence

REPORT DATE: January 14, 1999

CLIENT PROJ. #: NI

PROJECT CODE: 1013

Ref. #:	133,626	133,627	133,628	133,629	133,630
Site:	Trip Blank	MW-1	MW-3	MW-4	Field Blank
Date Sampled:	1/11/99	1/11/99	1/11/99	1/11/99	1/11/99
Time Sampled:	9:30	10:30	11:00	11:30	12:00
Sampler:	J. Roman				
Date Analyzed:	1/13/99	1/14/99	1/14/99	1/13/99	1/14/99
UIP Count:	0	> 10	0	0	0
Dil. Factor (%):	100	100	100	100	100
Surr % Rec. (%):	99	96	96	98	95
Parameter	Conc. (ug/L)				
MTBE	<10	<10	<10	<10	<10
Benzene	<1	<1	<1	<1	<1
Toluene	<1	1.1	<1	1.0	<1
Ethylbenzene	<1	<1	<1	<1	<1
Xylenes	<1	3.5	1.9	3.3	<1
1,3,5 Trimethyl Benzene	<1	1.2	<1	1.2	<1
1,2,4 Trimethyl Benzene	<1	1.9	<1	1.7	<1
Naphthalene	<1	4.6	<1	<1	<1

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

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

CHAIN-OF-CUSTODY RECORD

Project Name: <i>Kinaman Residence</i>	Reporting Address: <i>KSK Geos</i>	Billing Address: <i>KSK Geos</i>
Site Location: <i>ESSEX JCT VT</i>	<i>164 Osgood Hill Rd Essex Jct VT</i>	<i>164 Osgood Hill Essex VT 05452</i>
Endyne Project Number: <i>1013</i>	Company: <i>KSK Geos</i>	Sampler Name: <i>JOHN ROMAN</i>
	Contact Name/Phone #: <i>878-1620</i>	Phone #: <i>802 878-1620</i>

Lab #	Sample Location	Matrix	GRA B	COMP	Date/Time	Sample Containers		Field Results/Remarks	Analysis Required	Sample Preservation	Rush
						No.	Type/Size				
133626	TRIP BLANK	STUCK	X		1/11 09:30	2	40 VOA		8021B	HCL	NO
133627	MW-1	GW	X		1/11 10:00	2	40 VOA		8021B	HCL	
	MW-1	GW	X		1/11 10:15	2	40 VOA		MOD 8015	HCL	
133628	MW-3	GW	X		1/11 11:00	2	40 VOA		8021B	HCL	
	MW-3	GW	X		1/11 11:15	2	40 VOA		MOD 8015	HCL	
133629	MW-4	GW	X		1/11 11:30	2	40 VOA		8021B	HCL	
	MW-4	GW	X		1/11 11:45	2	40 VOA		MOD 8015	HCL	
133630	FIELD BLANK	HEAD	X		1/11 12:00	2	40 VOA		8021B	HCL	

Relinquished by: Signature <i>John C. Roman</i>	Received by: Signature <i>[Signature]</i>	Date/Time <i>1/11/99 1:38</i>
Relinquished by: Signature	Received by: Signature	Date/Time

New York State Project: Yes No Requested Analyses *KSK GEO PROS # 98026*

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 ₅	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):										



Received 1/29/99

Laboratory Services

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

LABORATORY REPORT

CLIENT: KSK GeoEnvironmental Services, Inc.

ORDER ID: 1013

PROJECT: Kinaman Residence

DATE RECEIVED: January 11, 1999

REPORT DATE: January 25, 1999

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. Different groups of analyses may be reported under separate cover.

All samples were prepared and analyzed by requirements outlined in the referenced methods and within the specified holding times.

All instrumentation was calibrated with the appropriate frequency and verified by the requirements outlined in the referenced methods.

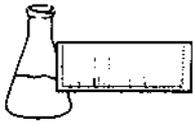
Blank contamination was not observed at levels affecting the analytical results.

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, unless otherwise noted.

Reviewed by,

Harry B. Locker, Ph.D.
Laboratory Director

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LABORATORY REPORT

CLIENT: KSK GeoEnvironmental Services, Inc.
PROJECT: Kinaman Residence
REPORT DATE: January 25, 1999

ORDER ID: 1013
DATE RECEIVED: January 11, 1999
SAMPLER: JR
ANALYST: 725

Ref. Number: 133627

Site: MW-1

Date Sampled: 1/11/99

Time: 10:30 AM

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Method</u>	<u>Analysis Date</u>
TPH 8015 GRO	TBQ <0.10	mg/L	SW 8015	1/19/99

Ref. Number: 133628

Site: MW-3

Date Sampled: 1/11/99

Time: 11:00 AM

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Method</u>	<u>Analysis Date</u>
TPH 8015 GRO	<0.10	mg/L	SW 8015	1/19/99

Ref. Number: 133629

Site: MW-4

Date Sampled: 1/11/99

Time: 11:30 AM

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Method</u>	<u>Analysis Date</u>
TPH 8015 GRO	<0.10	mg/L	SW 8015	1/19/99

CHAIN-OF-CUSTODY RECORD

Project Name: <i>K. Naman Residence</i>	Reporting Address: <i>KSK Geos</i> <i>164 OSGOOD HILL RD ESSEX JCT VT</i>	Billing Address: <i>KSK Geos</i> <i>164 Osgood Hill Essex VT 05452</i>
Site Location: <i>ESSEX JCT VT</i>	Company: <i>KSK Geos</i>	Sampler Name: <i>JOHN ROMAN</i>
Endyne Project Number: <i>1013</i>	Contact Name/Phone #: <i>878-1620</i>	Phone #: <i>802 878-1620</i>

Lab #	Sample Location	Matrix	GRA B	COMP	Date/Time	Sample Containers		Field Results/Remarks	Analysis Required	Sample Preservation	Rush
						No.	Type/Size				
133626	TRIP BLANK	DISTILLED	X		1/11 0930	2	40 VOA		8021B	HCL	NO
133627	MW-1	GW	X		1/11 1030	2	40 VOA		8021B	HCL	
	MW-1	GW	X		1/11 1045	2	40 VOA		MOD 8015	HCL	
133628	MW-3	GW	X		1/11 1100	2	40 VOA		8021B	HCL	
	MW-3	GW	X		1/11 1115	2	40 VOA		MOD 8015	HCL	
133629	MW-4	GW	X		1/11 1130	2	40 VOA		8021B	HCL	
	MW-4	GW	X		1/11 1145	2	40 VOA		MOD 8015	HCL	
133630	FIELD BLANK	H ₂ O	X		1/11 1200	2	40 VOA		8021B	HCL	

Relinquished by: Signature <i>John C. Roman</i>	Received by: Signature <i>[Signature]</i>	Date/Time <i>1/11/99 1:38</i>
Relinquished by: Signature	Received by: Signature	Date/Time

New York State Project: Yes No Requested Analyses *KSK GEO PROS # 98026*

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