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13 February 1998

Mr. Don Robisky
Vermont Department of Environmental Conservation
Sites Management Section
103 South Main Street, West Building
Waterbury, Vermont 05671-0404

FEB 17 10 29 AM '98

Dear Mr. Robisky:

Enclosed is one bound copy of the Initial Site Investigation Report for the Carlet, Gilson, and Hurley building located in St. Johnsbury, Vermont.

Please call me if you have any questions regarding the enclosed information.

Sincerely,

Terry W. Robbins

Terry W. Robbins, E.I.T.
Environmental Scientist

Enclosure

cc. Mr. Francis Carlet

Ref: 97030C03.DOC

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INITIAL SITE INVESTIGATION REPORT

CARLET, GILSON & HURLEY BUILDING
50 Bay Street
St. Johnsbury, Vermont

13 February 1998

Prepared for:

Carlet, Gilson & Hurley Property
P.O. Box 391
50 Bay Street
St. Johnsbury, Vermont 05458

Contact: Mr. Francis Carlet
Phone: 802-748-6200

Prepared by:

Marin Environmental, Inc
Ground Water of Vermont Division
1700 Hegeman Avenue
Colchester, VT 05446

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MARIN Project #: V97-030
MARIN Document #: 97030R02.DOC

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EXECUTIVE SUMMARY

Marin Environmental, Inc. (MARIN) has conducted an initial site investigation at the Carlet, Gilson & Hurley Building, located on 50 Bay Street in St. Johnsbury, Vermont and has concluded the following:

- An abandoned fuel-oil underground storage tank (UST) removed from the site on 17 July 1997 has released fuel oil to the subsurface. Several holes were observed in the UST, and free-phase petroleum product and evidence of significant soil contamination were observed in the tank excavation. No other underground storage tanks are known to exist on the property, and the absence of detected soil or ground-water contamination in upgradient soil borings and monitoring wells suggests that the contamination has not migrated onto the site from adjacent properties. The fuel oil UST was reportedly abandoned prior to 1982, when Messrs. Carlet, Gilson, and Hurley purchased the property.

- Due to the south-southwesterly ground-water flow direction beneath the site, fuel oil has migrated into the building basement along the base of the stone and concrete foundation. Free-phase petroleum seeps were observed along the interior basement wall adjacent to the former UST location. Total petroleum hydrocarbons (TPH) were detected in three soil samples collected from the basement's earthen floor – one near the observed seep area (SS-1, 246 parts per million, or ppm) and two crossgradient and downgradient, respectively, of the seep area (SS-2, 23.6 ppm and SS-3, 38.0 ppm). Low levels of toluene, ethylbenzene, and xylene were also identified in the SS-1 soil sample. TPH was also identified in a basement water sample at 4.91 ppm.

- A sump-pump system operating in the building basement appears to have contributed to contaminant entry into the basement, and has acted as a preferential pathway for low-level contaminant migration to soils southeast of the building. Depth to water in the vicinity of the former UST, located adjacent to the northeast basement corner, is approximately four feet below ground surface (bgs), which is two feet higher than the dirt-floored basement. Water accumulates in the basement whenever the sump-pump system is not operating. The sump-pump system discharges to the ground surface at a point approximately 60 feet southeast of the buildings' southeast corner. TPH was detected at 10.1 ppm in a soil sample collected at the outfall of the suspected basement discharge pipe; no volatile compounds were detected at this location, however.

- The sump-pump system operating in the building basement may be affecting the direction of ground-water flow in the vicinity of the site. On 12 September 1997, ground water in the surficial aquifer at the site was flowing south-southwest, at an average gradient of about 1.5 percent. This flow direction was unexpected, as the Passsumpsic River is located approximately 650 feet to the east of the property, and the site is located on the floodplain.

- The removal of approximately 75 cubic yards of contaminated soil during the July 1997 UST closure appears to have removed the bulk of contamination from the source area. All contaminated soils above the water table were excavated and sent for asphalt batching at MTS, Inc. of Epsom, New Hampshire. No volatile petroleum compounds and only a trace amount of TPH were detected in a ground-water sample collected on 12 September 1997 from the

monitoring well installed in the former UST location. No contaminants were detected in any of the other three on-site monitoring wells.

- The presence of significant soil contamination in the building basement may present a human health risk through direct contact, ingestion of contaminated soils and through inhalation of petroleum vapors. Inhalation is the most likely route of long-term low-level exposure; the basement is not normally occupied, but the fresh-air intake for the building heating system is located in the basement interior. The presence of approximately eight inches of water covering the building basement dirt-floor on 12 September 1997 may have prevented the measurement of elevated PID readings.
- No other sensitive receptors appear to be threatened by the residual contamination. No drinking-water supplies appear to be threatened, as the site and all buildings in the vicinity are served by the St. Johnsbury municipal water system. It is likely that the natural processes of dilution, degradation and dispersion will reduce ground-water contaminant concentrations to below detectable levels before ground water flowing through the former UST location discharges into the Passumpsic River.

On the basis of the results of this investigation, MARIN makes the following recommendations:

1. A curtain drain system should be installed along the northeast corner of the building to prevent continued entry of contaminated ground water. The effluent should be treated with activated carbon and discharged to the ground surface east of the building.
2. After the inflow of ground water into the basement has been diverted, all petroleum-contaminated soils in the building basement should be removed and properly disposed of.
3. Potentially contaminated soils located around the suspected basement discharge pipe should be screened using a PID. If PID readings are greater than the 10 ppm VT DEC guideline for fuel-oil contaminated soils, the soils should be excavated and properly disposed of.
4. The on-site monitoring wells should be resampled to confirm the September 1997 analytical results. The samples should be analyzed for BTEX compounds by EPA Method 8020 and for polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8100. At that time, ground-water level measurements should be obtained from the on-site monitoring wells to evaluate whether seasonal fluctuations in ground-water flow direction exist.
5. Until an appropriate ground-water flow diversion trench is installed and providing the current grinder pumps can force 11 gallons per minute (gpm) through a two-inch main, the basement sump-pump effluent water should be discharged directly into the municipal sewer system upon receiving appropriate approval.

1.0 INTRODUCTION

This report details the results of an initial site investigation conducted at the Carlet, Gilson & Hurley Building (herein referred to as the "site"), located at 50 Bay Street in the town of St. Johnsbury, Vermont (Figure 1). This report has been prepared by Marin Environmental, Inc. (MARIN) for Carlet, Gilson and Hurley of St. Johnsbury, Vermont. The site investigation was initiated with Vermont Department of Environmental Conservation (VT DEC) approval following the discovery of a petroleum release to the subsurface from an abandoned heating-oil underground storage tank (UST).

1.1 Site Location and Physical Setting

The site is located at 50 Bay Street in St. Johnsbury, Vermont. The facility consists of a two-story building, which houses three commercial businesses. The on-site building is located approximately 50 feet east of Bay Street. The parking lot, north of the facility, is approximately 63 feet wide by 125 feet long. The abutting property to the north of the site is occupied by Northern Petroleum's bulk storage facility. The Passumpsic River is located approximately 650 feet east of the parking lot.

There are no private residences in the immediate vicinity. The site and all businesses on adjacent properties are serviced by municipal water and sewer systems.

The former UST was located on the northeastern portion of the property, approximately three feet from the northeast wall of the building (Figure 2).

The ground surface around the site has an average elevation of about 180 feet above mean sea level and is generally flat. Surface drainage appears to be controlled by two drainage swales—one constructed on the northern edge of the parking lot in a west-east direction, and one constructed on the eastern edge of the property between the former Ralston Mill property in a north-south direction. The presumed direction of ground-water flow in the area is east-southeast toward the Passumpsic River, which flows southward in the vicinity of the site.

Two municipal water lines exist on the site in the northern part of the property at the parking lot—one six-inch line, located parallel to the northern drainage swale, approximately 30 feet from the former UST, connecting to the on-site fire hydrant and routing through an eight-inch line toward the former Ralston Mill building.

Native surficial materials in the area are mapped as well-sorted sand (Stewart and MacClintock, 1970). Bedrock in the area is mapped as the Waits River Formation, which is composed predominantly of gray quartzose and micaceous crystalline limestone of lower Devonian Age (Doll, 1961).

1.2 Site History

Messrs. Carlet, Gilson and Hurley have owned the property since 1982. Previous owners of the site include Charles Miellar & Son, Tempered Maple Manufacturing, and Goss Tire.

The present owners of the property were reportedly unaware of the existence of an on-site heating-oil UST on the property. Fuel oil had reportedly been stored in a basement tank since before they purchased the property. A 27 March 1991 Phase I Environmental Site

Assessment performed by Dubois & King, Inc. stated that *"the Underground Storage Tank Section does not have any records of an underground storage tank at this property"*, and that *"there are no underground storage tanks on the property that are indicated on any of the documents we reviewed or which were noticed during field inspections."*

Evidence of a petroleum release from an on-site UST was detected in early 1997 when free-phase petroleum resembling heating oil was observed seeping into the building basement, along the north wall near the northeast corner. Excavation performed on 24 April 1997 confirmed the presence of an on-site UST adjacent to the north building wall. Observations made by MARIN during the excavation suggested that the UST was the source of observed contamination. In a letter dated 29 April 1997, the VT DEC directed that the abandoned fuel-oil UST be removed from the property.

On 17 July 1997, MARIN inspected the removal of the abandoned 550-gallon UST. The UST was found to be in very poor condition upon removal, with several holes ranging from less than one-quarter inch to five-eighths inches in diameter, and extensive pitting and rust. Petroleum saturated soils were observed beneath the tank, and photoionization detector (PID) readings on soil samples collected from the UST excavation ranged from 1.2 to 391 parts per million (ppm). The highest PID readings were noted at three feet below ground surface (bgs) above the south-central portion of the tank; nearby soils had dark staining and exhibited a strong petroleum odor. The horizontal extent of soil contamination above the water table was defined; however, contamination extended beneath the water table, which was encountered at five feet bgs. A thin layer of free-phase No. 2 fuel-oil was observed floating on the water surface in the UST excavation.

Approximately 75 cubic yards of petroleum contaminated soils associated with the abandoned UST were removed from above the water table and later transported to MTS, Inc. of Epsom, NH for asphalt batching.

Also on 17 July 1997, MARIN personnel observed water containing petroleum odors and sheens being pumped by a sump-pump system in the basement. Water in the basement appeared to contain fuel-oil contamination, but no free-phase product was noted. MARIN collected a water sample for laboratory analysis of volatile organic compounds (VOCs) by EPA Method 8260 and total petroleum hydrocarbons (TPH) by modified EPA method 8100. No volatile petroleum compounds were detected in the basement water; however, TPH was identified at a concentration of 3.5 ppm.

On 18 July 1997, under direction of the VT DEC, MARIN began pumping fuel oil-contaminated water from the basement through two 55-gallon carbon-filter canisters connected in series, each containing about 200 pounds of granular activated carbon. From 18 July 1997 through 29 August 1997, approximately 300,000 gallons of fuel-oil contaminated water were treated and discharged to the St. Johnsbury municipal sewer system with approval from the operator. On 25 August 1997, after receiving the laboratory results of the basement-sump sample, the VT DEC granted MARIN permission to discontinue carbon treatment, and the discharge was rerouted back to the drainage swale southeast of the building.

1.3 Objectives and Scope of Work

The objectives of this initial site investigation were to:

- Evaluate the degree and extent of petroleum contamination in soil and ground water;
- Qualitatively assess the risks to environmental and public health via relevant sensitive receptors and potential contaminant migration pathways; and
- Identify potentially appropriate monitoring and/or remedial actions based on the site conditions.

To accomplish these purposes, MARIN has:

- Supervised the installation of four soil borings/monitoring wells, and determined the extent of fuel-oil contamination, and the local ground-water flow direction, gradient and approximate velocity.
- Screened subsurface soils from the soil borings for the possible presence of volatile organic compounds (VOCs) using a photoionization detector (PID).
- Collected and submitted ground-water samples from the on-site monitoring wells and basement surface water for laboratory analysis of volatile petroleum compounds and total petroleum hydrocarbons.
- Collected and submitted soil samples from both the basement's earthen floor and suspected basement discharge pipe for laboratory analysis of VOCs and TPH.
- Screened the breathing zone air in the basement using a PID.
- Identified sensitive receptors in the area, and assessed the risk posed by the contamination to these potential receptors.
- Evaluated the need for treatment and/or a long-term monitoring plan for the site.
- Prepared this summary report, which details the work performed, qualitatively assesses risks, provides conclusions and offers recommendations for further action.

2.0 INVESTIGATIVE PROCEDURES AND RESULTS

2.1 Soil Boring / Monitoring Well Installation

Prior to backfilling the UST excavation with clean fill on 17 July 1997, one monitoring well (MW-1) was placed within the UST excavation. The monitoring well consisted of two 5-foot sections of two-inch-diameter machine-slotted PVC screen extending to ground surface. The bottom of MW-1 was set at approximately 9 feet below ground surface (bgs). The well was backfilled with clean fill material. The completed monitoring well was protected by a flush-mounted steel roadbox surrounded and packed with staymat at ground surface. A water-tight compression cap was placed on top of the PVC.

On 3 September 1997, MARIN supervised the completion of three soil borings/monitoring wells (MW-2, MW-3, and MW-4). Approximate monitoring well locations are shown on Figure 2. The soil borings and monitoring wells were installed using hollow stem auger (HSA) drilling, by Tri-State Drilling and Boring of West Burke, Vermont.

The soils encountered in each boring generally consisted of brown poorly sorted fine sand and trace cobbles, underlain by well sorted coarse sand and gravel at approximately 11 feet bgs. Ground water was encountered between 6 and 9 feet bgs at the time of drilling. Soil samples were collected from each boring using a two-foot long split spoon sampler. Soil recovery was generally fair, ranging between 33 and 83 percent, and averaging 64 percent. The split-spoon samples were screened for the possible presence of VOCs with a photoionization detector (PID) and logged for lithology by MARIN field personnel. All downhole drilling and sampling equipment was decontaminated during use as appropriate.

Two-inch-diameter PVC monitoring wells with 10 feet of 0.010-inch slots were installed to 12 feet bgs at MW-3 and MW-4, and to 14 feet bgs at MW-2. Sections of solid PVC were added to bring the tops of the well casings to approximately 0.5 feet bgs. Clean silica #1 filter sand was placed in the borehole annulus around each well to nominally one foot above the slotted interval. A bentonite pellet seal, approximately 1 foot thick, was set above the sand pack and the remainder of the annular space was backfilled with native material. Each completed monitoring well was protected by a flush-mounted steel roadbox cemented into place. Each well casing was topped with a water-tight compression cap. Monitoring-well construction details are included on the soil-boring and well-construction logs in Appendix A.

2.2 Soil-Screening Results

During the completion of soil borings on 3 September 1997, no PID field-screening response was detected on soil samples collected from any of the soil borings. PID readings at MW-1, installed on 17 July in the UST excavation, ranged from 1 to 391 ppm, with the highest readings obtained at about 3 feet bgs. PID screening results are included on the boring logs in Appendix A.

2.3 Soil Sampling and Analysis

On 12 September 1997, three soil samples were collected from the earthen floor of the building basement to evaluate possible impacts from seeping fuel-oil from the former UST. Sample SS# 1 was collected next to the wall closest the former UST, SS# 2 was collected near the northwest corner of the basement, and SS# 3 was collected in the center of the

southern portion of the basement (Figure 4). Analytical results are presented in Table 1 below.

TPH was identified at a concentration of 10.1 ppm in a soil sample collected from the presumed location of the basement outfall pipe. Based on site plans provided by Carlet, Gilson, & Hurley Property, the outfall pipe presumably leads from the southeast portion of the basement, running southeast for approximately 60 feet, turning due east toward the Passumpsic River for discharge. However, during field observations MARIN personnel could not locate the discharge pipe; it appears the pipe was destroyed during site work at the former Ralston Mill building. MARIN did locate a moist area in the drainage swale located southeast of the building. Based on the location of the moist area and faint petroleum odors in the soil, MARIN personnel determined this area to be the basement discharge outfall.

Table 1. Soil Sample Analytical Results

12 September 1997

Sample I.D.	Benzene	Ethyl benzene	Toluene	Xylenes	Total BTEX	MTBE	TPH (ppm)
SS-1	ND <25	**37.2**	**37.9**	**40.7**	**116**	ND <25	**246**
SS-2	ND <10	ND <10	ND <10	ND <10	ND <10	ND <10	**23.6**
SS-3	ND <10	ND <10	ND <10	ND <10	ND <10	ND <10	**38.0**
Outfall-Soil Sample	NT	NT	NT	NT	NT	NT	**10.1**

Results reported as parts per billion (ppb), unless noted otherwise.
ND = Not detected above indicated detection limit.
NT = Not Tested

2.4 Determination of Ground-Water Flow Direction and Gradient

Ground water in the unconfined surficial aquifer directly beneath the site appears to be flowing in a south-southwesterly direction. The average gradient of the local ground-water table on 12 September 1997 was about 1.5 percent. Average flow velocities in the ground water moving through fine sands are estimated to be in the range of 0.001 to 0.2 feet per day (ft/day). Water-level measurements and elevation calculations for 12 September 1997 are presented in Table 2. The ground-water contour map in Figure 3 was prepared using this data.

TABLE 2. Ground-Water Elevation Calculations

Well I. D.	Top of Casing Elevation *	Depth to Water (feet, TOC)	Ground Water Elevation
MW-1	97.88	3.96	93.92
MW-2	100.00	6.23	93.77
MW-3	98.17	3.10	95.07
MW-4	98.16	3.82	94.34

*Top of casing (TOC) and ground water elevations are relative to an arbitrary site datum of 100.00 feet

Fluid levels were measured in the four monitoring wells on 12 September 1997. The depth to water varied from 3.10 feet (MW-3) to 6.23 feet (MW-2) below top-of-casing. No free-phase fuel-oil was observed in any of the on-site monitoring wells. Static water-table elevations were computed for each monitoring well by subtracting the measured depth-to-water readings from the surveyed top-of-casing elevations, which are relative to an arbitrary site datum of 100.00 feet.

The shallow aquifer at the site consists predominantly of poorly sorted fine sand, with a well sorted coarse sand layer at approximately 11 feet bgs. Fine sands typically exhibit effective porosities of about 0.20 to 0.30 and hydraulic conductivities of about 0.03 to 3 ft/day (Fetter, 1994). Assuming Darcian flow, these estimated ranges of porosity and conductivity combine with the calculated ground-water gradient of 1.5 percent to yield an estimated range of ground-water flow velocities in the surficial aquifer of between 0.001 and 0.2 ft/day.

2.5 Ground-Water Sampling and Analysis

No benzene, toluene, ethylbenzene, xylene (BTEX) compounds were identified in ground-water samples collected from the four on-site monitoring wells or the basement-water sample. Total petroleum hydrocarbons (TPH) were detected at trace levels (below the laboratory quantitation limit of 0.8 ppm) at MW-1, located in the vicinity of the former UST and at 4.9 ppm in the basement water sample, located downgradient of the former UST. Methyl tertiary butyl-ether (MTBE), which is added to gasoline as an octane-boosting agent, was identified at low levels in both the basement-water sample and MW-1 at 2.7 ppb and 2.3 ppb, respectively. The significance of this detection is uncertain, however, as MTBE was detected at a similar concentration in the trip blank (see below). Ground-water analytical results are summarized in Table 3. Laboratory report forms are included in Appendix B.

TABLE 3. Ground Water Analytical Results

12 September 1997

Well I.D.	Benzene	Ethyl benzene	Toluene	Xylenes	Total BTEX	MTBE	TPH (ppm)
MW-1	ND <1	ND <1	ND <1	ND <1	ND	**2.3**	TBQ <0.8
MW-2	ND <1	ND <1	ND <1	ND <1	ND	ND <1	ND
MW-3	ND <1	ND <1	ND <1	ND <1	ND	ND <1	ND
MW-4	ND <1	ND <1	ND <1	ND <1	ND	ND <1	ND
Basement Water	ND <1	ND <1	ND <1	ND <1	ND	**2.7**	**4.91**
duplicate	ND <1	ND <1	ND <1	ND <1	ND	**2.2**	TBQ <0.8
trip blank	ND <1	ND <1	ND <1	ND <1	ND	**4.2**	ND
VGES	**5**	**700**	**1,000**	**10,000**	---	**40**	---

Results reported as parts per billion (ppb), unless noted otherwise.
ND = Not detected above indicated detection limit.
VGES = Vermont Groundwater Enforcement Standard.
Duplicate collected from MW-1.

Ground-water samples were collected from the four monitoring wells on 12 September 1997. Each monitoring well was purged and then sampled using a dedicated bailer and dropline. Purge water was discharged directly to the ground in the vicinity of each well. Trip blank and duplicate samples were collected during the sampling event for quality assurance/quality control (QA/QC) purposes. All field procedures were conducted in accordance with MARIN standard protocols.

Each water sample was collected in two 40-milliliter (mL) glass vials with Teflon-lined-septa lids and the sample preserved with hydrochloric acid. All samples were transported in an ice-filled cooler under chain-of-custody to Endyne, Inc. of Williston, Vermont for laboratory analysis, where they were analyzed for the possible presence of BTEX and MTBE by EPA Method 8020 and TPH by modified EPA Method 8100. Analytical results from the QA/QC samples indicate low-level MTBE concentration at some point in the sampling or analytical process. MTBE, a gasoline additive that is not found in heating oil, was detected in the trip-blank sample, duplicate sample, basement-water sample, and MW-1.

2.6 Basement Air Quality Screening

On 17 July and 12 September 1997, MARIN field personnel performed indoor air PID screening to evaluate possible impacts to air quality from the migration of fuel-oil into the basement soils. At these times, PID responses were 0 ppm. Approximately 14 to 18 inches of water covered the basement floor on both days, possibly preventing the volatilization of petroleum compounds

adsorbed to soils and may, in effect, be contributing to an under-estimation of volatilized petroleum product concentrations present.

3.0 SENSITIVE RECEPTOR SURVEY AND RISK ASSESSMENT

3.1 Sensitive Receptor Survey

MARIN conducted a survey to identify sensitive receptors in the vicinity of the site that could potentially be impacted by residual soil contamination and migration of contaminated ground water. The following sensitive receptors were identified in the vicinity of the site:

- Soils in the building basement.
- Interior air in the building.
- Soils adjacent to the discharge-pipe outfall.
- The Passumpsic River, whose nearest point is located approximately 650 feet east of the former UST.

The site and all buildings within a half-mile radius are served by a municipal water and sewer.

3.2 Risk Assessment

MARIN assessed the risks that the residual subsurface contamination poses to the receptors identified above. In general, human exposure to petroleum related contamination is possible through inhalation, ingestion, or direct contact while impacts to environmental receptors are due either to a direct release or contaminant migration through one receptor to another or along a preferential pathway. The findings of our risk assessment indicate that the presence of free-phase heating oil in the basement soils presents a risk to human contact by inhalation, ingestion, and/or direct contact. The discharge to ground surface of contaminated water from the basement sumps represents a preferential pathway by which contaminated groundwater may flow directly to the Passumpsic River.

4.0 CONCLUSIONS

Based on the results of the site investigation described above, MARIN concludes the following:

- An abandoned fuel-oil underground storage tank (UST) removed from the site on 17 July 1997 has released fuel oil to the subsurface at the site. Several holes were observed in the UST, and free-phase petroleum product and evidence of significant soil contamination were observed in the tank excavation. No other underground storage tanks are known to exist on the property, and the absence of detected soil or ground-water contamination in upgradient soil borings and monitoring wells suggests that the contamination has not migrated onto the site from adjacent properties. The fuel oil UST was reportedly abandoned prior to 1982, when Messrs. Carlet, Gilson, and Hurley purchased the property.

- Fuel oil has migrated into the building basement along the base of the stone and concrete foundation. Free-phase petroleum seeps were observed along the interior basement wall adjacent to the former UST location. Total petroleum hydrocarbons (TPH) were detected in three soil samples collected from the basement's earthen floor – one near the observed seep area (SS-1, 246 parts per million, or ppm) and two samples each collected crossgradient and downgradient of the seep area (SS-2, 23.6 ppm and SS-3, 38.0 ppm). Low levels of toluene, ethylbenzene, and xylene were also identified in analytical results from SS-1. TPH was also identified in a basement water sample at 4.91 ppm.

- A sump-pump system operating in the building basement appears to have contributed to contaminant entry into the basement, and has acted as a preferential pathway for low-level contaminant migration to soils southeast of the building. Depth to water in the vicinity of the former UST is approximately four feet below ground surface (bgs), which is two feet higher than the dirt-floored basement. The sump-pump system discharges to the ground surface at a point approximately 60 feet southeast of the building's southeast corner. TPH was detected at 10.1 ppm in a soil sample collected at the outfall of the suspected basement discharge pipe; no volatile compounds were detected at this location, however.

- The sump-pump system operating in the building basement may be affecting the direction of ground-water flow in the vicinity of the site. On 12 September 1997, ground water in the surficial aquifer at the site was flowing south-southwest, at an average gradient of about 1.5 percent. This flow direction was unexpected, as the Passsumpsic River is located approximately 650 feet to the east of the property, and the site is located on the floodplain.

- The removal of approximately 75 cubic yards of contaminated soil during the July 1997 UST closure appears to have removed the bulk of contamination from the source area. All contaminated soils above the water table were excavated and sent for asphalt batching at MTS, Inc. of Epsom, New Hampshire. No volatile petroleum compounds and only a trace amount of TPH were detected in a ground-water sample collected on 12 September 1997 from the monitoring well installed in the former UST location. No contaminants were detected in any of the other three on-site monitoring wells.

- The presence of significant soil contamination in the building basement may present a human health risk through direct contact, ingestion of contaminated soils and through inhalation of petroleum vapors. Inhalation is the most likely route of long-term low-level exposure; the basement is not normally occupied, but the fresh-air intake for the building heating system is

located in the basement interior. On the other hand, no elevated PID readings were measured in the building basement on 12 September 1997.

- No other sensitive receptors appear to be threatened by the residual contamination. No drinking-water supplies appear to be threatened, as the site and all buildings in the vicinity are served by the St. Johnsbury municipal water system. It is likely that the natural processes of dilution, degradation and dispersion will reduce ground-water contaminant concentrations to below detectable levels before ground water flowing through the former UST location discharges into the Passumpsic River, which is located approximately 650 feet east of the site.

5.0 RECOMMENDATIONS

On the basis of the results of this investigation and the conclusions stated above, MARIN recommends the following:

1. A curtain drain system should be installed along the northeast corner of the building to prevent continued entry of contaminated ground water. The effluent should be treated with activated carbon and discharged to the ground surface east of the building.
2. All petroleum-contaminated soils in the building basement should be removed and properly disposed of.
3. Potentially contaminated soils located around the suspected basement discharge pipe should be screened using a PID. If PID readings are greater than the 10 ppm VT DEC guideline for fuel-oil contaminated soils, the soils should be excavated and properly disposed of.
4. The on-site monitoring wells should be resampled to confirm the September 1997 analytical results. The samples should be analyzed for BTEX compounds by EPA Method 8020 and for polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8100. At that time, ground-water level measurements should be obtained from the on-site monitoring wells to evaluate whether seasonal fluctuations in ground-water flow direction exist.
5. Until an appropriate ground-water flow diversion trench is installed and providing the current grinder pumps can force 11 gallons per minute (gpm) through a two-inch main, the basement sump-pump effluent water should be discharged directly into the municipal sewer system upon receiving appropriate approval.

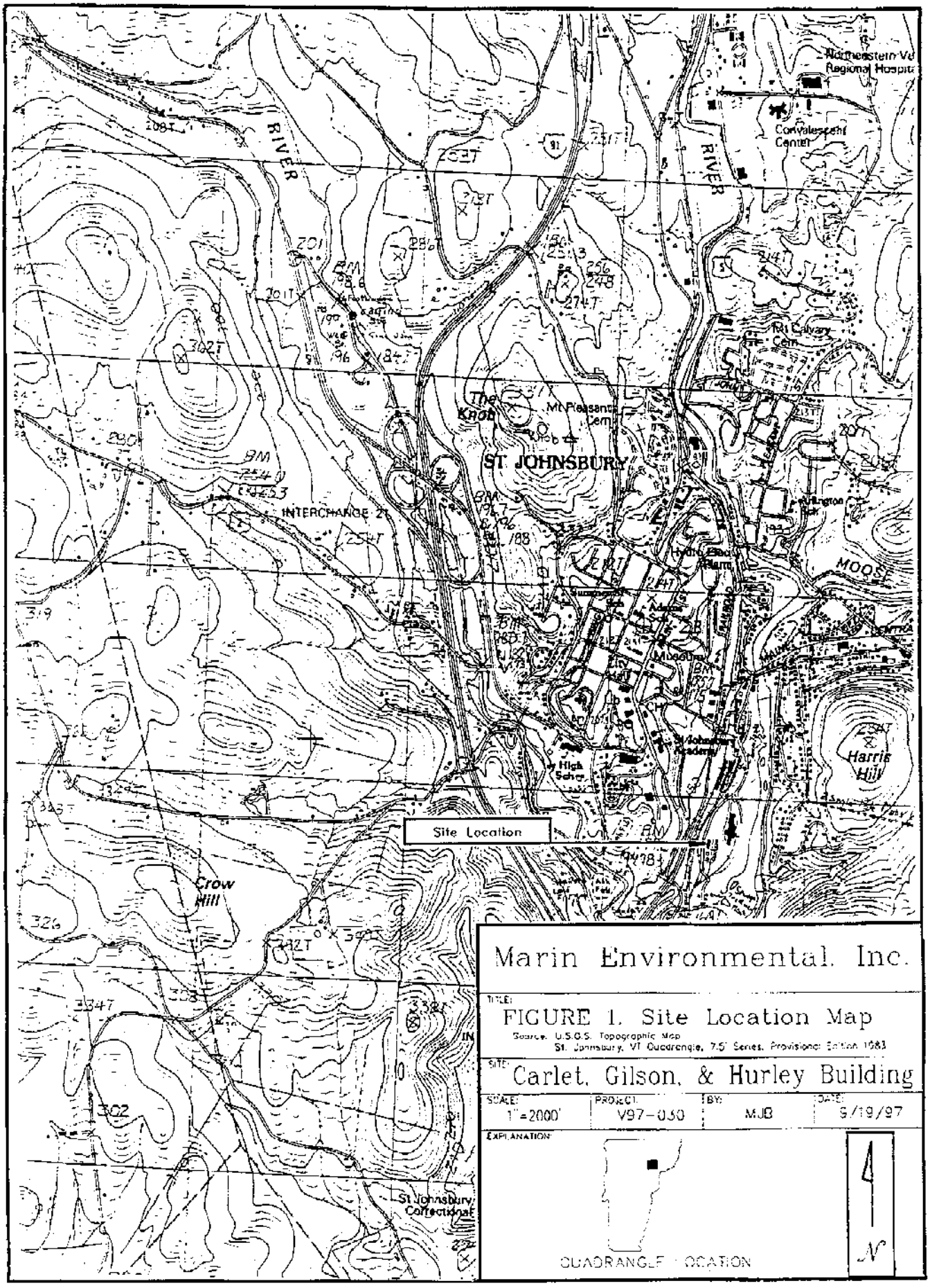
6.0 REFERENCES

Doll, C.G. and others, 1961. *Geologic Map of Vermont*, Office of the State Geologist.

Fetter, C.W., 1994. *Applied Hydrogeology, 3rd Ed.*, Prentice Hall, Englewood Cliffs, New Jersey, 98 p.

Stewart, D.P. and MacClintock, P., *1970. Surficial Geologic Map of Vermont*, Office of the State Geologist.

USGS, 1983. St. Johnsbury, Vermont. U.S. Geological Survey. 7.5x15 minute series (topographic). Provisional Edition, 1983.


RIVER
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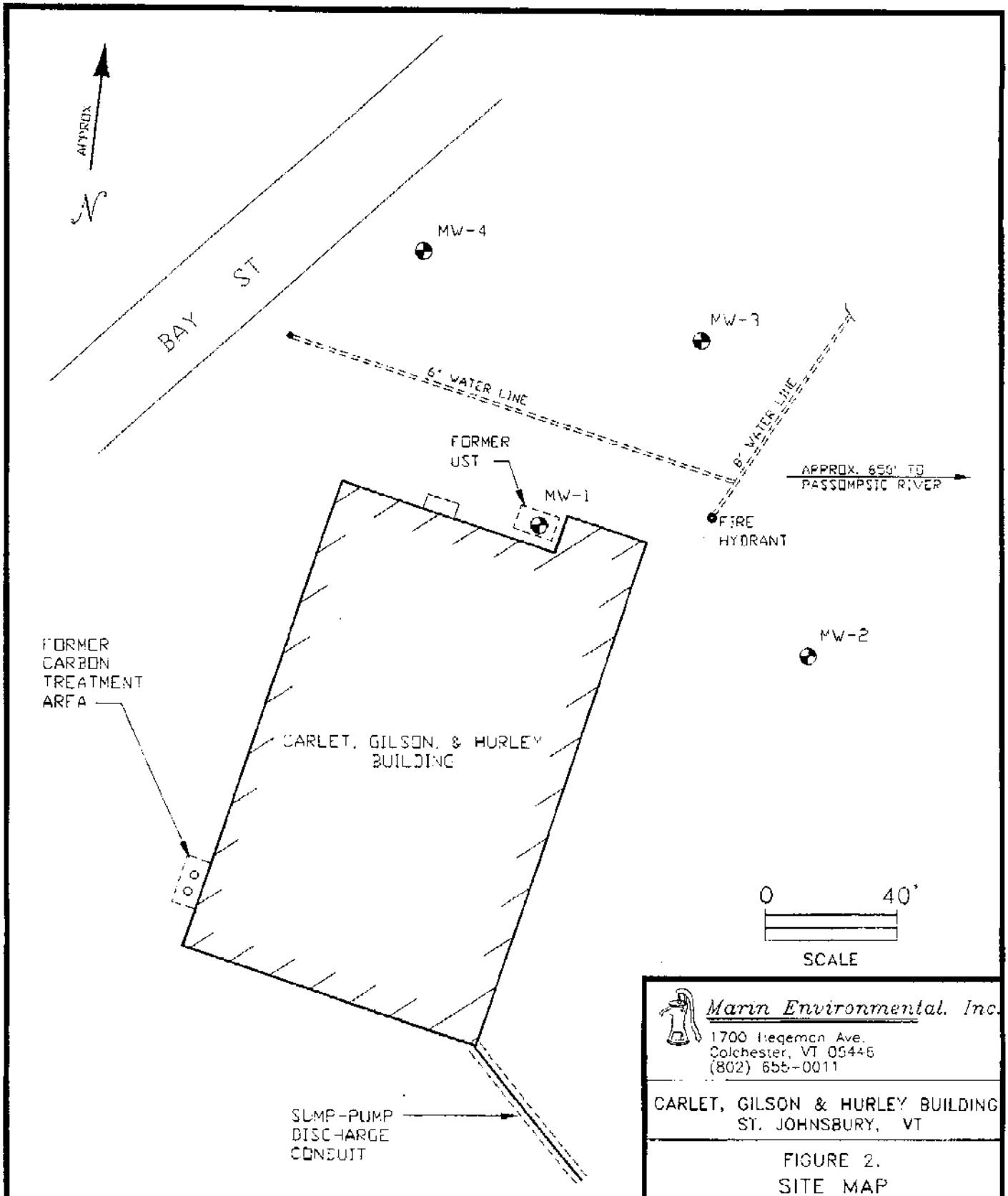
Northeastern Vt Regional Hospital
Convalescent Center
Mt Calvary Cem
The Knob
Mt Pleasant Cem
ST JOHNSBURY
INTERCHANGE 21
MOOSE
Harris Hill
Site Location
Crow Hill
St Johnsbury Correctional
Marin Environmental, Inc.
TITLE:
FIGURE 1. Site Location Map
Source: U.S.G.S. Topographic Map
St. Johnsbury, VT Quadrangle, 7.5' Series, Provisional Edition 1983
SITE:
Carlet, Gilson, & Hurley Building
SCALE: 1"=2000'
PROJECT: V97-050
BY: MJB
DATE: 9/19/97
EXPLANATION:
QUADRANGLE LOCATION
4
N



ALL LOCATIONS ARE APPROXIMATE

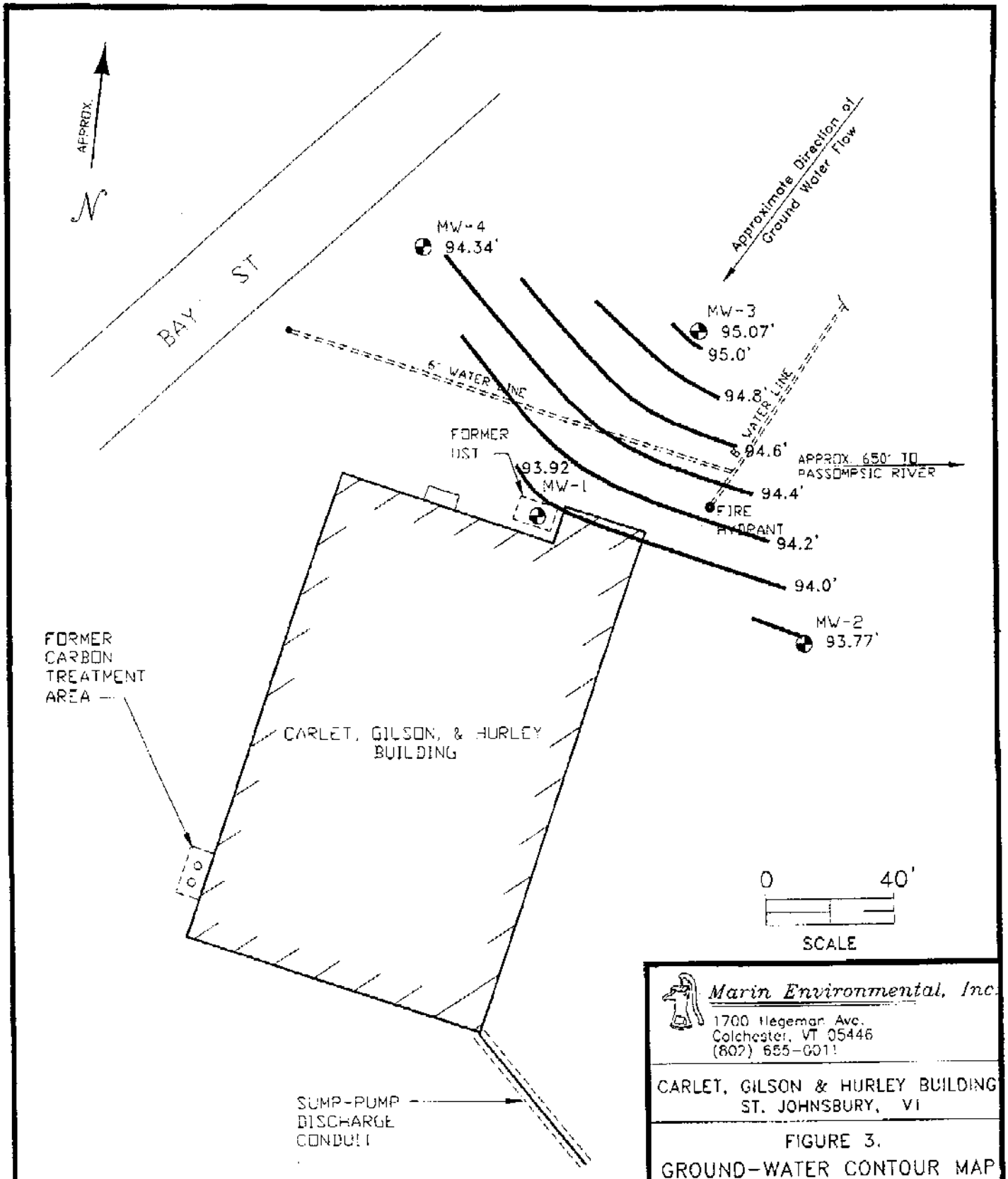
Marin Environmental, Inc.
1700 Hegeman Ave.
Colchester, VT 05446
(802) 655-0011

CARLET, GILSON & HURLEY BUILDING
ST. JOHNSBURY, VT

FIGURE 2.
SITE MAP
With Monitoring Well Locations

LEGEND:
Monitoring Well

DRAWN BY: MJB	DATE: SEP 97
APPROVED BY: RM	FILE No. 97030



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Colchester, VT 05446
(802) 655-0011

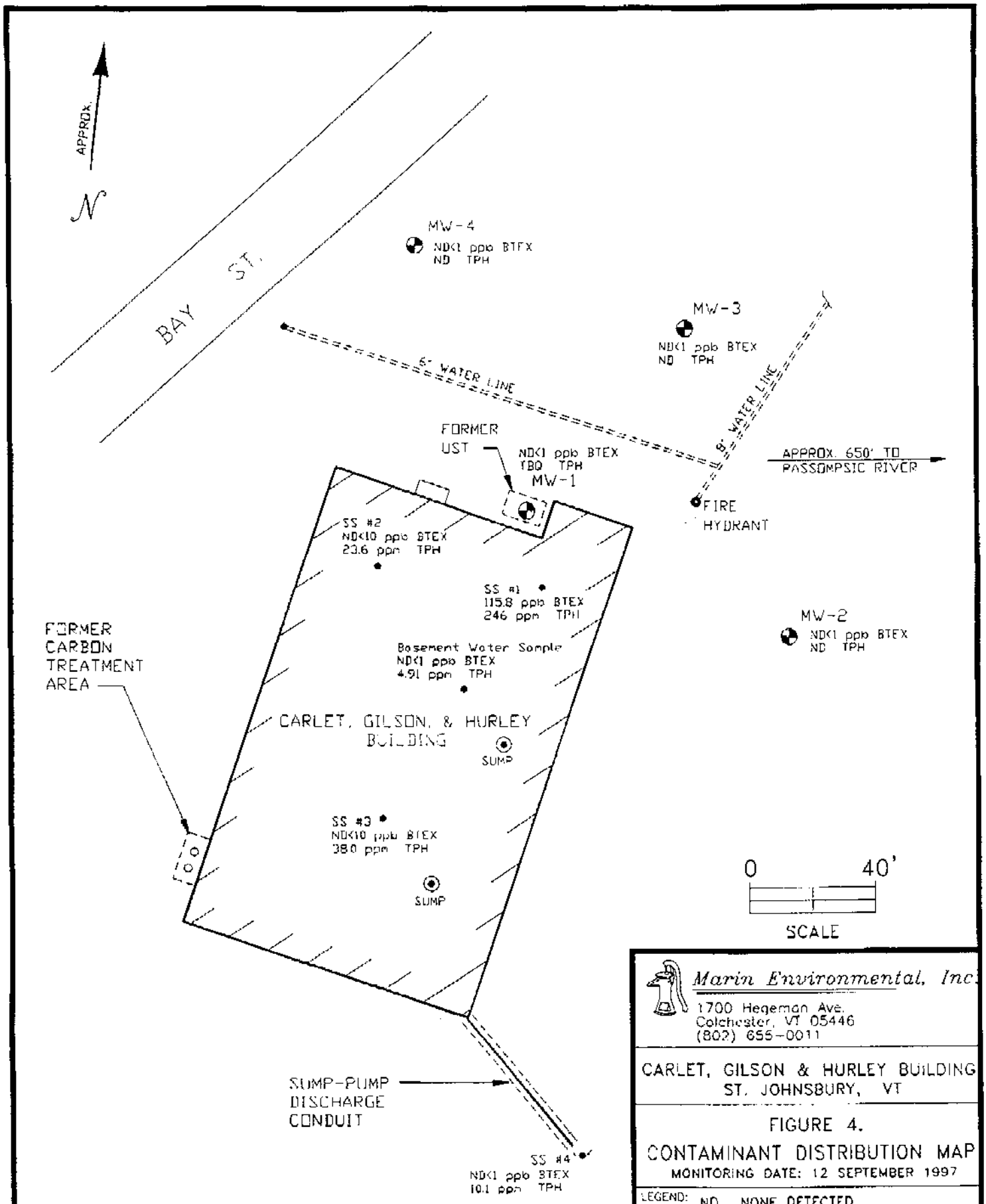
CARLET, GILSON & HURLEY BUILDING
ST. JOHNSBURY, VT

FIGURE 3.
GROUND-WATER CONTOUR MAP
MONITORING DATE: 12 SEPT 1997

LEGEND: — Ground-Water Contour
Monitoring Well

DRAWN BY: MJB	DATE: SEPT 97
APPROVED BY: RM	FILE No.: 97030

ALL LOCATIONS ARE APPROXIMATE



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1700 Hegeman Ave.
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CARLET, GILSON & HURLEY BUILDING
ST. JOHNSBURY, VT

FIGURE 4.

CONTAMINANT DISTRIBUTION MAP

MONITORING DATE: 12 SEPTEMBER 1997

LEGEND: ND NONE DETECTED
Monitoring Well

DRAWN BY: MJB	DATE: SEPT 97
APPROVED BY: RM	FILE No.: 97030

APPENDIX A

Soil Boring and Well Construction Logs

Marin Environmental, Inc.

FIELD SUPERVISOR Jay Garyaw
CONTRACTOR Dana Calkins Excavating
DRILLERS

JOB LOCATION 199030
ST. Johnsbury
DATE 17 July 1997

DRILLING METHOD Excavation
BORING DIAMETER

AND 40 - 50%
SOME 10 - 40%
TRACE 0 - 10%

BORING LOCATION sketch on back or on-site plan with measurements
BORING # MW-1
TOTAL DEPTH 9'

DEPTH	SAMPLES SAMPLE NUMBER	BLOWS PER 6" 0/6 6/12 12/18 18/24	REC.	SAMPLE DESCRIPTION	STRAT CHG	GENERAL DESCRIPTION	WELL DETAIL	DEPTH
5'				Clean fill				5'
10'								10'
15'								15'
20'								20'
25'								25'
30'								30'
35'								35'
40'								40'

MATERIALS USED	SIZE/TYPE	QUANTITY	MATERIALS USED	SIZE/TYPE	QUANTITY
WELL SCREEN	2" Sch 40	PK	GROUT	—	—
SLOT SIZE	10 Slot	10'	BACKFILL	Yes	
RISER PIPE			WATER USED	ND	
GRADED SAND			STEAM CLEANER	—	—
PELLET BENTONITE					
GRANULAR BENTONITE			Roadbox		

Marin Environmental, Inc.
Ground Water of Tomorrow Division

FIELD SUPERVISOR T. Robbins/B. Deshaies
CONTRACTOR Tri-State
DRILLERS Jeff Falso / Thaven Faulkner

JOB LOCATION Carlet, Gilson & Hurley Prop.
DATE September 3, 1997

DRILLING METHOD HSA
BORING DIAMETER

AND 40 – 60%
SOME 10 – 40%
TRACE 0 – 10%

BORING LOCATION (sketch on back or on-site plan with measurements)
BORING # MW-2
TOTAL DEPTH 14.0'

DEPTH	SAMPLES SAMPLE NUMBER	BLOWS PER 6" 0/6	6/12	12/18	18/24	REC.	SAMPLE DESCRIPTION	STRAT CHG	GENERAL DESCRIPTION	WELL DETAIL	DEPTH
							gravel stay mat				
		4	3	2	7	8"	fine silty sand and gravel brown grey coarse sand and gravel some wood material	clay	0'-1' pre-bore through gravel stay mat 1-3' no odor 0.0 ppm	Bentonite Riser	
5'											5'
		1	2	1	2	13.5'	Fine brown silty sand little gravel fine brown moist silty sand		5'-7' no odor 0.0 ppm water at 9.0'		
10'											10'
		1	2	2	2	16	Grey well sorted wet med. sand uniform wet gravel		10'-12' no odor 0.0 ppm		
15'							BOB at 14.0'				15'
20'											20'
25'											25'
30'											30'
35'											35'
40'											40'

MATERIALS USED	SIZE/TYPE	QUANTITY	MATERIALS USED	SIZE/TYPE	QUANTITY
WELL SCREEN	2" PVC	10'	GROUT	—	—
SLOT SIZE	.010" PVC	10'	BACKFILL	above bentonite	
RISER PIPE	2" PVC	4'	WATER USED	yes	
GRADED SAND	#1 Silica	10'	STEAM CLEANER	yes	
PELLET BENTONITE	—	—			
GRANULAR BENTONITE	yes	2'			

Marin Environmental, Inc.
Ground Water of Fremont Division

FIELD SUPERVISOR T. Robbins/B. Deshaies
CONTRACTOR Tri-State
DRILLERS Jeff Falco / Tharon Faulkner

JOB LOCATION Carlot, Gilson & Hurley Prop.
DATE September 3, 1997

DRILLING METHOD HSA
BORING DIAMETER

AND 40 – 50%
SOME 10 – 40%
TRACE 0 – 10%

BORING LOCATION sketch on back or on site plan with measurements
BORING # MW-3
TOTAL DEPTH 12.0'

Depth	SAMPLES	SAMPLE NUMBER	BLOWS PER 6" 0/6	6/12	12/18	18/24	REC.	SAMPLE DESCRIPTION	STRAT CHG	GENERAL DESCRIPTION	WELL DETAIL	DEPTH
								Stay mat				
5'			2	3	3	2	20"	brown fine wet sand		5'-7' 0.0ppm water at 6'		5'
10'			4	3	10	16	18"	grey well sorted wet sand poorly sorted coarse sand and gravel with trace cobbles BOB at 12'		10'-12' 0.0 ppm wet		10'
15'												15'
20'												20'
25'												25'
30'												30'
35'												35'
40'												40'

MATERIALS USED	SIZE/TYPE	QUANTITY	MATERIALS USED	SIZE/TYPE	QUANTITY
WELL SCREEN	2" PVC	10'	GROUT	—	—
SLOT SIZE	.010" PVC	10'	BACKFILL	above bentonite	
RISER PIPE	2" PVC	2'	WATER USED	yes	
GRADED SAND	#1 silica	10'	STEAM CLEANER	no	
PELLET BENTONITE	—	—			
GRANULAR BENTONITE	yes	1'			

Marin Environmental, Inc.
Ground Water at Formation Division

FIELD SUPERVISOR T. Robbins / B. Deshaies
CONTRACTOR Tri-State
DRILLERS Jeff Falso / Tharon Faulkner

JOB LOCATION Carlet, Gilson & Hurley
DATE September 3, 1997

DRILLING METHOD HSA
BORING DIAMETER

AND 40 – 50%
SOME 10 – 40%
TRACE 0 – 10%

BORING LOCATION
sketch on back or on-site plan with measurements

BORING # MW-4
TOTAL DEPTH 12.0'

DEPTH	SAMPLES	SAMPLE NUMBER	BLOWS PER 6" 0/6	6/12	12/18	18/24	REC.	SAMPLE DESCRIPTION	STRAT CHG	GENERAL DESCRIPTION	WELL DETAIL	DEPTH
								Stay mat		0'-2' pre-bore through gravel stay mat		
								fill material				
			6	6	3	4	18"	brown med. coarse sand and gravel		2-4'		
								brown fine sand slightly moist		no odor 0.0 ppm		
5'			4	4	2	3	14"	brown fine sand trace gravel		5'-7'		
								brown fine wet sand trace grey silt		no odor 0.0 ppm water at 6'		5'
10'												
			6	14	21	28	1'	fine brown sand		10'-12' 0.0 ppm		10'
								fine brown sand and gravel		no odor wet		
								BOB at 12.0'				
15'												15'
20'												20'
25'												25'
30'												30'
35'												35'
40'												40'

MATERIALS USED	SIZE/TYPE	QUANTITY	MATERIALS USED	SIZE/TYPE	QUANTITY
WELL SCREEN	2" PVC	10'	GROUT	—	—
SLOT SIZE	.010" PVC	10'	BACKFILL	above bentonite	
RISER PIPE	2" PVC	2'	WATER USED	yes	
GRADED SAND	#1 silica	10'	STEAM CLEANER	no	
PELLET BENTONITE	—	—			
GRANULAR BENTONITE	yes	1'			

APPENDIX B

Laboratory Report Forms

ENDYNE, INC.

Laboratory Services

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

LABORATORY REPORT

TOTAL PETROLEUM HYDROCARBONS (TPH) BY MODIFIED EPA METHOD 8100

DATE: September 26, 1997
CLIENT: Marin Environmental
PROJECT: Carlet, Gilson & Hurley
PROJECT CODE: GWVT1353
COLLECTED BY: Jay Gonyaw
DATE SAMPLED: September 12, 1997
DATE RECEIVED: September 15, 1997

Reference #	Sample ID	Concentration (mg/L)
109,778	Duplicate	TBQ[1]
109,779	Trip Blank; 1130	ND[2,3]
109,780	Basement Water; 1220	4.91
109,781	MW4; 1330	ND
109,782	MW3; 1355	ND
109,783	MW2; 1410	ND
109,784	MW1; 1430	TBQ
109,785	SS#1; 1235	246.[4]
109,786	SS#2; 1245	23.6
109,787	SS#3; 1250	38.0
109,788	Basement Outfall; 1450	10.1

Notes:

1 Trace below quantitation limit
2 None detected
3 Method detection limit for water is 0.8 mg/L.
4 Method detection limit for soil is 5.0 mg/kg.

ENDYNE, INC.

Laboratory Services

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

EPA METHOD 602--PURGEABLE AROMATICS

CLIENT: Marin Environmental
PROJECT NAME: Carlet, Gilson & Hurley
CLIENT PROJ. #: V97030

DATE RECEIVED: September 15, 1997
REPORT DATE: September 26, 1997
PROJECT CODE: GWVT1352

Ref. #:	109,767	109,768	109,769	109,770	109,771
Site:	Duplicate	Trip Blank	Basement Water	MW-4	MW-3
Date Sampled:	9/12/97	9/12/97	9/12/97	9/12/97	9/12/97
Time Sampled:	NI	11:30	12:20	13:30	13:55
Sampler:	J. Gonyaw	J. Gonyaw	J. Gonyaw	J. Gonyaw	J. Gonyaw
Date Analyzed:	9/23/97	9/20/97	9/20/97	9/20/97	9/20/97
UIP Count:	>10	0	0	0	0
Dil. Factor (%):	100	100	100	100	100
Surr % Rec. (%):	98	100	99	102	98
Parameter	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
Benzene	<1	<1	<1	<1	<1
Chlorobenzene	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	<1	<1	<1	<1	<1
Ethylbenzene	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	<1
Xylenes	<1	<1	<1	<1	<1
MTBE	2.2	4.2	2.7	<1	<1

Ref. #:	109,772	109,773	109,774	109,775	109,776
Site:	MW-2	MW-1	SS #1	SS #2	SS #3
Date Sampled:	9/12/97	9/12/97	9/12/97	9/12/97	9/12/97
Time Sampled:	14:10	14:30	12:35	12:45	12:50
Sampler:	J. Gonyaw	J. Gonyaw	J. Gonyaw	J. Gonyaw	J. Gonyaw
Date Analyzed:	9/22/97	9/21/97	9/23/97	9/23/97	9/23/97
UIP Count:	0	>10	>10	3	0
Dil. Factor (%):	100	100	40	100	100
Surr % Rec. (%):	100	96	105	86	98
Parameter	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/kg)	Conc. (ug/kg)	Conc. (ug/kg)
Benzene	<1	<1	<25	<10	<10
Chlorobenzene	<1	<1	<25	<10	<10
1,2-Dichlorobenzene	<1	<1	<25	<10	<10
1,3-Dichlorobenzene	<1	<1	<25	<10	<10
1,4-Dichlorobenzene	<1	<1	<25	<10	<10
Ethylbenzene	<1	<1	37.9	<10	<10
Toluene	<1	<1	37.2	<10	<10
Xylenes	<1	<1	40.7	<10	<10
MTBE	<1	2.3	<25	<10	<10

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

ENDYNE, INC.

Laboratory Services

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

EPA METHOD 602--PURGEABLE AROMATICS

CLIENT: Marin Environmental
PROJECT NAME: Carlet, Gilson & Hurley
CLIENT PROJ. #: V97030

DATE RECEIVED: September 15, 1997
REPORT DATE: September 26, 1997
PROJECT CODE: GWVT1352

Ref. #:	109,777				
Site:	Outfall SS				
Date Sampled:	9/12/97				
Time Sampled:	14:50				
Sampler:	J. Gonyaw				
Date Analyzed:	9/23/97				
UIP Count:	0				
Dil. Factor (%):	100				
Surr % Rec. (%):	89				
Parameter	**Conc. (ug/kg)**				
Benzene	<1				
Chlorobenzene	<1				
1,2-Dichlorobenzene	<1				
1,3-Dichlorobenzene	<1				
1,4-Dichlorobenzene	<1				
Ethylbenzene	<1				
Toluene	<1				
Xylenes	<1				
MTBE	<1				

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

ENDYNE, INC.

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

V97030 109,767 — 109,788

CHAIN-OF-CUSTODY RECORD

22783

Project Name: Catlet, Gilson & Site Location: Hurley	Reporting Address: 1700 Heyeman Ave Colchester, VT	Billing Address:
Endyne Project Number: GWVT 1352	Company: Marin Env. Contact Name/Phone #: T. Robbins 655-0011	Sampler Name: Jay Gunyaw Phone #: 655-0011

Lab #	Sample Location	Matrix	GRAB	COMP	Date/Time	Sample Containers No.	Sample Containers Type/Size	Field Results/Remarks	Analysis Required	Sample Preservation	Rush
109,767	Duplicate	H_2O	X		9/12/97	4	40 cc glass		19,30		
109,768	Trip Blank				1130						
109,769	Basement Water				1220						
109,770	mw-4				1330						
109,771	mw-3				1355						
109,772	mw-2				1410						
109,773	mw-1				1430						
109,774	SS#1	soil			1235	3	(40cc glass) (250ml)				
109,775	SS#2				1245						
109,776	SS#3				1250						
109,777	Basement outfall PSS				1450						

Relinquished by: Signature	Received by: Signature Tom M Chalfen	Date/Time 9-15-97 11:40
Relinquished by: Signature	Received by: Signature	Date/Time

New York State Project: Yes ___ No X

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_5	14	Turbidity	(19)	BTEX + MTBE	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): TPH by mod. 8100										

ENDYNE, INC.

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

V97030

CHAIN-OF-CUSTODY RECORD

22783

Project Name: Cariet, Gilson &	Reporting Address: 1700 Hyeman Ave	Billing Address:
Site Location: Hurley	Colchester, VT	
Endyne Project Number: GOVT 1353	Company: Marin Env.	Sampler Name: Jay Genereux
	Contact Name/Phone #: T. Robbins 655-0011	Phone #: 655-0011

Lab #	Sample Location	Matrix	GRAB	COMP	Date/Time	Sample Containers No.	Sample Containers Type/Size	Field Results/Remarks	Analysis Required	Sample Preservation	Rush
109,778	Duplicate	H2O	X		9/12/97	4	40cc vial		19, 30		
109,779	Trip Blank				1130						
109,780	Basement Water				1220						
109,781	mw-4				1330						
109,782	mw-3				1355						
109,783	mw-2				1410						
109,784	mw-1				1430						
109,785	SS#1	Soil			1235	3	(40cc jar) (250ml)				
109,786	SS#2				1245						
109,787	SS#3				1250						
109,788	Basement outfall SS				1450						

Relinquished by: Signature: [signature]

Received by: Signature: Tom M Chaulen

Date/Time: 9-15-97 11:40

Relinquished by: Signature

Received by: Signature

Date/Time

New York State Project: Yes ___ No X

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_5	14	Turbidity	(19)	BTEX + MTBE	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): TPH by mod. 8100										