INITIAL SITE INVESTIGATION REPORT

LONDONDERRY CITGO
Vermont Route 100 (96 2015)
Londonderry Center, Vermont

17 February, 1997

Prepared for:

Rice Oil Company
P.O. Box 106
34 Montague City Road
Greenfield, Massachusetts 01302

Contact: John Fox
Phone: (413) 772-0227

Prepared by:

Ground Water of Vermont
1 Mill Street, Box C-5
Burlington, VT 05401

Contact: Robert J. Ross, CGWP
Phone: (802) 860-6065

GWV Project #: V96-093
GWV Document #: 96093R02.DOC

TABLE OF CONTENTS

monitoring wells located southwest of the station, but identified a south-directed gradient above bedrock south of the station.

- Subsurface contamination at the site does not appear to pose a threat to nearby surface water bodies or the basements of the Clark's IGA and Thorne-Thomsen buildings.

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

1. Either the possibility of an on-going release should be evaluated or the existing UST systems at the site should be removed and replaced following applicable VT DEC regulations.
2. The treatment systems serving the Thorne-Thomsen and both shopping center supply wells should be inspected and sampled monthly to ensure proper operation. The samples should be analyzed for BTEX compounds and MTBE by EPA Method 8020.
3. The responsibility for monitoring contaminant concentrations in the supply wells serving the Center Service station and Merrill residence should be assumed by the owner of Center Service station.
4. Bottled drinking-water should be made available to supply-well owners whose drinking-water has been impacted by gasoline contamination.
5. The route of contaminant entry into the bedrock supply wells should be evaluated. This should include a review of the driller's logs for the impacted supply wells.
6. A Corrective Action Feasibility Investigation (CAFI) should be completed to evaluate the most appropriate remedy for the site. The CAFI should include an evaluation of various technologies such as pump and treat, vapor extraction, air sparging, and bioventing.
7. The four on-site monitoring wells should be resampled to confirm the November 1996 analytical results. The samples should be analyzed for BTEX compounds and MTBE by EPA Method 8020.
8. At least one additional shallow overburden monitoring well should be installed near the IGA supply well to determine the downgradient extent of contamination in the surficial aquifer and to evaluate a possible shallow route of contaminant entry into the IGA supply well.
9. The three monitoring wells installed to evaluate subsurface conditions related to the shopping center's fuel-oil USTs should be surveyed relative to the four Citgo monitoring wells. Water-level measurements and ground-water samples should then be collected from these wells along with those collected from the Citgo wells. The samples should be analyzed for BTEX compounds and MTBE by EPA Method 8020.
10. The abandoned supply well on the Thorne-Thomsen property should be inspected and evaluated for possible use as a water-quality monitoring point. If suitable, a sample should be collected from this well and analyzed for BTEX compounds and MTBE by EPA Method 8020 to help define the extent of contamination in the bedrock aquifer.

monitoring wells located southwest of the station, but identified a south-directed gradient above bedrock south of the station.

- Subsurface contamination at the site does not appear to pose a threat to nearby surface water bodies or the basements of the Clark's IGA and Thorne-Thomsen buildings.

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

1. Either the possibility of an on-going release should be evaluated or the existing UST systems at the site should be removed and replaced following applicable VT DEC regulations.
2. The treatment systems serving the Thorne-Thomsen and both shopping center supply wells should be inspected and sampled monthly to ensure proper operation. The samples should be analyzed for BTEX compounds and MTBE by EPA Method 8020.
3. The responsibility for monitoring contaminant concentrations in the supply wells serving the Center Service station and Merrill residence should be assumed by the owner of Center Service station.
4. Bottled drinking-water should be made available to supply-well owners whose drinking-water has been impacted by gasoline contamination.
5. The route of contaminant entry into the bedrock supply wells should be evaluated. This should include a review of the driller's logs for the impacted supply wells.
6. A Corrective Action Feasibility Investigation (CAFI) should be completed to evaluate the most appropriate remedy for the site. The CAFI should include an evaluation of various technologies such as pump and treat, vapor extraction, air sparging, and bioventing.
7. The four on-site monitoring wells should be resampled to confirm the November 1996 analytical results. The samples should be analyzed for BTEX compounds and MTBE by EPA Method 8020.
8. At least one additional shallow overburden monitoring well should be installed near the IGA supply well to determine the downgradient extent of contamination in the surficial aquifer and to evaluate a possible shallow route of contaminant entry into the IGA supply well.
9. The three monitoring wells installed to evaluate subsurface conditions related to the shopping center's fuel-oil USTs should be surveyed relative to the four Citgo monitoring wells. Water-level measurements and ground-water samples should then be collected from these wells along with those collected from the Citgo wells. The samples should be analyzed for BTEX compounds and MTBE by EPA Method 8020.
10. The abandoned supply well on the Thorne-Thomsen property should be inspected and evaluated for possible use as a water-quality monitoring point. If suitable, a sample should be collected from this well and analyzed for BTEX compounds and MTBE by EPA Method 8020 to help define the extent of contamination in the bedrock aquifer.

1.0 INTRODUCTION

This report details the results of an initial site investigation conducted at Londonderry Citgo, located at the intersection of Vermont Routes 11 and 100 south in the town of Londonderry, Vermont (Figure 1). This report has been prepared by Ground Water of Vermont (GWV) under the direction of Mr. John Fox, of Rice Oil Company. The site investigation was initiated with Vermont Department of Environmental Conservation (VT DEC) approval following the discovery of gasoline-related contamination in an on-site drinking-water supply well and in soil-gas near the station.

1.1 Site Location and Physical Setting

The site is occupied by a Citgo gasoline station and is located on the northern portion of the Londonderry Shopping Center property (Figure 2). The ground surface around the Citgo station has an average elevation of about 1,100 feet above mean sea level and slopes generally toward the south-southeast. Surface drainage appears to be controlled by the slope of the ground surface, and the on-site storm water system. The presumed direction of ground-water flow in the area is toward the south-southeast in the direction of the West River, which is located approximately 500 feet southeast of the Citgo station. Utley Brook, located approximately 200 feet east of the site, flows to the southeast, and discharges into the West River approximately 500 feet southeast of the Citgo station (USGS, 1986).

Native surficial materials in the vicinity of the Citgo station are mapped as glacial outwash, consisting of horizontally bedded glaciofluvial gravel (Stewart and MacClintock, 1970). Bedrock in the area is mapped as the Mount Holly Complex, which is composed of fine-to-medium-grained biotitic gneiss of Precambrian age (Doll, 1961). Bedrock outcrops are present on-site and on adjacent properties the north and east.

1.2 Site History

The property on which the Citgo station is located is a portion of a parcel of land that includes the Londonderry Shopping Center. The entire property has been owned since 1976 by Robert Waite of Londonderry Ventures, Inc. Rice Oil Company operates the Citgo station under a lease agreement with Londonderry Ventures, Inc. The property has been occupied by a shopping center since the mid-1960s.

Four 1,000-gallon fuel-oil and five 4,000-gallon gasoline USTs are currently located on the shopping center property. The fuel-oil USTs, which are owned by Londonderry Ventures, Inc., are located on the southwest side of the shopping-center building and are used for heating. The five gasoline USTs, which are owned by Rice Oil Company, are located approximately five feet northeast of the pump island, and are used to store gasoline for retail sale. VT DEC registration records indicate that three of the USTs were installed in 1972 and two were installed in 1977. According to Mr. John Fox, of Rice Oil, the USTs were lined on 13 April 1990. Mr. Fox added that there was no indication that the tanks had leaked at that time. All five of the UST systems passed a tightness test on 29 March 1996 using the Tracer Tight™ test method. According to Mr. Fox, the UST systems also passed

tightness tests in 1995, 1994, 1993, 1992, 1990, and 1987. Copies of the lining installation record and the March 1996 Tracer Tight™ test results are included in Appendix B.

Subsurface petroleum contamination was first discovered on the shopping center property in June 1996, when two other fuel-oil USTs serving the shopping center were permanently taken out of service. During the UST closure assessment, GWV identified petroleum-stained soils and elevated PID readings adjacent to one tank. GWV subsequently installed three monitoring wells to evaluate the degree and extent of fuel-oil contamination at the site under the VT DEC "Expressway" process. During the initial site investigation, GWV learned that point-of use carbon treatment systems had been installed on the shopping center's main supply well and the supply well serving Clark's IGA. The initial site investigation, whose findings were presented in a report dated 26 August 1996, identified contamination characteristic of gasoline, including the gasoline additive MTBE, in all of the monitoring wells and in the shopping center's main supply well. Based on the observed contaminant distribution and ground-water flow direction in the shallow overburden formation, two possible sources were identified: a leaking gas tank on a car that had reportedly been parked adjacent to the shopping center's main supply well in late 1991/early 1992; and the Citgo gas station, located approximately 260 feet northeast of the shopping center's main supply well.

In August 1996, GWV completed a soil-gas survey in the vicinity of the shopping center's main supply well and the Citgo station to identify the likely source of gasoline contamination. The findings of the soil-gas survey, presented in a report dated 29 August 1996, suggested that contamination principally originates near the Citgo pump island, and is migrating to the west toward the Londonderry Shopping Center and along the sewer and water lines serving the Citgo station. In its report, GWV recommended additional investigation to evaluate the degree and extent of subsurface contamination in the vicinity of the Citgo station, and to determine whether any other supply wells in the area had been contaminated. Appendix C includes soil-gas contaminant distribution maps and tabulated field gas chromatograph (GC) results from the soil-gas survey.

On 7 August 1996, during the soil-gas survey, GWV personnel identified a leak at one of the gasoline pumps. The leak was immediately reported to the station attendant and subsequently repaired by Rice Oil Company personnel on 8 August 1996.

In mid-October 1996, while awaiting VT DEC approval to implement the recommendations outlined in the August soil-gas survey report, GWV was informed by the VT DEC that gasoline contamination had been detected by the Vermont Department of Health in a supply well serving a house with two separate apartments, owned by Roger Thorne-Thomsen, located approximately 100 feet east of the Citgo station. A carbon treatment system was subsequently installed on the water supply in late October 1996 at the direction of the VT DEC.

GWV initiated an initial site investigation of subsurface contamination at the Citgo station under the VT DEC "Expressway" process after receiving approval on 22 October 1996 from Mr. John Fox, of Rice Oil and Mr. Matthew Moran of the VT DEC.

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 in the vicinity of the Citgo station;
- 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, GWV has:

- Reviewed existing historical data for the site and adjacent properties.
- Identified supply wells located within 1,000 feet of the site and arranged permission to collect samples for laboratory analysis.
- Collected and submitted ground-water samples from supply wells located within 1,000 feet of the site for laboratory analysis of volatile petroleum compounds.
- Supervised the installation of six soil borings and four monitoring wells, evaluated the extent of petroleum contamination, and determined 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 for laboratory analysis of volatile petroleum compounds.
- 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

On 31 October 1996, a GWV geologist supervised the completion of four soil borings/monitoring wells (MW-1, MW-2, MW-3, and MW-4). Two other soil borings (SB-1 and SB-5) encountered refusal at bedrock within two feet of ground surface. Approximate monitoring well and soil boring locations are shown on Figure 3. The soil borings and monitoring wells were installed using the hollow-stem auger drilling technique by American Drilling, Inc. of Westminster, Massachusetts.

The soils encountered in each boring generally consisted of brown coarse sand with some gravel. The borings for MW-1, MW-2, and MW-3 were completed to approximately 15 feet below ground surface (bgs) and MW-4 was completed to approximately seven feet bgs. Ground water was encountered between 8 and 10 feet bgs in MW-1, MW-2, and MW-3 at the time of drilling. Ground water was not encountered in the borings for MW-4, SB-1, or SB-5. Soil samples were collected from each boring at five-foot intervals using a standard split-spoon barrel. Soil recovery was generally very good, ranging between 75 and 100 percent. The soil samples were screened for the possible presence of VOCs with a photo-ionization detector (PID) and logged for lithology by the GWV geologist. 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 15 feet bgs at MW-1, MW-2 and MW-3. The bottoms of the screen sections were set about five to six feet below the ground water level. MW-4 was completed with 4 feet of 0.010-inch slotted PVC with the bottom set near the bedrock at a depth of six feet bgs, to intercept water during seasonally high water-table conditions. 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 1.5 feet 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. The monitoring wells that contained water were developed by hand after installation using dedicated bailers. Monitoring-well construction details are included on the soil-boring and well-construction logs in Appendix D.

2.2 Soil-Screening Results

Photoionization detector (PID) field-screening results on soil samples collected from the soil borings ranged from 0.1 to 280 parts per million (ppm). The highest PID readings (75 to 280 ppm) were at monitoring well MW-2, located approximately 10 feet west-southwest of the pump island. PID readings at monitoring well MW-3, located 70 feet west-southwest of the pump island and USTs, were 0.1 ppm or less. PID readings at monitoring well MW-1, located 25 feet northwest (upgradient) of the pump island and USTs, were between 0.2 and 1.0 ppm. PID screening results are included on the boring logs in Appendix B.

The GWV field geologist screened soil samples from each soil boring for the possible presence of volatile organic compounds (VOCs) using Photovac Tip II portable photoionization detector (PID). The PID was calibrated on the day of soil boring with an isobutylene standard gas to a benzene reference.

2.3 Determination of Ground-Water Flow Direction and Gradient

The ground-water flow direction in the unconfined surficial aquifer directly beneath the site appears to vary seasonally. Water-level measurements obtained on 14 November 1996 indicate that ground water was flowing in a southwesterly direction, parallel to the West River, with no ground water above bedrock to the south of the station. Water-level measurements obtained on 15 January 1997, on the other hand, indicated a similar flow direction in monitoring wells located west of the station, but identified a south-directed water table above bedrock south of the station. The average gradient of the local ground-water table was about 0.8 percent on 14 November 1996 and about 4 percent on 15 January 1997. Average flow velocities in the ground water moving through the coarse sand deposits are estimated to be in the range of 0.13 to 20 feet per day (ft/day). Water-level measurements and elevation calculations for 14 November 1996 and 15 January 1997 are presented in Table 1. The ground-water contour maps in Figures 4a and 4b were prepared using this data.

Fluid levels were measured in the four monitoring wells on 14 November 1996 and 15 January 1997. Comparison of the depth-to-water measurements between the two monitoring events indicated that the measurements on 14 November were between 0.5 to 0.7 feet lower than that measured on 15 January. No free-phase gasoline 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 coarse sands, which typically exhibit effective porosities of about 0.2 to 0.4 and hydraulic conductivities of about 2.5 to 100 ft/day (Fetter, 1994). Assuming Darcian flow, these estimated ranges of porosity and conductivity combine with the calculated ground-water gradient of 4 percent to yield an estimated range of ground-water flow velocities in the surficial aquifer of between 0.13 and 20 ft/day.

2.4 Monitoring Well Sampling and Analysis

Volatile petroleum compounds were detected in the ground water samples collected from all three of the monitoring wells that contained water during the 14 November 1996 sampling event. The highest contaminant concentrations were detected in the sample collected from MW-2, located approximately 10 feet west of the pump island.

The Vermont Groundwater Enforcement Standards (VGESs) for benzene, toluene, ethylbenzene, and xylenes (BTEX), and the Vermont Health Advisory (VHA) for methyl-tertiary butyl ether (MTBE) were exceeded in the ground-water sample collected from MW-2. The benzene VGES and MTBE VHA were also exceeded in the sample collected from MW-3. Ground-water analytical results for the monitoring wells are summarized in Table 2. The

contaminant distribution based on monitoring-well data is shown on Figure 5. Laboratory report forms are included in Appendix E.

Ground-water samples were collected from three monitoring wells on 14 November 1996. No sample was collected from MW-4, which was dry at the time of sample collection. Each monitoring well was purged and then sampled using the 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 GWV standard protocols.

The ground-water samples were transported under chain-of-custody in an ice-filled cooler to Endyne, Inc. of Williston, Vermont, where they were analyzed for the possible presence of benzene, toluene, ethylbenzene, xylenes (BTEX) and methyl-tertiary butyl ether (MTBE) by EPA Method 8020. Analytical results from the QA/QC samples indicate that adequate QA/QC was maintained during sample collection and analysis. The analytical results for the blind field-duplicate sample were within 25 percent of the original results and none of the BTEX compounds or MTBE were detected in the trip-blank sample.

2.5 Supply Well Sampling and Analysis

Volatile petroleum compounds were detected in five of the eighteen supply wells sampled on 14 November 1996 — the shopping center's main well, the Clark's IGA well, and the Thorne-Thomsen residential well, all located on the west side of Utley Brook, and the Center Service station well and Merrill residential well, located east of Utley Brook. The Vermont drinking-water standard (VDS) for benzene was exceeded in the influent samples collected from the Thorne-Thomsen and the shopping center's main supply wells. Methyl-tertiary butyl ether (MTBE) was detected in the influent samples collected from the Thorne-Thomsen, the shopping center's main, and the Clark's IGA supply wells at 14.4, 15.2, and less than 1.0 parts per billion (ppb), respectively. MTBE was also detected in the tap-water samples collected from the Center Service and Merrill supply wells at 8.8 and 6.8 ppb, respectively. Low levels of xylenes and toluene (2 ppb or less) were detected in the sample collected from the Center Service supply well. Supply well analytical results are summarized in Table 3. Approximate locations of the supply wells sampled in November 1996 are shown on Figure 6. Laboratory report forms are included in Appendix E.

Point-of-use carbon treatment systems have been installed on the Thorne-Thomsen, Clark's IGA, and shopping center's main supply wells. The 14 November 1996 analytical results for the Thorne-Thomsen and Clark's IGA treatment systems indicate both systems are effectively removing BTEX compounds and MTBE, but that MTBE has broken through the treatment system serving the shopping center's main supply well. A summary of the treatment system results are included on Table 4.

Supply wells were sampled after allowing the water to run for approximately ten minutes. 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 GWV standard protocols.

The supply well samples were transported under chain-of-custody in an ice-filled cooler to Endyne, Inc. of Williston, Vermont, where they were analyzed for the possible presence of BTEX compounds and MTBE by EPA Method 8020. Analytical results from the QA/QC samples indicate that adequate QA/QC was maintained during sample collection and analysis. The analytical results for the blind field-duplicate sample were within 12 percent of the original results and none of the BTEX compounds or MTBE were detected in the trip blank sample.

3.0 SOURCE AREA ASSESSMENT

The distribution of contamination at the site suggests that the gasoline UST systems at the Citgo station are the source of gasoline contamination in the on-site monitoring wells and in the three bedrock drinking-water supply wells located west of Utley Brook — Thorne-Thomsen, Clark's IGA, and shopping center's main supply wells. The source of contamination in the two bedrock supply wells east of Utley Brook, the Center Service station well and Merrill residential well, has not been determined. The Citgo station is a possible source, but significant gasoline releases have also been documented at the Center Service station and Jelly's Automotive, both of which are located on the east side of Utley Brook. Also, the Center Service station is closer to the two impacted supply wells than the Citgo station. Approximate locations of the Citgo station, the Center Service station and Jelly's Automotive with respect to the supply well locations are shown on Figure 6.

Both the Center Service station and Jelly's Automotive are included on the VT DEC Active Hazardous Waste Sites List. Jelly's Automotive (VT DEC Site # 911061), located approximately 800 feet east of the site, is a Mobil gasoline retail outlet. Review of available information regarding the status of this site indicated that a remediation system (soil vapor extraction) was installed in 1995 and was not operating due to mechanical problems as of November 1996. The VT DEC is requiring quarterly monitoring of ground water at the site; however, no recent ground-water quality data is available. Center Service (VT DEC Site # 961995), located approximately 300 feet east of the site, is a Sunoco gasoline retail outlet. GWV reviewed an initial site investigation completed by Strategic Analytical Systems, Inc. in July 1996 — a summary of which follows:

- Maximum PID readings obtained during the removal of five USTs ranged from 2.3 to 1,726 parts per million (ppm);
- The VGES for benzene was exceeded in three on-site monitoring wells and the VHA for MTBE was exceeded in two on-site monitoring wells sampled on 19 July 1996;
- None of the BTEX compounds or MTBE were detected in the on-site supply sampled on 19 July 1996;
- Ground water flow in the shallow overburden formation beneath the Center Service site on 19 July 1996 was to the south; and
- The extent of ground-water contamination at the Center Service site had not been determined.

4.0 SENSITIVE RECEPTOR SURVEY AND RISK ASSESSMENT

4.1 Sensitive Receptor Survey

GWV conducted a survey to identify sensitive receptors in the vicinity of the Londonderry Citgo that could potentially be impacted by subsurface contamination originating from the site. The following sensitive receptors were identified in the vicinity of the site:

- Eighteen active and one abandoned supply wells located within 1,000 feet of the Citgo station.
- Underground water and sewer lines located approximately 30 feet south of the USTs and pump island.
- The West River, located approximately 500 feet south (downgradient) of the site.
- The Utley Brook, located approximately 200 feet east (obliquely upgradient) of the site.
- The basements of Clark's IGA and the Thorne-Thomsen residential building, both of which are located within 150 feet of the USTs and pump island.

4.2 Risk Assessment

GWV assessed the risks that the 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 subsurface petroleum contamination at the site may have impacted up to five bedrock supply wells, although additional information is required to properly identify the source of contamination. Two other gasoline retail outlets (Center Service and Jelly's Automotive), both of which are included on the VT DEC Active Hazardous Waste Sites List, are located within 1,000 feet of the site. At this time, none of the other sensitive receptors identified above appear to be impacted by subsurface contamination originating from the site; however, additional work is required to evaluate possible impact to the on-site underground utilities.

4.2.1 Drinking-Water Supplies

Drinking water for the Londonderry area is supplied by on-site supply wells. Nineteen supply wells (residential and commercial) are located within 1,000 feet of the Citgo station, including an abandoned supply well, reportedly located on the Thorne-Thomsen property east of the site. Approximate supply well locations are shown on Figure 6. Current owners and available well data are listed on Table 5.

Drinking water for the Citgo station is supplied by a bedrock well located approximately 260 feet southwest of the facility. This well, reported to be 121 feet deep with an estimated yield of 25 gallons per minute (gpm), is the main supply well for the Londonderry Shopping Center. The shopping center has another bedrock supply well, located approximately 200 feet southwest of the Citgo station, which provides water for Clark's IGA supermarket. This well is reported to be 150 feet deep with an estimated yield of two gpm. A house with two separate apartments, located 100 feet east of the site

and owned by Roger Thorne-Thomsen, is served by a bedrock supply well, reportedly 230 feet deep with an estimated yield of 30 gpm.

Volatile petroleum compounds were detected in five of the eighteen supply wells sampled on 14 November 1996 — the shopping center's main well, the Clark's IGA well, and the Thorne-Thomsen residential well, all located on the west side of Utley Brook, and the Center Service station well and Merrill residential well, located east of Utley Brook. The shopping center's main well, the Clark's IGA well, and the Thorne-Thomsen residential well all have point-of-use carbon treatment systems. The other two impacted wells do not have treatment systems; however, the Center Service supply well is not used for drinking.

Three of the impacted supply wells — the shopping center's main well, the Center Service well, and the Thorne-Thomsen residential well, have estimated yields of 25 gallons per minute (gpm) or more, which indicates they intercept a significant water-bearing fracture. Other wells in the vicinity with similar yields include those owned by Galpin, Rowley, and Jelly; of which, the Rowley's well appears to be the most susceptible to contamination, based on the reported yield and depth of the well, and location relative to the site and other impacted supply wells.

4.2.2 Confined Spaces and Underground Utilities

The accumulation of gasoline vapors in confined spaces or underground utilities such as basements, crawl spaces and sewer lines, could be an explosion hazard, if a significant amount of vapors were to accumulate and an ignition source was also present. At this time, there does not appear to be an impact to ambient air in the basements of Clark's IGA or the Thorne-Thomsen buildings. PID readings obtained on 31 January 1997 were between 0.3 and 1.2 parts per million (ppm) in the IGA's basement and zero ppm in the Thorne-Thomsen basement. The risks posed by possible accumulation of vapor-phase contamination in the on-site sewer line need further evaluation. According to Mr. Robert Waite, owner of the shopping center, bedrock was encountered during the installation of the water and sewer lines serving the Citgo station.

4.2.3 Surface-Water Quality

In general, human exposure through direct contact or ingestion (direct or indirect) of contaminated surface water or sediment is possible through recreational activities such as swimming, fishing, or boating. The nearest downgradient surface water body is the West River, located approximately 500 feet south of the site. Utley Brook, located approximately 200 feet northeast-east of the site, appears to be obliquely upgradient of the USTs and pump island. Current information does not suggest that contamination from the site has migrated to either surface-water body.

4.2.4 Direct Soil / Ground-Water Contact

The risk of human exposure through direct contact with contaminated soils is considered to be low at the site, considering that a majority of the petroleum contaminated soils are located beneath paved areas. However, direct contact with contaminated soil is possible, if any subsurface exploratory or construction work (including removal of the on-site USTs) is conducted in the vicinity of the site. The risk of human exposure through direct contact with contaminated ground water is considered to be very low at the site, considering that the depth to ground water is greater than 5 feet bgs.

5.0 CONCLUSIONS

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

- Gasoline has been released to the subsurface at the site.
- The five gasoline underground storage tank (UST) systems at the site, installed in the early to mid-1970s, were lined in 1990, and passed a Tracer Tight™ tightness test on 29 March 1996. A gasoline pump was found to be leaking on 7 August 1996 and repaired on 8 August 1996.
- Ground water in the surficial and bedrock aquifers underlying the site contains gasoline-related compounds at levels exceeding Vermont regulatory standards. One or more gasoline-related compounds were detected in five bedrock drinking-water supply wells — the shopping center's main well, the Clark's IGA well, and the Thorne-Thomsen residential well, all located on the west side of Utley Brook; and the Center Service station well and Merrill residential well, located east of Utley Brook.
- The distribution of contamination suggests that the gasoline UST systems at the Citgo station are the source of gasoline contamination in the surficial aquifer in the vicinity of the site. Releases from the Citgo station also appear to be the source of contamination in the three bedrock drinking-water supply wells located west of Utley Brook.
- The source of contamination in the two bedrock supply wells east of Utley Brook has not been determined. The Citgo station is a possible source, but significant gasoline releases have also been documented at the Center Service station and Jelly's Automotive, both of which are located on the east side of Utley Brook and are closer to these two impacted supply wells than the Citgo station.
- No volatile petroleum compounds were detected in thirteen other supply wells sampled on 14 November 1996, located within 1,000 feet of the site.
- The most likely route of contaminant entry into the Thorne-Thomsen and the shopping center's main supply wells appears to be bedrock fractures, because the surficial aquifer contaminant plume does not appear to extend past these wells. The route of contaminant entry into the IGA well is uncertain, since the surficial aquifer contaminant plume may intersect this well.
- Point-of-use carbon treatment systems have been installed at the Thorne-Thomsen residence, Clark's IGA, and shopping center's main supply wells. Analytical results from samples collected on 14 November 1996 indicate that the Thorne-Thomsen and Clark's IGA treatment systems were removing gasoline compounds to below detectable levels, but that the gasoline additive MTBE had broken through the shopping center's main well treatment system.
- The direction of ground-water flow in the unconfined surficial aquifer directly beneath the site appears to vary seasonally. Water-level measurements obtained on 14 November 1996 indicated ground-water flow to be to the southwest, parallel to the West River, with no ground water above bedrock south of the station. Water-level measurements obtained on 15 January 1997, on the other hand, indicated a similar flow direction in monitoring wells located southwest of the station, but identified a south-directed gradient above bedrock south of the station.
- Subsurface contamination at the site does not appear to pose a threat to nearby surface water bodies or the basements of the Clark's IGA and Thorne-Thomsen buildings.

6.0 RECOMMENDATIONS

On the basis of the results of this investigation and the conclusions stated above, Ground Water of Vermont recommends the following:

1. Either the possibility of an on-going release should be evaluated or the existing UST systems at the site should be removed and replaced following applicable VT DEC regulations.
2. The treatment systems serving the Thorne-Thomsen and both shopping center supply wells should be inspected and sampled monthly to ensure proper operation. The samples should be analyzed for BTEX compounds and MTBE by EPA Method 8020.
3. The responsibility for monitoring contaminant concentrations in the supply wells serving the Center Service station and Merrill residence should be assumed by the owner of Center Service station.
4. Bottled drinking-water should be made available to supply-well owners whose drinking-water has been impacted by gasoline contamination.
5. The route of contaminant entry into the bedrock supply wells should be evaluated. This should include a review of the driller's logs for the impacted supply wells.
6. A Corrective Action Feasibility Investigation (CAFI) should be completed to evaluate the most appropriate remedy for the site. The CAFI should include an evaluation of various technologies such as pump and treat, vapor extraction, air sparging, and bioventing.
7. The four on-site monitoring wells should be resampled to confirm the November 1996 analytical results. The samples should be analyzed for BTEX compounds and MTBE by EPA Method 8020.
8. At least one additional shallow overburden monitoring well should be installed near the IGA supply well to determine the downgradient extent of contamination in the surficial aquifer and to evaluate a possible shallow route of contaminant entry into the IGA supply well.
9. The location of the three monitoring wells installed to evaluate subsurface conditions related to the shopping center's fuel-oil USTs should be surveyed relative to the four Citgo monitoring wells. Water-level measurements and ground-water samples should then be collected from these wells along with those collected from the Citgo wells. The samples should be analyzed for BTEX compounds and MTBE by EPA Method 8020.
10. The abandoned supply well on the Thorne-Thomsen property should be inspected and evaluated for possible use as a water-quality monitoring point. If suitable, a sample should be collected from this well and analyzed for BTEX compounds and MTBE by EPA Method 8020 to help define the extent of contamination in the bedrock aquifer.

7.0 REFERENCES

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

Domenico, P.A., and Schwartz, F.W., 1990. *Physical and Chemical Hydrogeology*, John Wiley and Sons, New York, 824 p.

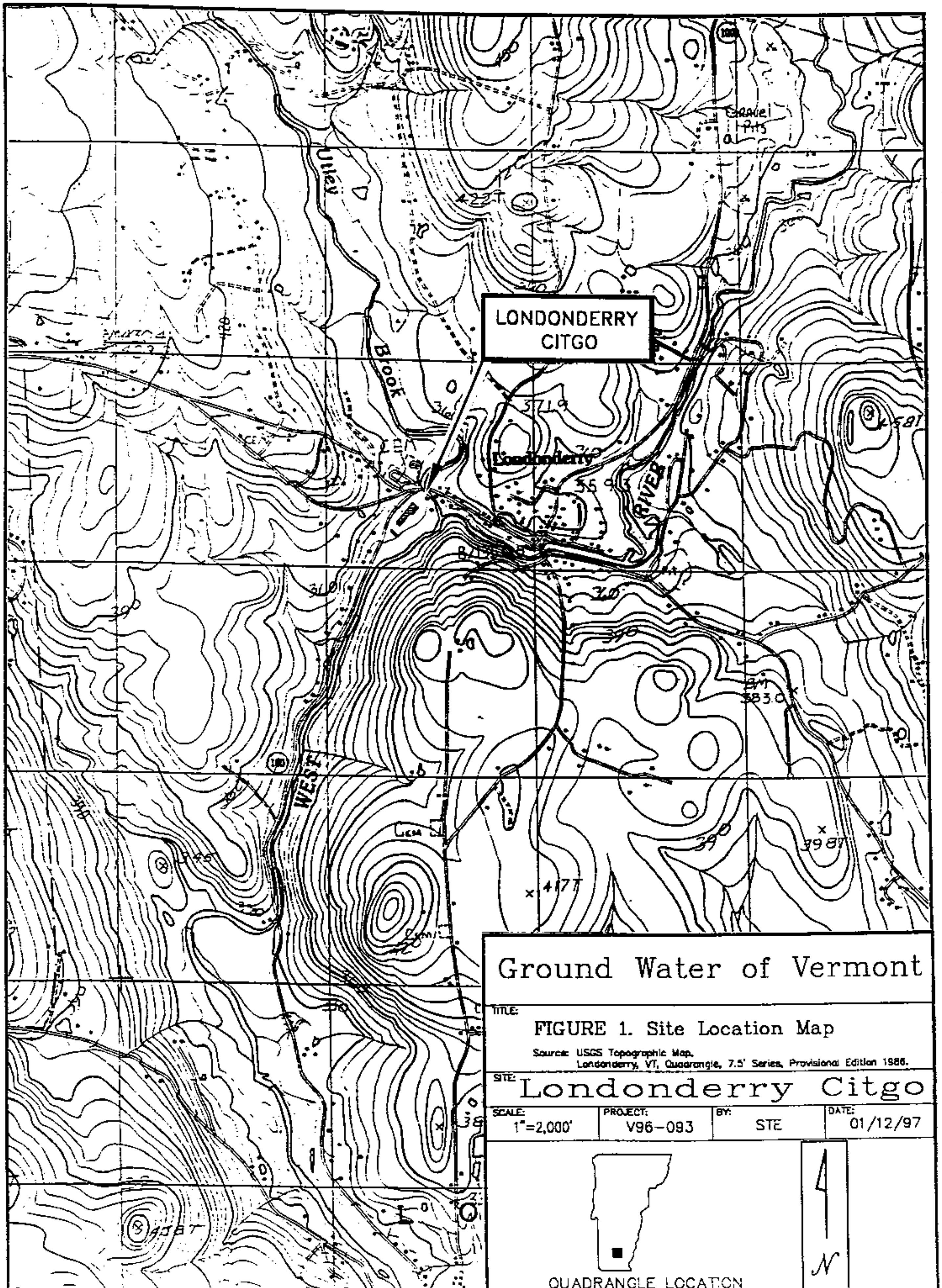
Fetter, C.W., 1994. *Applied Hydrogeology, 3rd Ed.*, Prentice Hall, Englewood Cliffs, New Jersey, 691 p.

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

USGS, 1986. Londonderry Quadrangle Vermont. U.S. Geological Survey. 7.5 minute series (topographic). Provisional Edition, 1986.

APPENDIX A

Figures and Tables



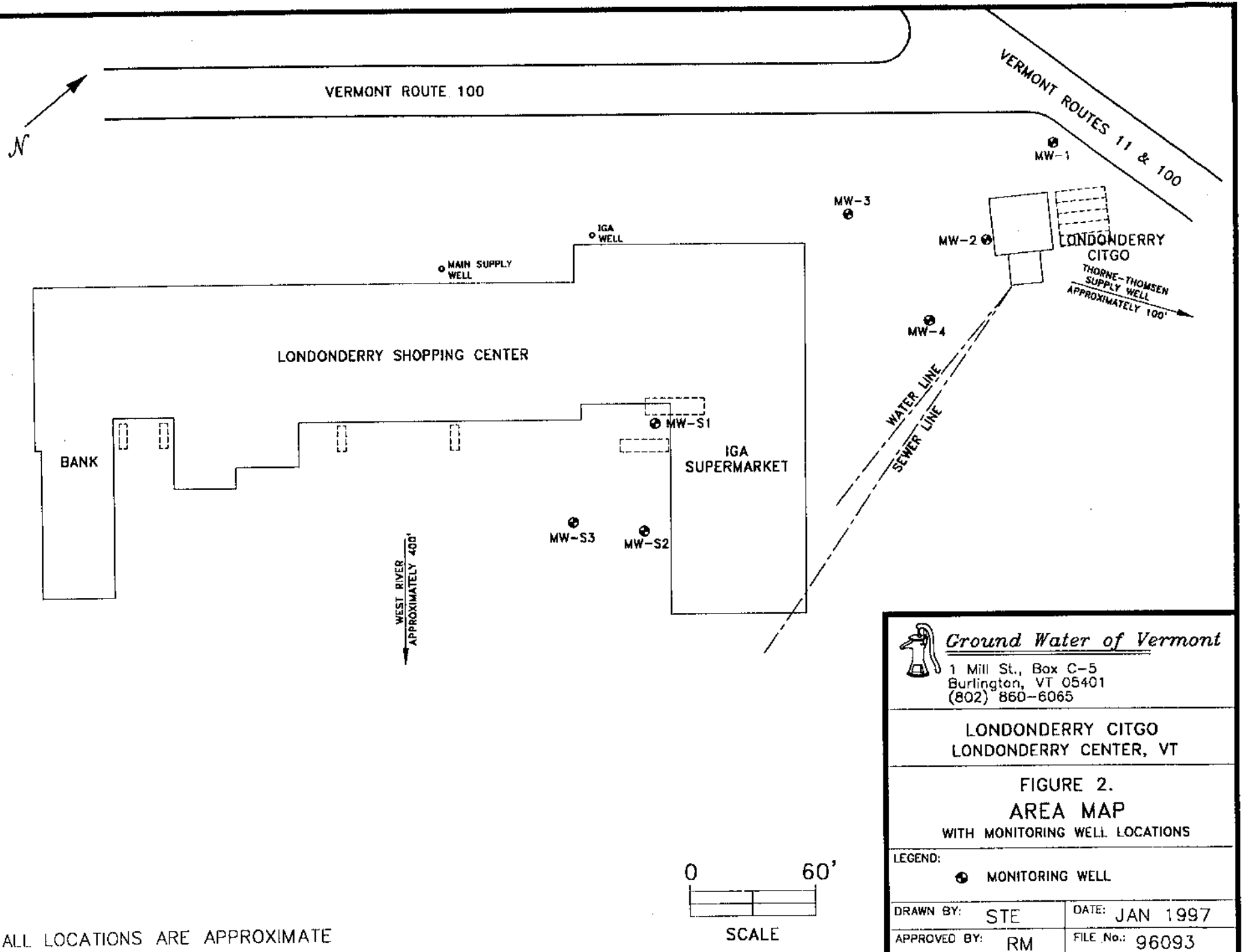
Ground Water of Vermont

TITLE: FIGURE 1. Site Location Map

Source: USGS Topographic Map, Londonderry, VT, Quadrangle, 7.5' Series, Provisional Edition 1986.

SITE: Londonderry Citgo

SCALE:	PROJECT:	BY:	DATE:
1"=2,000'	V96-093	STE	01/12/97



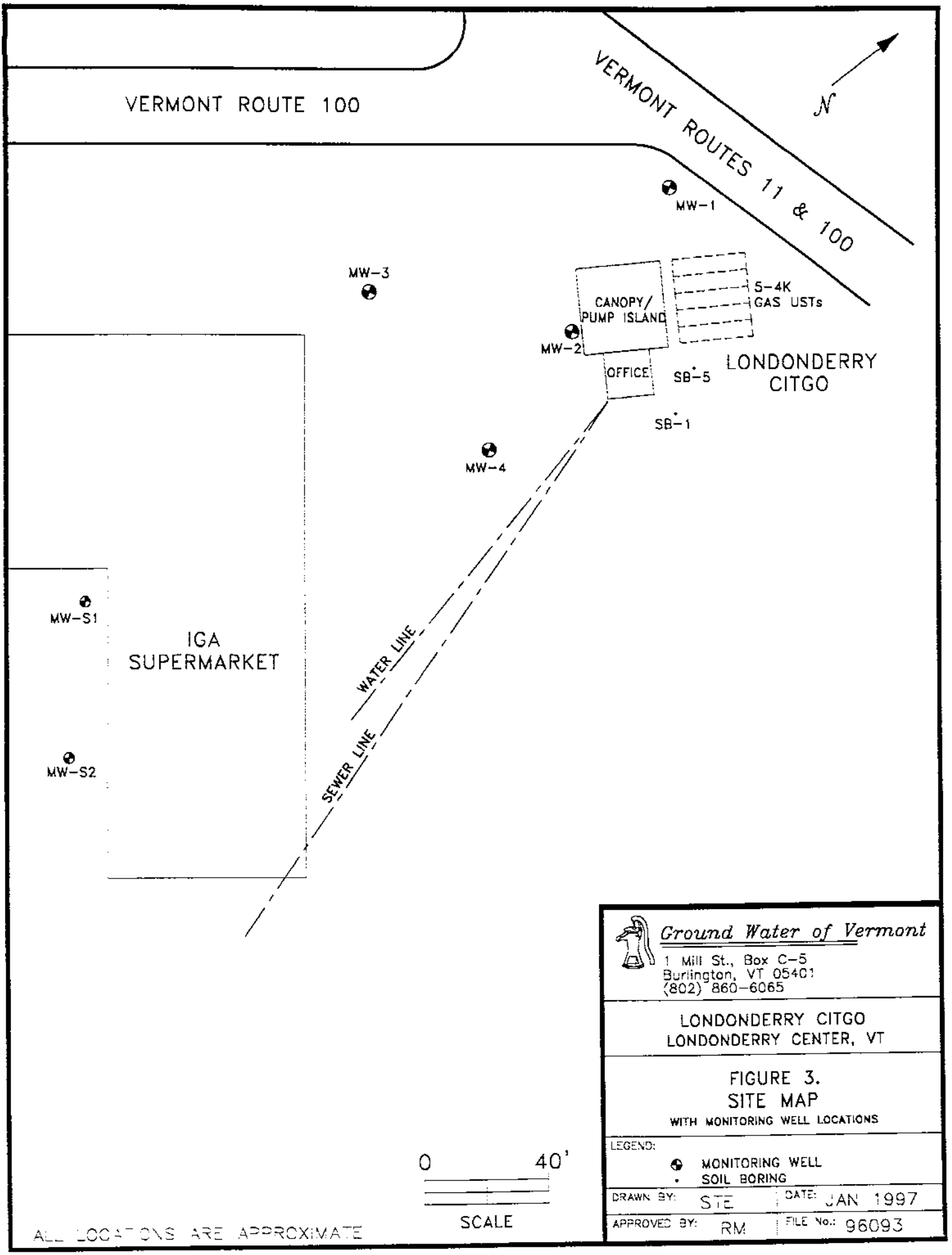
Ground Water of Vermont
1 Mill St., Box C-5
Burlington, VT 05401
(802) 860-6065

LONDONDERRY CITGO
LONDONDERRY CENTER, VT

FIGURE 2.
AREA MAP
WITH MONITORING WELL LOCATIONS

LEGEND:
MONITORING WELL

DRAWN BY: STE	DATE: JAN 1997
APPROVED BY: RM	FILE No.: 96093



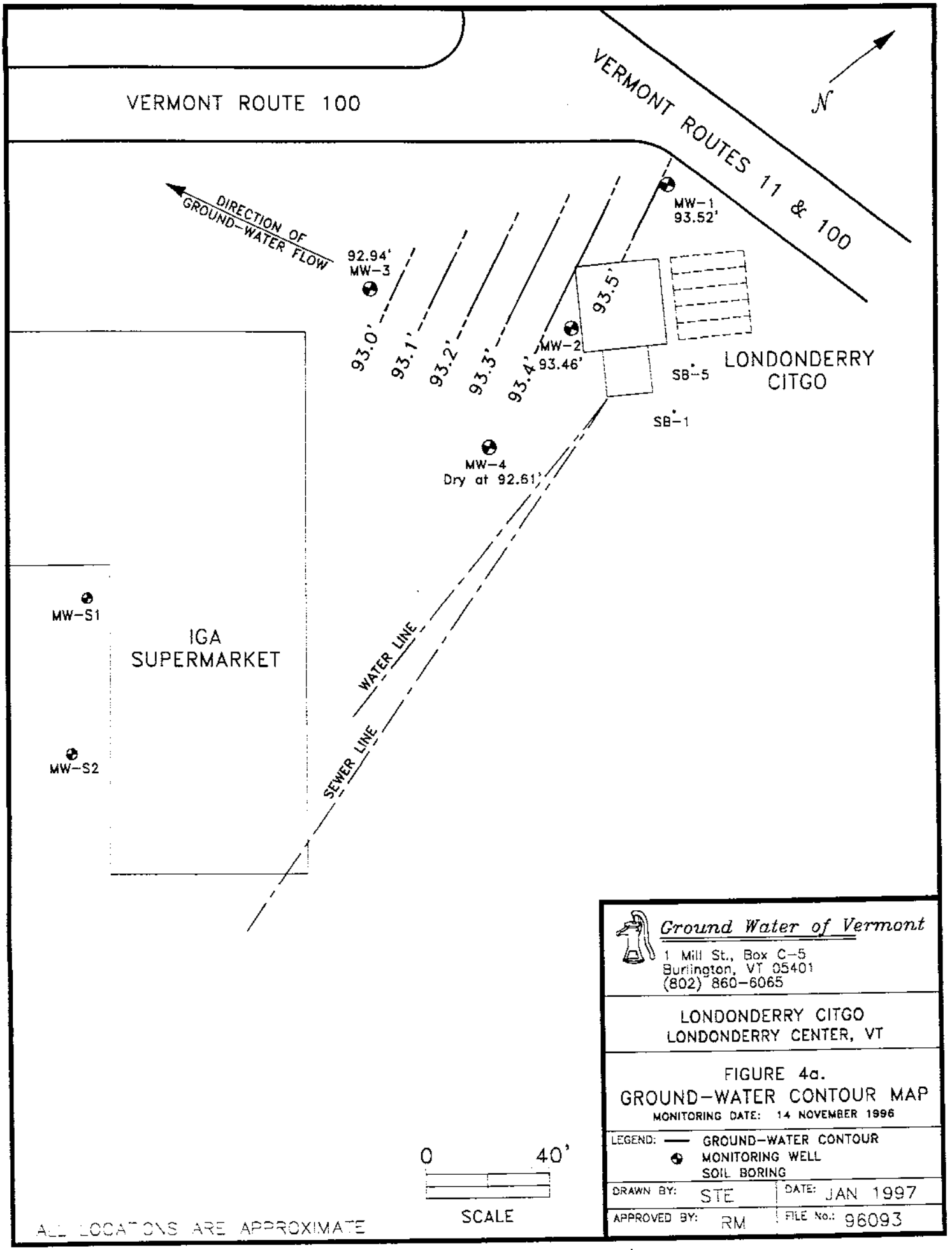
Ground Water of Vermont
1 Mill St., Box C-5
Burlington, VT 05401
(802) 860-6065

LONDONDERRY CITGO
LONDONDERRY CENTER, VT

FIGURE 3.
SITE MAP
WITH MONITORING WELL LOCATIONS

LEGEND:
MONITORING WELL
SOIL BORING

DRAWN BY: STE	DATE: JAN 1997
APPROVED BY: RM	FILE No.: 96093



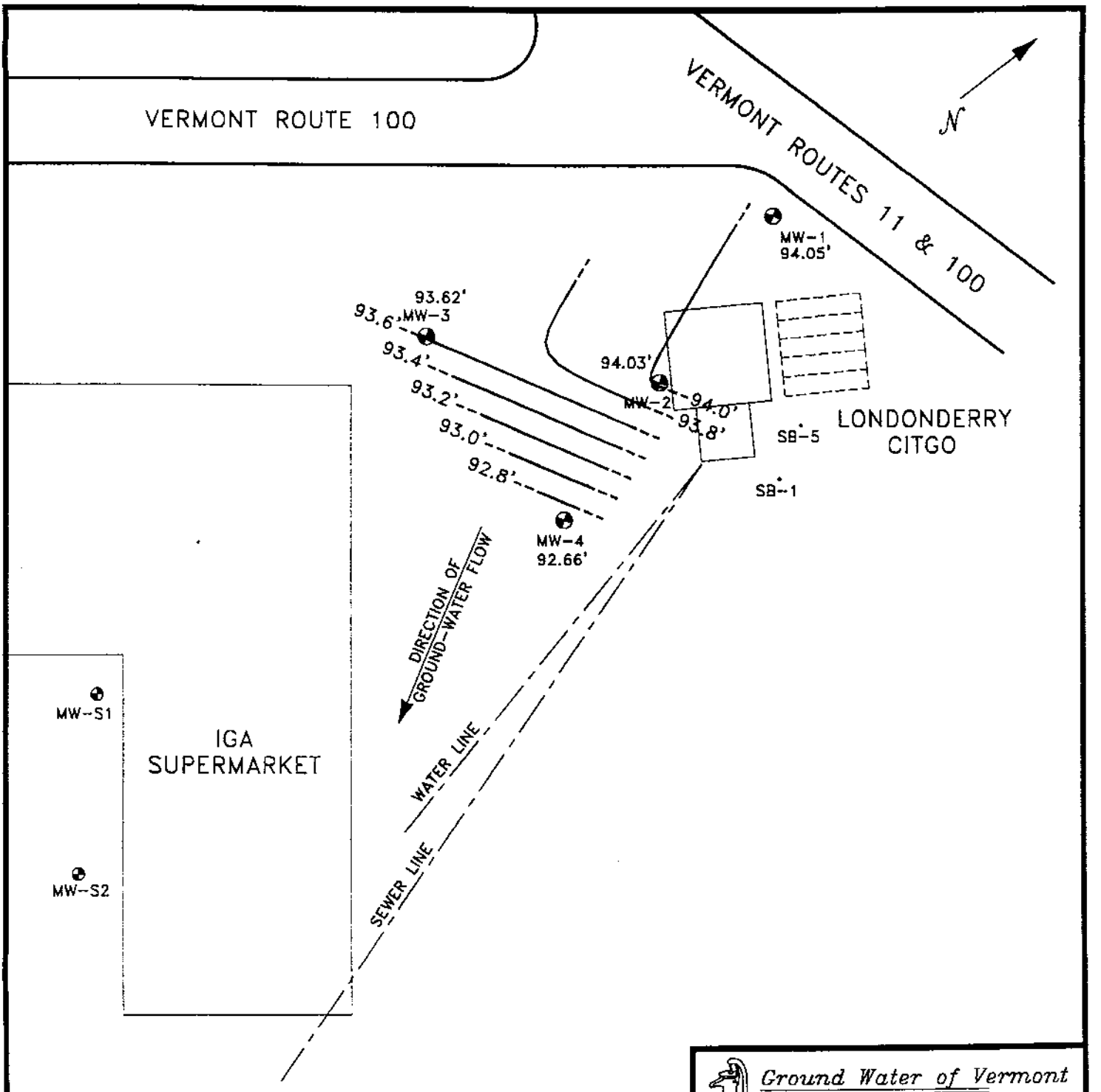
Ground Water of Vermont
1 Mill St., Box C-5
Burlington, VT 05401
(802) 860-6065

LONDONDERRY CITGO
LONDONDERRY CENTER, VT

FIGURE 4a.
GROUND-WATER CONTOUR MAP
MONITORING DATE: 14 NOVEMBER 1996

LEGEND: — GROUND-WATER CONTOUR
MONITORING WELL
SOIL BORING

DRAWN BY: STE	DATE: JAN 1997
APPROVED BY: RM	FILE No.: 96093



0 40'

SCALE

ALL LOCATIONS ARE APPROXIMATE

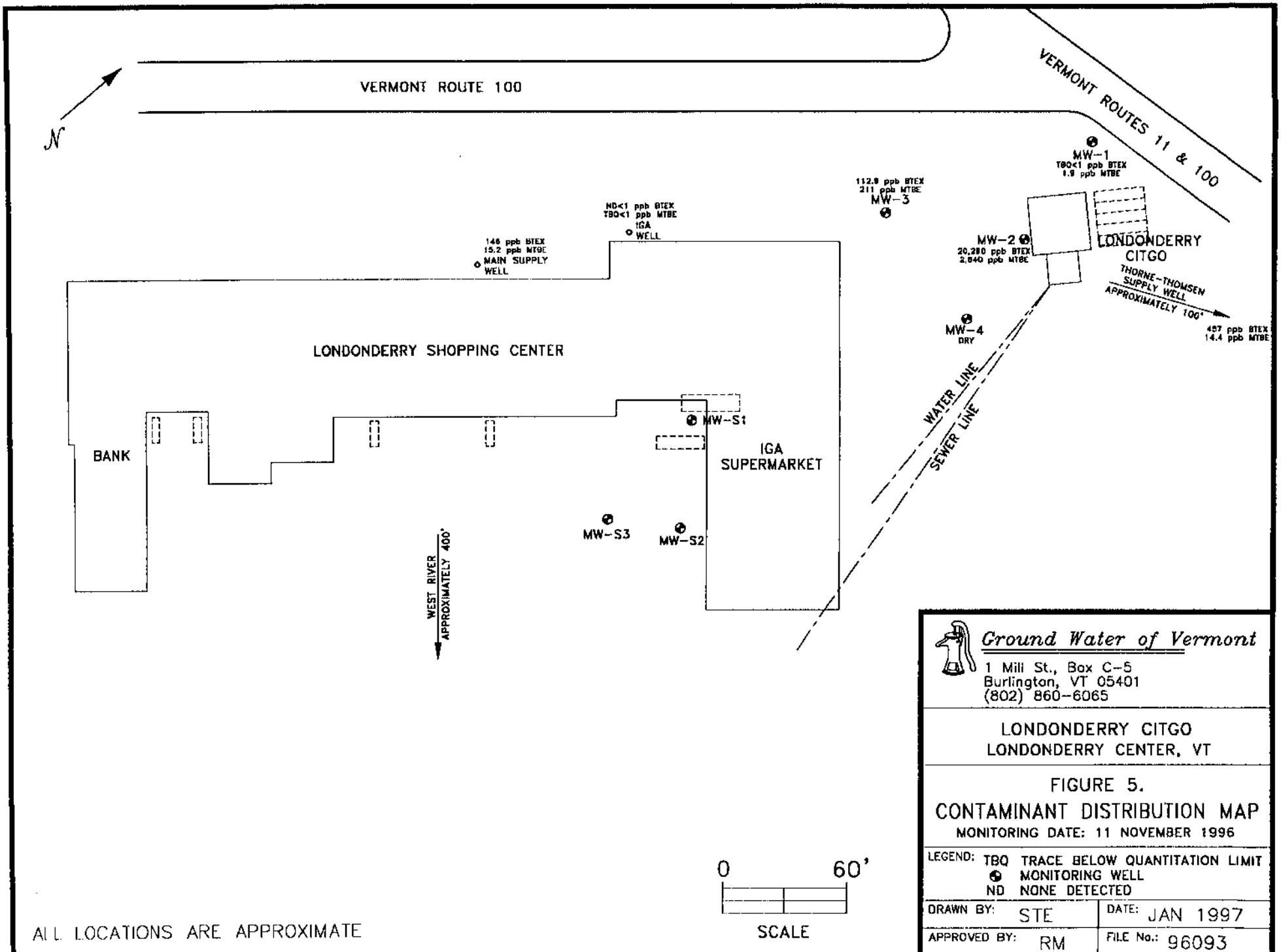
Ground Water of Vermont
1 Mill St., Box C-5
Burlington, VT 05401
(802) 860-6065

LONDONDERRY CITGO
LONDONDERRY CENTER, VT

FIGURE 4b.
GROUND-WATER CONTOUR MAP
MONITORING DATE: 15 JANUARY 1997

LEGEND: —— GROUND-WATER CONTOUR
● MONITORING WELL
SOIL BORING

DRAWN BY: STE	DATE: JAN 1997
APPROVED BY: RM	FILE No.: 96093



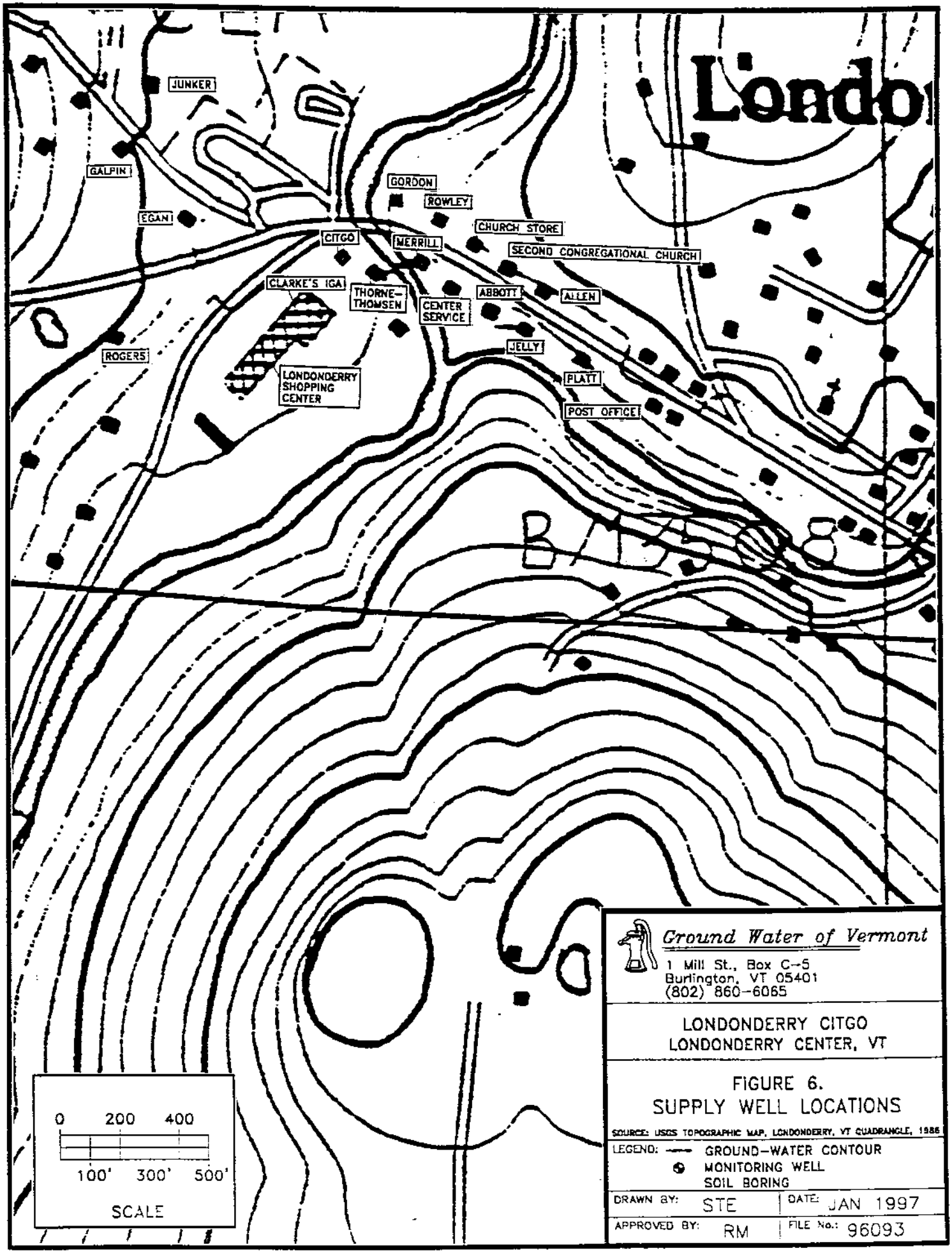
Ground Water of Vermont
1 Mill St., Box C-5
Burlington, VT 05401
(802) 860-6065

LONDONDERRY CITGO
LONDONDERRY CENTER, VT

FIGURE 5.
CONTAMINANT DISTRIBUTION MAP
MONITORING DATE: 11 NOVEMBER 1996

LEGEND: TBQ TRACE BELOW QUANTITATION LIMIT
⊕ MONITORING WELL
ND NONE DETECTED

DRAWN BY: STE	DATE: JAN 1997
APPROVED BY: RM	FILE No.: 96093



Ground Water of Vermont
1 Mill St., Box C-5
Burlington, VT 05401
(802) 860-6065

LONDONDERRY CITGO
LONDONDERRY CENTER, VT

FIGURE 6.
SUPPLY WELL LOCATIONS

SOURCE: USGS TOPOGRAPHIC MAP, LONDONDERRY, VT QUADRANGLE, 1986

LEGEND: GROUND-WATER CONTOUR
MONITORING WELL
SOIL BORING

DRAWN BY: STE	DATE: JAN 1997
APPROVED BY: RM	FILE No.: 96093

TABLE 1. GROUND-WATER ELEVATION CALCULATIONS

Londonderry Citgo
Londonderry, Vermont

Monitoring Date: 14 November 1996

Well I.D.	Top of Casing Elevation	Depth to Product (feet, TOC)	Depth to Water (feet, TOC)	Product Thickness (feet)	Corrected Depth to water (feet, TOC)	Water Table Elevation
MW-1	100.00	--	6.48	--	--	93.52
MW-2	98.90	--	5.44	--	--	93.46
MW-3	98.69	--	5.75	--	--	92.94
MW-4	98.32	--	dry	--	--	---

Monitoring Date: 15 January 1997

Well I.D.	Top of Casing Elevation	Depth to Product (feet, TOC)	Depth to Water (feet, TOC)	Product Thickness (feet)	Corrected Depth to water (feet, TOC)	Water Table Elevation
MW-1	100.00	--	5.95	--	--	94.05
MW-2	98.90	--	4.87	--	--	94.03
MW-3	98.69	--	5.07	--	--	93.62
MW-4	98.32	--	5.66	--	--	92.66

All values reported in feet relative to an arbitrary 100' datum.

TABLE 2
Monitoring Well Analytical Results
Londonderry Citgo
Londonderry, Vermont

Well I.D.	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	MTBE
MW-1	TBQ <1	ND <1	ND <1	ND <1	TBQ	1.9
MW-2	1,360	9,540	2,540	6,850	20,290	2,840
MW-3	95.7	TBQ < 10	ND <10	17.2	112.9	211
duplicate	1,480	10,800	2,930	7,910	23,120	2,420
Trip Blank	ND <1	ND <1	ND <1	ND <1	ND	ND <1
VGES*	5	2,420	680	400	---	40

Notes:
Results given in parts per billion (ppb).
ND - None detected at indicated detection limit.
TBQ - Trace below quantitation limit indicated.
Duplicate sample collected at MW-2.
All samples collected by GWV on 14 November 1996 and analyzed by Endyne, Inc.
VGES - Vermont Groundwater Enforcement Standards.
* Vermont Health Advisory (VHA) for MTBE.

TABLE 3

Drinking-Water Analytical Results
Londonderry Citgo
Londonderry Center, Vermont

Supply Well	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	MTBE
Shopping Center Main	**146**	ND <10	ND <10	ND <10	**146**	**15.2**
Clark's IGA	ND < 1	ND <1	ND <1	ND <1	**ND**	**TBQ <1**
Thorne-Thomsen	**451**	ND < 10	ND < 10	ND < 10	**451**	**14.4**
Center Service (SUNOCO)	ND < 1	**TBQ <1**	ND <1	**2.0**	**2.0**	**8.8**
Merrill	ND < 1	ND <1	ND <1	ND <1	**ND**	**6.8**
Jelly (Mobil)	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Second Congregational Church	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Church Store	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Egan	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Rowely	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Junker	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Galpin	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Rogers	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
P.O. Building	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Allen	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Platt	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Abbott	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Gordon	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Duplicate	**145**	ND <1	ND <1	**10.8**	**155.8**	**13.3**
VDS	5	1 000	700	10 000	---	40

Notes:

Results given in parts per billion (ppb).

ND - None detected at indicated detection limit.

TBQ - Trace below quantitation limit indicated.

All samples collected by GWV and analyzed by Endyne, Inc.

VDS - Vermont drinking-water standards.

Duplicate sample collected from Shopping Center's Main supply well.

TABLE 4

Treatment System Analytical Results
Londonderry Citgo
Londonderry Center, Vermont

Supply Well	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	MTBE
Shopping Center Main - Before	**146**	ND <10	ND <10	ND <10	**146**	**15.2**
Shopping Center Main - Mid	**15.0**	ND <1	ND <1	ND <1	**15.0**	**11.3**
Shopping Center Main - After	**TBQ < 1**	ND <1	ND <1	ND <1	**ND**	**13.6**
Clark's IGA - Before	ND < 1	ND <1	ND <1	ND <1	**ND**	**TBQ <1**
Clark's IGA - After	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Thorne-Thomsen - Before	**451**	ND < 10	ND < 10	ND < 10	**451**	**14.4**
Thorne-Thomsen - Mid	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Thorne-Thomsen - After	ND < 1	ND <1	ND <1	ND <1	**ND**	ND <1
Duplicate	**145**	ND <1	ND <1	**10.8**	**155.8**	**13.3**
VDS	5	1,000	700	10,000	---	40

Notes:

Results given in parts per billion (ppb).

ND - None detected at indicated detection limit.

TBQ - Trace below quantitation limit indicated.

All samples collected by GWV and analyzed by Endyne, Inc.

VDS - Vermont drinking-water standards.

Duplicate sample collected from Shopping Center's Main supply well.

TABLE 5

List of Supply Wells located
within 1,000 feet of Londonderry Citgo
Londonderry Center, Vermont

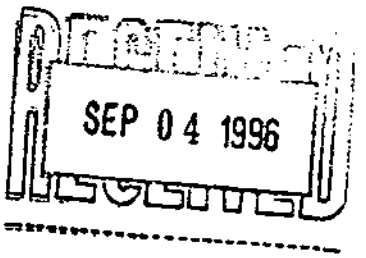
Well ID	Owner Name	Yield	Total Depth	Depth to Rock	Casing Length	Static Water	driller ID
286	Center Merrill (Sunoco)	25	130	NR	48	NR	26
272	Congregational Church	3	125	55	63	NR	26
98	Congregational Church	5	171	60	68	20	26
187	William Rogers	0.3	371	NR	46	40	26
126	Allan Galpin	50	205	3	20	40	23
62	Londonderry Shopping Center	25	121	23	29	15	26
---	Clarke's IGA (Adams Market)	2	150	23	23	15	26
6	Casey Rowley	30	205	117	122	NR	26
99	Thomas Platt	4	196	64	68	NR	26
438	Londonderry PO/Grover	5	200	NR	60	7	26
638	Jelly's Automotive (Mobil)	50	206	43	56	4	26
---	Thorne-Thomsen	30	230	NR	NR	NR	26
51	Gordon (Elizabeth Hutchins)	4	75	NR	30	15	23
---	Junker	---	---	---	---	---	---
---	Egan	---	---	---	---	---	---
---	Betsy Allen	---	---	---	---	---	---
---	Henry Abbott	100	62	50	---	---	26
---	Thorne-Thomsen (abandoned)	---	---	---	---	---	---
---	Merrill	---	---	---	---	---	---

Based on Basic Well Data sheets provided by the VT DEC Water Supply Division.
NR = information not reported.
"---" = information not available.

APPENDIX B

UST Lining Installation Record and Tracer Tight Test Results

RICE



September 3, 1996

Ron Miller, Regional Manager
Ground Water of Vermont
One Mill Street, Box C-5
Burlington, VT 05401

Dear Mr. Miller:

Enclosed are the most current tank and line test results for the Londonderry Citgo, as discussed with Tim. I thought they were last month, but these are from March, 1996. In review of the file, I have noticed that we had successful test results in '95, '94, '93, '92, '90, and '87. I have also enclosed a copy of the lining installation record and warranty done in April 1990. Hope this is helpful.

If you have any questions, please call.

Sincerely,

John J. Fox,
Environmental Compliance

Encl.:copies, warranty
1996 test results

jjf/win/let/env/lond996.doc

334 Chapman Street
P.O. BOX 127
Greenfield, MA 01302
(413) 773-3693

FAX (413) 773-9487

34 Montague City Road
P.O. BOX 106
Greenfield, MA 01302
(413) 772-0227

Tracer Research Corporation

TRACER TIGHT® TEST RESULTS

Prepared for:

EAFSD
25 Chenell Drive
Concord, NH 03301
Testers St. Lic. No: N/A

03/29/96

Job No: 310054b
Londonderry Citgo
Route No. 11
Londonderry, VT 05148

SYSTEM#	PRODUCT	SIZE	TRACER	LEAK STATUS TANK	LEAK STATUS LINE
Tank 1	M-Unleaded	4,000	C	Pass	Pass
Tank 2	Super Unl.	4,000	A	Pass	Pass
Tank 3	Super Unl.	4,000	C	Pass	Pass
Tank 4	R-Unleaded	4,000	A	Pass	Pass
Tank 5	R-Unleaded	4,000	C	Pass	Pass

Soil permeability is greater than 41.6 darcys.

SYSTEM#	AT INOCULATION 03/13/96 H_2O (in)	AT INOCULATION 03/13/96 PROD (in)	AT SAMPLING 03/27/96 H_2O (in)	AT SAMPLING 03/27/96 PROD (in)	DEPTH FROM GRADE TO WATER TABLE (in)	DEPTH FROM GRADE TO TANK BOTTOM (in)
Tank 1	0.63	32.00	0.63	41.00	56	100
Tank 2	0.50	25.00	0.50	32.00	56	101
Tank 3	0.25	23.50	0.25	32.00	56	100
Tank 4	0.50	23.00	0.50	29.50	56	102
Tank 5	0.25	23.50	0.25	29.00	56	102

Submitted by:

Rob Griffin
Tracer Research Corporation

Location	Compound	Concentration(mg/L)
001	A	0.0000
001	C	0.0000
002	A	0.0000
002	C	0.0000
003	A	0.0000
003	C	0.0000
004	A	0.0000
004	C	0.0000
005	A	0.0000
005	C	0.0000
006	A	0.0000
006	C	0.0000

TVHC (Total Volatile Hydrocarbons) values reported in milligrams/liter (mg/L).
Tracer values reported in milligrams/liter (mg/L).

0.0000 = Not Detected -9999999.0000 = No Sample

Results of U.S. EPA Standard Evaluation

Nonvolumetric Tank Tightness Testing Method

This form tells whether the tank tightness testing method described below complies with the performance requirements of the federal underground storage tank regulation. The evaluation was conducted by the equipment manufacturer or a consultant to the manufacturer according to the U.S. EPA "Standard Test Procedure for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods." The full evaluation report also includes a form describing the method and a form summarizing the test data.

Tank owners using this leak detection system should keep this form on file to prove compliance with the federal regulations. Tank owners should check with State and local agencies to make sure this form satisfies their requirements.

Method Description

Name: Tracer Tight®

Version:

Vendor: Tracer Research Corporation

(address): 3855 North Business Center Drive

(city): Tucson (state) Arizona (zip) 85705 (phone) 602/888-9400

Evaluation Results

This method, which declares a tank to be leaking when tracer is detected outside the tank at concentrations greater than 3×10^{-5} times the tracer concentration in the tank has an estimated probability of false alarms [P(FA)] of a 0.0 % based on the test results of 0 false alarms out of 22 tests. A 95% confidence interval for P(FA) is from 0 % to 13 %

The corresponding probability of detection [P(D)] of a 0.05 gallon per hour leak is 100 % based on the test results of 45 detections out of 45 simulated leak tests. A 95% confidence interval for P(D) is from 92.4 % to 100 %

The corresponding probability of detection [P(D)] of a 0.1 gallon per hour leak is 100 % based on the test results of 93 detections out of 93 simulated leak tests. A 95% confidence interval for P(D) is from 96.2 % to 100 %

Does this method use additional modes of leak detection? ☒ Yes ☐ No If Yes, complete additional evaluation results on page 3 of this form.

Based on the results above, and on page 3 if applicable, this method ☒ does ☐ does not meet the federal performance standards established by the U.S. Environmental Protection Agency (0.10 gallon per hour at P(D) of 95% and P(FA) of 5%).

Test Conditions During Evaluation

The evaluation testing was conducted outside a 55 -gallon ☒ steel ☐ fiberglass tank that was 22 inches in diameter and 34 inches long, installed in silty clay native soil backfill.

The ground-water level was 0 inches above the bottom of the tank.

CONCEPT OF OPERATION AND IMPLEMENTATION

The tracer leak detection method relies upon the addition of a highly volatile liquid chemical to the product in a storage system. If a leak occurs in the storage system. the tracer labeled product is released. Tracer escapes from the product by vaporization and disperses by molecular diffusion. Various means are used to sample the vapors in the immediate vicinity of the storage systems and associated piping. Each probe should detect a leak anywhere within the area described by the 10 foot radius around a probe. The process of leak detection by placing a liquid or gas tracer in a liquid product followed by detection of the tracer underground in the vapor phase is protected under *TRACER* patents.

WATER INGRESS

The detection of water ingress relies on measurements of the level of water in a storage system. The water level is measured by placing water indicating paste on the lower end of a stick used to measure the product level. The minimum required waiting period between water level measurements is the time required for a 0.1 gph ingress or the inward leakage of water to produce a change in the water level of 0.25 inches. The typical waiting period between measurements is 14-30 days as part of the Tracer Tight® test. Tanks greater than 60,000 gallons require a longer waiting period than the minimum 14 days.

TVHC

If requested, total volatile hydrocarbon (TVHC) concentrations are measured to give additional information about site conditions. The TVHC data provide information about the severity of the leakage, and the degree of any possible environmental damage that may have occurred. The TVHC data is not used as a criterion factor to determine the status of a particular storage system and is provided as supplemental information only.

LEAK DETECTION CRITERIA

The classification of leakage is based on the presence or absence of tracer.

PASS: NO Tracer Detected or Water Level Change < 0.25 inches.

FAIL: Tracer Detected or Water Level Change ≥ 0.25 inches.

Nonvolumetric TTT Method Tracer Tight®
Version

>Safety disclaimer: This test procedure only addresses the issue of the methods ability to detect leaks. It does not test the equipment for safety hazards.

Additional Evaluation Results (if applicable)

This method, which declares a tank to be leaking when water ingress is detected has an estimated probability of false alarms [P(FA)] of N/A % based on the test results of false alarms out of N/A tests. Note: A perfect score during testing does not mean that the method is perfect. Based on the observed results, a 95% confidence interval for P(FA) is from 0 % to N/A %.

The corresponding probability of detetecton [P(D)] of a N/A gallon per hour leak is N/A % based on the test results of N/A detections out of N/A simulated leak tests. Note: A perfect score during testing does not mean that the method is perfect. Based on the observed results, a 95% confidence interval for P(D) is from N/A % to 100 %.

>Water detection mode (if applicable)

Using a false alarm rate of 0% the minimum water level that the water sensor can detect with a 100% probability of detection is 0.008 inches.

Using a false alarm rate of 5% the minimum change in water level that the water sensor can detect with a 95% probability of detection is 0.19 inches.

Based on the minimum water level and change in water level that the water sensor can detect with a false alarm rate of 5% and a 95% probability of detection, the minimum time for the system to detect an increase in water level at an incursion rate of 0.10 gallon per hour is 1836 minutes in a 75,000 - gallon tank.

Certification of Results

I certify that the nonvolumetric tank tightness testing method was installed and operated according the the vendors instructions. I also certify that the evaluation was performed according to the standard EPA test procedure for nonvolumetric tank tightness testing methods and that the results presented above are those obtained during the evaluation.

Curtis W. Bryant
(printed name)

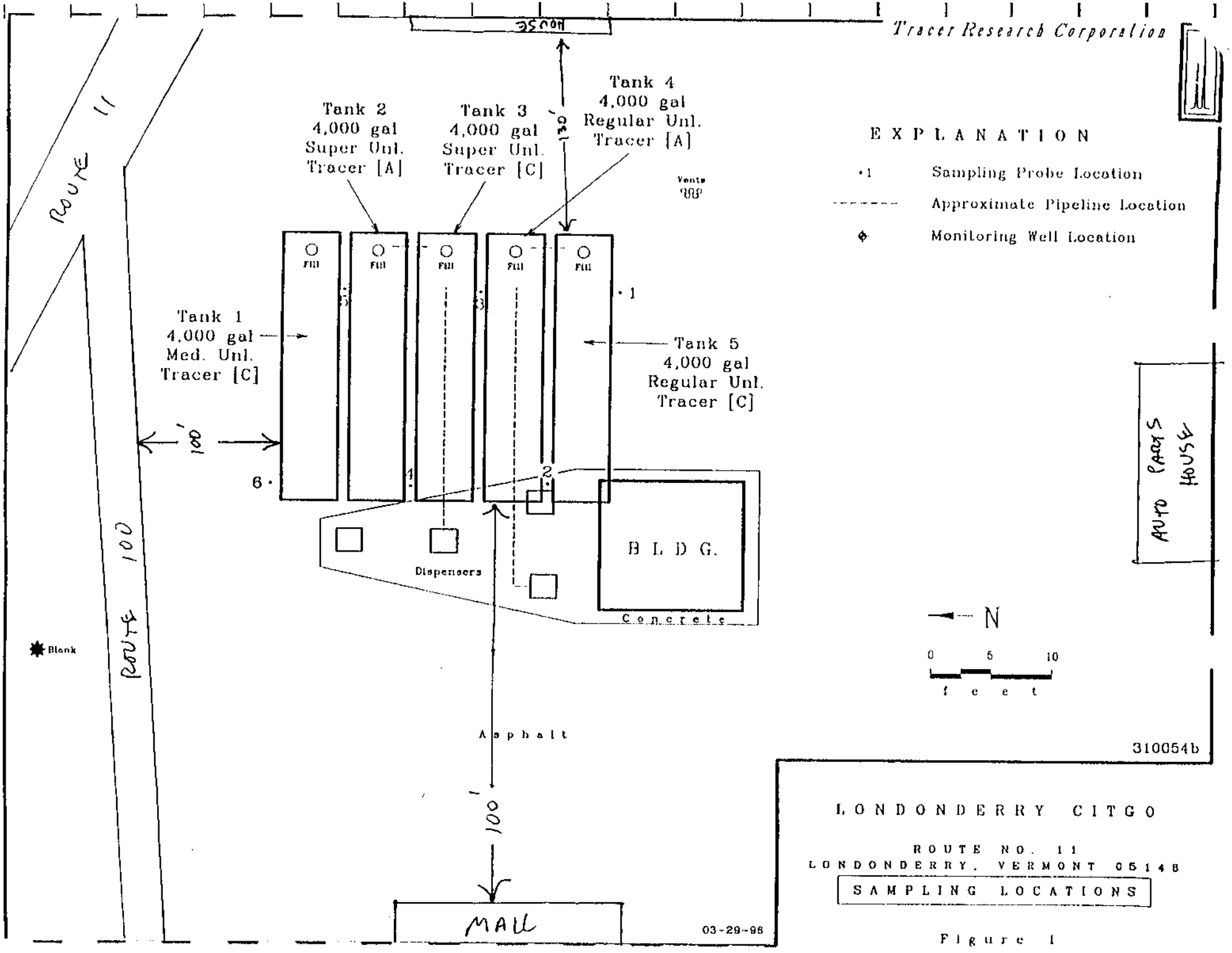
Curtis W. Bryant
(signature)

May 20, 1992
(date)

Control Strategies Engineering
(organization performing evaluation)

12550 West Manville Road
Tucson, Arizona 85743
(city, state, zip)

(602) 682-8726
(phone number)



LONDONDERRY CITGO

ROUTE NO. 11
LONDONDERRY, VERMONT 05148

SAMPLING LOCATIONS

Figure 1

INSTALLATION **A** 413

Invoice No. 4313 ~~4314~~

ARMOR SHIELD® INSTALLATION RECORD

DATE COMPLETED 4/13/90 Job Name: Rice Oil Company

Address Citgo S/S RTE 11 Londonderry,VT Station Manager:

APPLICATING COMPANY John D. Hallberg & Sons Inc.

The Applicator wishes to enter into a warranty agreement with the owner in accordance with the terms and conditions as described on the preceding page. The Applicator certifies that said lining has been done with lining materials compatable with the material stored, to a minimum thickness of 100 mils and a nominal thickness of 125 mils. Further, the Applicator certifies that all applicable standards, codes, and regulations, NLPA 631, API 1631, 40 CFR 280.21 and 40 CFR 280.33 were followed, including a proper surface preparation as specified by the SSPC5 white metal blast standard. The Applicator further certifies that the application was thoroughly checked by means of a mil guage to assess the thickness of the lining, a barcol tester to assess hardness and a holiday tester to detect pinholes, bubbles and voids in the lining in order to assure compliance with the above standards, codes, and regulations. The Applicator warranty number indicated above is issued to the below named customer and Armor Shield, Inc. representing said authentication.

CORPORATE OFFICER'S SIGNATURE Jeanine Hallberg

Jeanine D. Hallberg

Mail Warranty to:

RICE OIL COMPANY — COMPANY

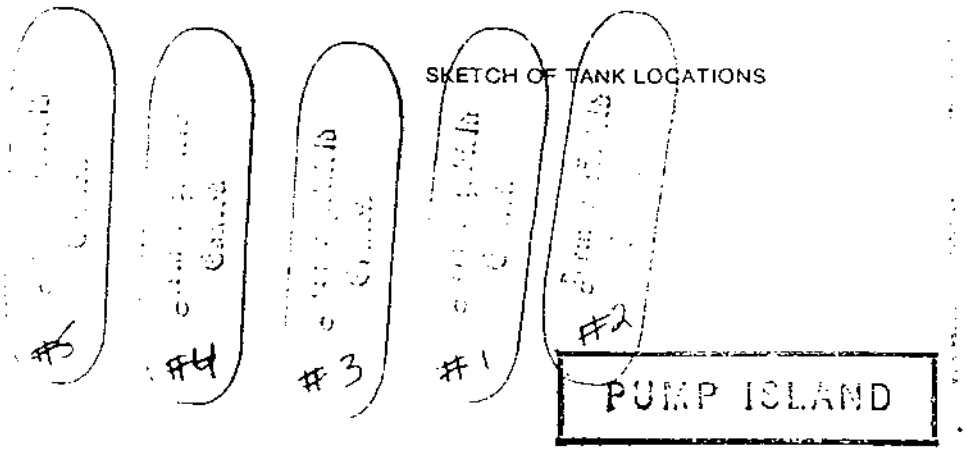
P.O. BOX 106 — ADDRESS

GREENFIELD, MA. 01301 — CITY, STATE and ZIP

ATTENTION (Name)

TANK # SIZE	NAME OF SPRAY	GALLONS USED	NAME OF TROWEL	NAME OF BASE RESIN
1. Reg. ul. 4m	TL-300	30	AG-300	
2. Reg UL 4M	TL-300	30	AG-300	
3. Super 4M	TL-300	30	AG-300	
4. Super 4M	TL-300	30	AG-300	
5. Plus 4M	TL-300	30	AG-300	
6.				

SKETCH OF TANK LOCATIONS



Applicator: Mail to Armor Shield, Inc. for Authentication Signature

AMOUNT OF ARMOR SHIELD'S SPRAY MATERIAL TO BE USED WHEN COATING A TANK

CAPACITY IN GALLONS	DIMENSION	SQ. FT.	GALLONS NEEDED
150	30" X 48"	41.23	3.22
200	36" X 48"	51.83	4.05
275	29" X 95"	69.28	5.41
280	42" X 48"	63.22	4.94
300	38" X 60"	65.49	5.12
345	46" X 48"	71.24	5.57
560	42" X 8'	107.20	8.37
560	48" X 6'	100.54	7.85
860	48" X 9'	138.24	10.80
1,000	48" X 10'8"	159.17	12.44
1,000	64" X 6'	145.21	11.34
1.500	64" X 9'	195.47	15.27
2,000	64" X 12'	245.74	19.20
2,500	64" X 15'	296.01	23.13
3,000	64" X 18'	346.27	27.05
3,000	72" X 14'	320.44	25.03
4,000	64" X 24'	446.80	34.91
4,000	72" X 19'	414.70	32.40
4,000	84" X 14'	384.85	30.07
4,000	96" X 11'	452.38	35.34
5,000	96" X 13'6"	439.82	34.36
5,000	72" X 23'8"	502.66	39.27
6,000	96" X 16'	502.65	39.27
6,000	72" X 29'1"	604.77	47.25
8,000	96" X 21'6"	640.88	50.07
8,000	120" X 14"	596.91	46.63
10,000	96" X 27'	779.11	60.87
10,000	126" X 15'9"	692.72	54.12
12,000	96" X 31'11"	902.67	70.52
12,000	126" X 18'7"	786.18	61.42
15,000	126" X 23'2"	937.37	73.23
20,000	126" X 31"	1,195.76	93.42

Installation No. A413

Warranty Agreement
10 Year

The Applicator warrants for ten years under normal use and service the lined steel storage tank, as described on page two, to remain free from internal corrosion due to defective workmanship in the application of the lining. For purposes of this warranty, normal use and service is deemed to be the storage of gasoline, gasohol (90% gasoline and 10% ethanol mixture), 90.5% gasoline and 9.5% oxinol - 50* (4.75% methanol and 4.75% GTBA mixture), kerosine and diesel fuel at ambient underground temperatures.

Any defect in the lining application or material will be repaired by the Applicator provided the tank is made available and accessible. In the event of lining failure, the exclusive remedy shall be for the Applicator to repair the lining. If conditions are such that the tank cannot be repaired, this Warranty Agreement is terminated with no further obligations of the applicator or Armor Shield, Inc. to owner. There is no refund of purchase price, if tank cannot be repaired under the warranty period. There will be a charge for travel, labor, excavation, fuel transfer, permits, and testing for any warranty work. Any and all incidence, including damage to a lined tank, which alters the structure of the lining, releases the Applicator, and the supplier of the lining material, from any liability, direct or indirect, and nullifies this warranty. In no way is the structural integrity of the tank shell, welds, or repairs made to the tank in preparation of applying the lining warranted. Any and all remedies for contamination shall be the sole responsibility of the owner.

The liability of the Applicator is limited to the repair of the installed lining. The liability of the Applicator includes the replacement of the lining material. No liability is assumed by the Applicator or Armor Shield, Inc. for any consequential or incidental damages caused by the use of or failure of the lining. Owner agrees to hold harmless and indemnify the Applicator and Armor Shield, Inc. from any liability.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. This Warranty is null and void if not validated by Owner's signature. Statements made by sales representatives or contained in advertising material are not warranties and should not be construed as such. This warranty is Non-Transferable.

The Applicator recommends that with any tank, regardless of age, a daily log of the tank's inventory be maintained. If any inventory shortage occurs, the tank should be drained and tested for leaks.

The undersigned Applicator certifies that said steel storage tank has been lined with Compatible Lining materials including quality control specifications, which include:

1. *Surface Preparation - (white metal blast, 3½ mil profile min.)*
2. *Surface To Be Lined - The relative humidty was 85% or less.*
3. *Lining Application - (125 mil nominal and 100 mil minimum thickness)*
4. *Final Inspection - (Holiday 12,500 volts - Barcol 935 hardness 80 minimum.)*

Dated: April 13, 1990

Applicator: J.D. Hallberg Tank Lining Corp

Address: P.O. Box 24, S. Chelmsford, MA 01824

Authentication Witness

By: Doris Manuel

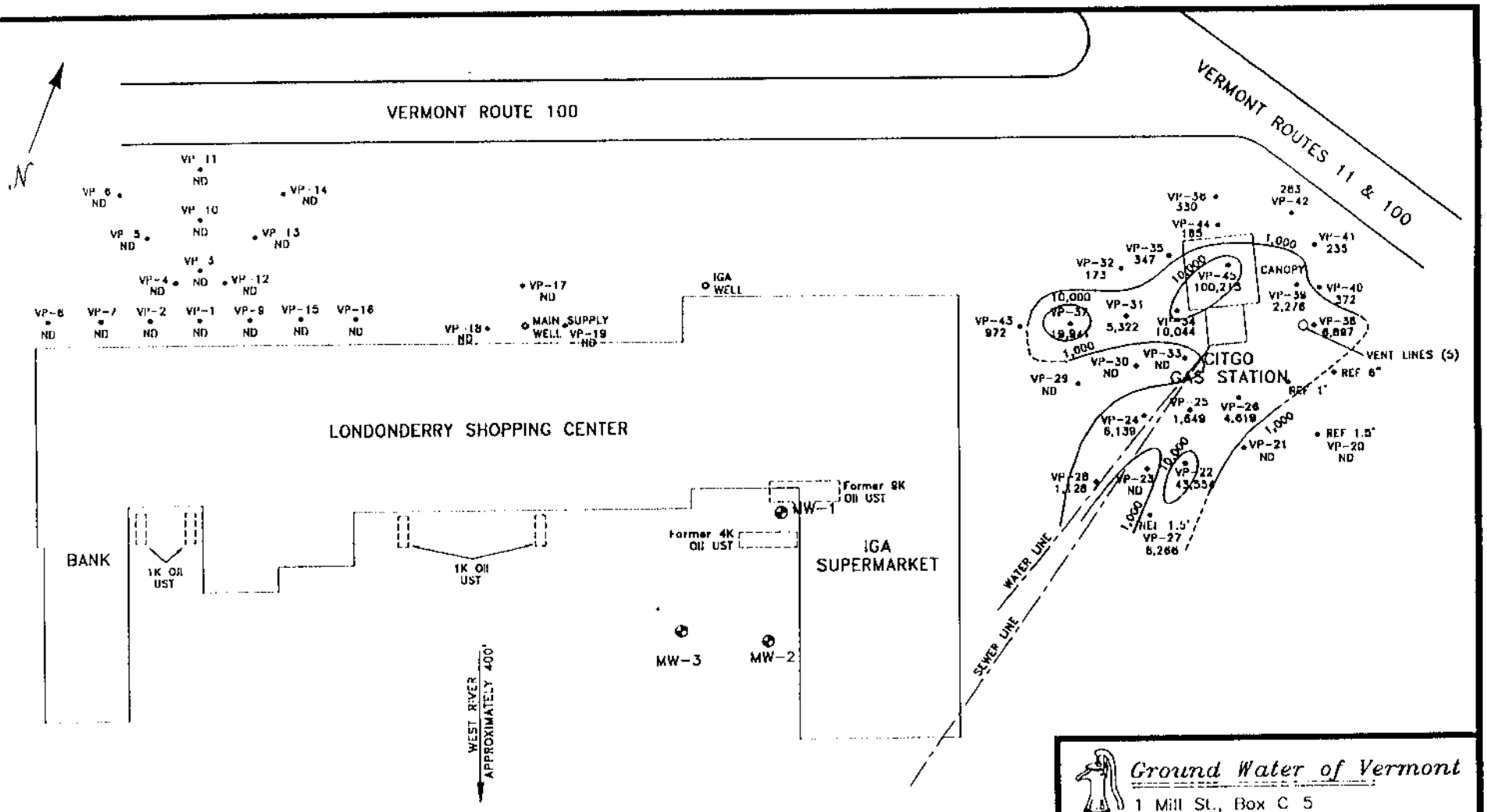
Owner's Validation Signature

By: _____

Owner acknowledgement of this warranty agreement is hereby made.

APPENDIX C

Soil-Gas Contaminant Distribution Maps and Field GC Data



* VAPOR SAMPLE POINT VALUES ARE ppb TOTAL BTX

ALL LOCATIONS ARE APPROXIMATE

0 60'

SCALE

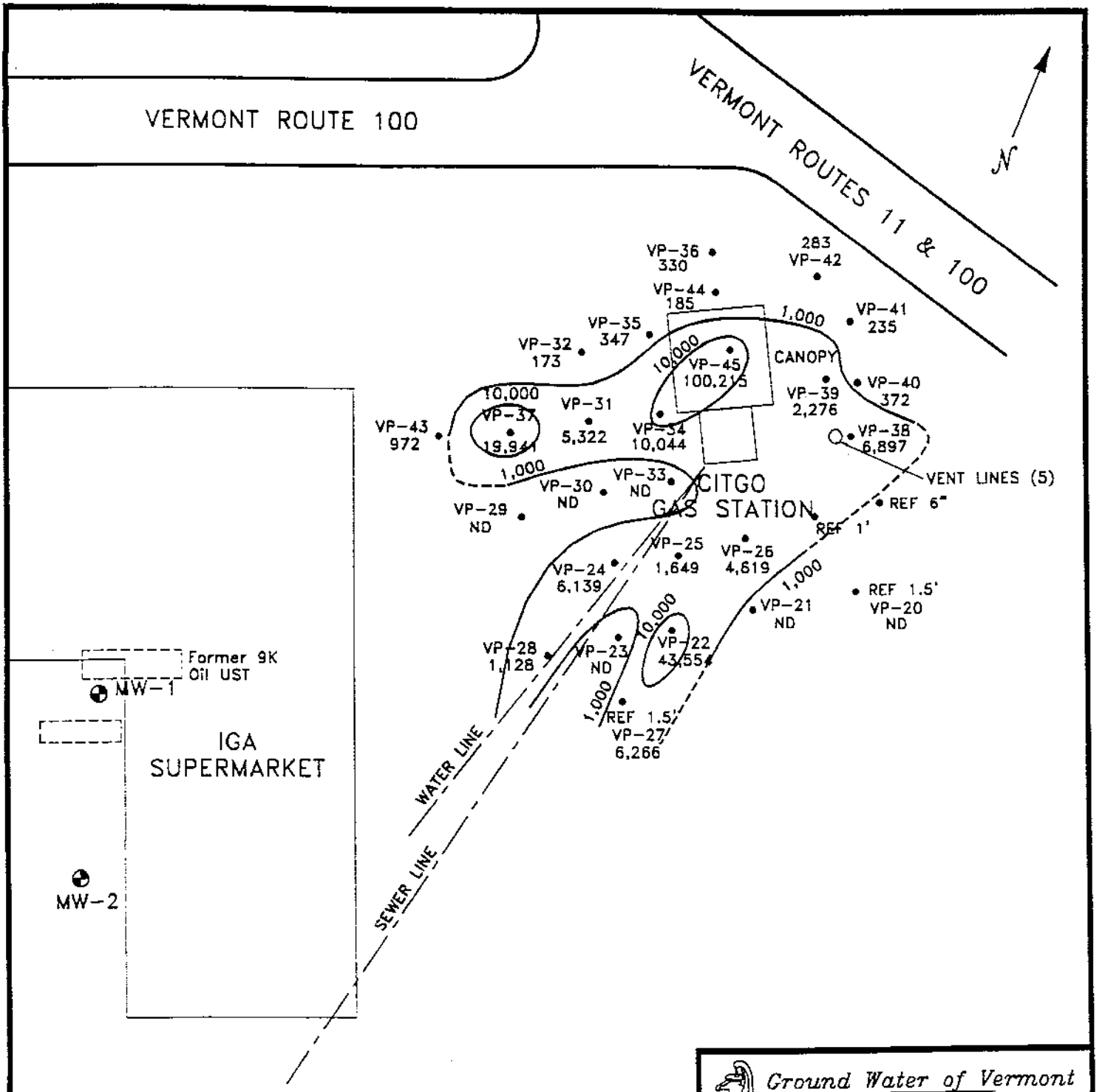
Ground Water of Vermont
1 Mill St., Box C 5
Burlington, VT 05401
(802) 860-6065

LONDONDERRY SHOPPING CENTER
LONDONDERRY CENTER, VT

FIGURE 2.
SITE CONTAMINANT DISTRIBUTION MAP

LEGEND: —— SOIL/GAS VAPOR CONTOUR
● MONITORING WELL
• VP-17 VAPOR SAMPLE POINT

DRAWN BY: STE	DATE: AUG 1996
APPROVED BY: RM	FILE No.: 96028



* VAPOR SAMPLE POINT VALUES ARE ppb TOTAL BTX

0 40'

SCALE

ALL LOCATIONS ARE APPROXIMATE

Ground Water of Vermont
1 Mill St., Box C-5
Burlington, VT 05401
(802) 860-6065

LONDONDERRY SHOPPING CENTER
LONDONDERRY CENTER, VT

FIGURE 3.
CITGO CONTAMINANT
DISTRIBUTION MAP

LEGEND: — SOIL/GAS VAPOR CONTOUR
◓ MONITORING WELL
•VP-17 VAPOR SAMPLE POINT

DRAWN BY: STE	DATE: AUG 1996
APPROVED BY: RM	FILE No.: 96028

TABLE 1 Portable GC Results
Londonderry Shopping Center
Londonderry, Vermont

Parking Lot	benzene	toluene	m-xylene	p-xylene	o-xylene	Total BTX
VP-1	-	-	-	-	-	-
VP-2	-	-	-	-	-	-
VP-3	-	-	-	-	-	-
VP-4	-	-	-	-	-	-
VP-5	-	-	-	-	-	-
VP-6	-	-	-	-	-	-
VP-7	-	-	-	-	-	-
VP-8	-	-	-	-	-	-
VP-9	-	-	-	-	-	-
VP-10	-	-	-	-	-	-
VP-11	-	-	-	-	-	-
VP-12	-	-	-	-	-	-
VP-13	-	-	-	-	-	-
VP-14	-	-	-	-	-	-
VP-15	-	-	-	-	-	-
VP-16	-	-	-	-	-	-
VP-17	-	-	-	-	-	-
VP-18	-	-	-	-	-	-
VP-19	-	-	-	-	-	-
Citgo	**benzene**	**toluene**	**m-xylene**	**p-xylene**	**o-xylene**	**Total BTX**
VP-20	-	-	-	-	-	-
VP-21	-	-	-	-	-	-
VP-22	-	-	22,898	5,607	15,049	43,554
VP-23	-	-	-	-	-	-
VP-24	-	-	1,712	822	3,606	6,139
VP-25	-	-	1,070	54	526	1,649
VP-26	-	451	1,177	483	2,508	4,619
VP-27	-	-	1,362	911	3,993	6,266
VP-28	-	-	582	-	546	1,128
VP-29	-	-	-	-	-	-
VP-30	-	-	-	-	-	-
VP-31	-	1,657	1,147	1,207	1,312	5,322
VP-32	-	173	-	-	-	173
VP-33	-	-	-	-	-	-
VP-34	1,694	7,868	-	486	-	10,049
VP-35	-	199	-	147	-	347
VP-36	-	330	-	-	-	330
VP-37	572	19,368	-	-	-	19,941
VP-38	774	5,387	224	49	464	6,897
VP-39	84	1,211	491	84	406	2,276
VP-40	-	327	-	-	-	327
VP-41	-	235	-	-	-	235
VP-42	-	283	-	-	-	283
VP-43	-	560	-	210	202	972
VP-44	-	185	-	-	-	185
VP-45	9,669	49,284	-	22,786	18,477	100,215

Note: All results reported as parts per billion (ppb) on a volume/volume (v/v) basis.
" - " indicates compound not detected.

TABLE 2

Portable GC - QA/QC Data

Londonderry Shopping Center
Londonderry, Vermont

8/7/96	Time	benzene	toluene	m-xylene	p-xylene	o-xylene
Column blk	9:40	—	—	—	—	—
Column blk	9:48	—	—	—	—	—
Column blk	9:55	—	—	—	—	—
Column blk	10:13	—	—	—	—	—
Rod blk	12:01	—	—	—	—	—
Rod blk	14:09	—	—	—	—	—
Column blk	14:17	—	—	—	—	—
Rod blk	16:44	—	—	—	—	—
Ambient	16:52	—	—	—	—	—
Column blk	18:53	—	—	—	—	—

Benzene, toluene, and xylenes standards run at 11:45, 14:25, 15:30, 16:59, and 19:06.

" - " indicates compound not detected.

8/8/96	Time	benzene	toluene	m-xylene	p-xylene	o-xylene
Column blk	7:13	—	—	—	—	—
Column blk	7:30	—	—	—	—	—
Column blk	7:44	—	—	—	—	—
Rod blk	8:58	—	—	—	—	—
Column blk	12:19	—	—	—	—	—
Column blk	13:53	—	—	—	—	—
Rod blk	14:24	2,778	14,466	—	539	610
Rod blk	14:32	352	2,845	—	117	180
Rod blk	14:46	112	381	—	49	—
Rod blk	15:06	134	347	—	—	—
Column blk	17:02	—	—	—	—	—

Benzene, toluene, and xylenes standards run at 8:13, 8:22, 8:35, 11:15, and 14:58.

" - " indicates compound not detected.

APPENDIX D

Soil Boring and Monitoring Well Logs

Ground Water of Vermont

FIELD SUPERVISOR Bob Ross
CONTRACTOR American Drilling, INC
DRILLERS mike Hayes

JOB LOCATION V96-093
Londonderry Citgo
DATE 10/31/96

DRILLING METHOD HSA
BORING DIAMETER 4 1/4"

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

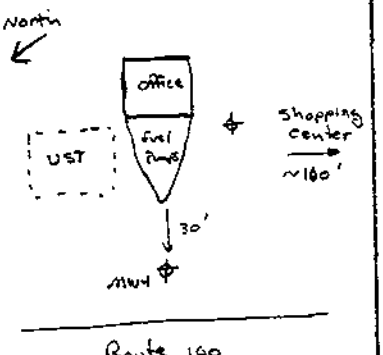
BORING LOCATION sketch on back or on-site plan with measurements
BORING # MW-1
TOTAL DEPTH 15'

DEPTH	SAMPLES	SAMPLE NUMBER	BLOWS PER 6" 0/6	6/12	12/18	18/24	REC.	SAMPLE DESCRIPTION	STRAT CHG	GENERAL DESCRIPTION
5'		SS-1	7	17	29	39	16/24	tan fine to coarse SAND, some Gravel		PID 0.2 ppm
10'		SS-2	7	11	11	9	12/24	▽ 9' ATD brown coarse SAND, some Gravel and medium-to-fine sand (saturated)		1.0 ppm
15'								BoB 15'		

WELL DETAIL: NATIVE; SAND

DEPTH: 5', 10', 15', 20', 25', 30', 35', 40'

– not to scale –



MATERIALS USED	SIZE/TYPE	QUANTITY
WELL SCREEN	2" Sch 40 PVC	
SLOT SIZE	10 Slot	10'
RISER PIPE	2" Sch 40 PVC	5'
GRADED SAND	yes	3 - 15'
PELLET BENTONITE	yes	2 - 3'
GRANULAR BENTONITE	–	–

MATERIALS USED	SIZE/TYPE	QUANTITY
GROUT	–	–
BACKFILL	natural	
WATER USED	–	–
STEAM CLEANER	–	–
Road box protective casing		

Ground Water of Vermont

FIELD SUPERVISOR Bob Ross
CONTRACTOR American Drilling, INC
DRILLERS Mike Hayes

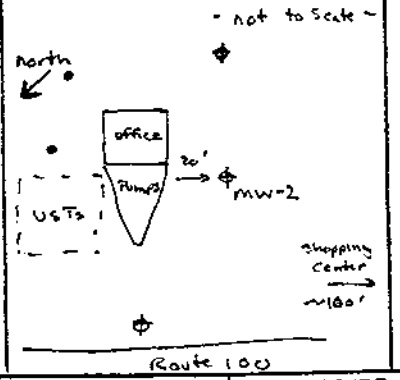
JOB LOCATION V96-093
Londonderry Citgo
DATE 10/31/96

DRILLING METHOD HSA
BORING DIAMETER 4 1/4"

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

BORING LOCATION sketch on back or on-site plan with measurements
BORING # MW-2
TOTAL DEPTH 15'

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'		SS-1	9	20	50/5"		14/17	brown fine-to-coarse SAND some Gravel (Petroleum odor)		PID 280 ppm		5'
10'		SS-2	6	15	18	13	18/24	▽ 10' ATD brown fine to coarse SAND, Some Gravel (Saturated) Slight odor		75 ppm		10'
15'												15'
20'												20'
25'												25'
30'												30'
35'												35'
40'												40'



MATERIALS USED	SIZE/TYPE	QUANTITY
WELL SCREEN	2" Sch 40 PVC	
SLOT SIZE	10 Slot	10'
RISER PIPE	2" Sch 40 PVC	5'
GRADED SAND	yes	3-15'
PELLET BENTONITE	yes	2-3'
GRANULAR BENTONITE		

MATERIALS USED	SIZE/TYPE	QUANTITY
GROUT		
BACKFILL	natural	
WATER USED		
STEAM CLEANER		
Road box protective casing		

Ground Water of Vermont

FIELD SUPERVISOR Bob Ross
CONTRACTOR American Drillers, Inc.
DRILLERS Mike Hayes

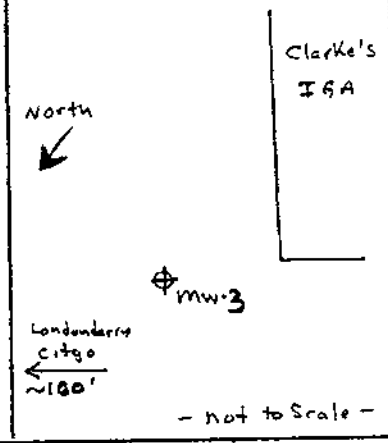
JOB LOCATION 096-093
Londonderry citgo
DATE 10/31/96

DRILLING METHOD HSA
BORING DIAMETER 4 1/4"

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

BORING LOCATION BORING #
sketch on back or on-site plan MW-3
with measurements TOTAL DEPTH 15'

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'	SS	SS-1	7	11	14	23	18/24	Lt gray-brown fine SAND, some silt (moist) horizontal oxidized seams ▽ 8' ATD		PID N.R.		5'
10'	SS	SS-2	4	13	30	32		brown poorly sorted coarse sand and gravel, some fine-to-medium sand (saturated)		0.1 ppm		10'
15'								BoB at 15'				15'
20'												20'
25'												25'
30'												30'
35'												35'
40'												40'



MATERIALS USED	SIZE/TYPE	QUANTITY
WELL SCREEN	2" sch 40 PVC	
SLOT SIZE	10 slot	10'
RISER PIPE	2" sch 40 PVC	5'
GRADED SAND		
PELLET BENTONITE		
GRANULAR BENTONITE		

MATERIALS USED	SIZE/TYPE	QUANTITY
GROUT		
BACKFILL	natural	
WATER USED		
STEAM CLEANER		
Road box Protective Casing		

Ground Water of Vermont

FIELD SUPERVISOR Bob Ross
CONTRACTOR American Drilling, Inc.
DRILLERS Mike Hayes

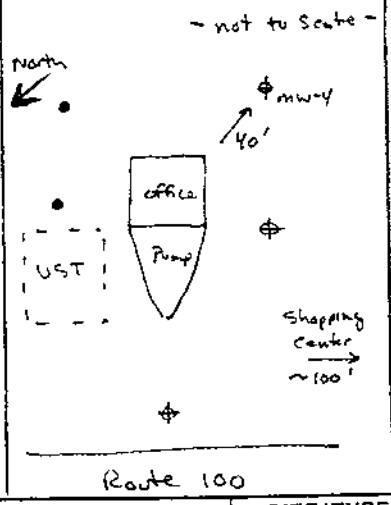
JOB LOCATION VT96-093 Londonderry Citgo
DATE 10/31/96

DRILLING METHOD HSA
BORING DIAMETER 4 1/4"

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 7'

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'	SS-1		12	28	29	38		Tan/lt brown fine Sand, Some silt, little Coarse Sand & Gravel (poorly sorted)		PID N.R.		5'
								Refusal at 7'		BOB 7'		
10'								No groundwater encountered at time of drilling				10'
15'												15'
20'												20'
25'												25'
30'												30'
35'												35'
40'												40'



MATERIALS USED	SIZE/TYPE	QUANTITY
WELL SCREEN	2" sch 40 PVC	
SLOT SIZE	10 slot	4'
RISER PIPE	2" sch 40 PVC	3'
GRADED SAND	#65	2->'
PELLET BENTONITE	#65	1-2'
GRANULAR BENTONITE	—	—

MATERIALS USED	SIZE/TYPE	QUANTITY
GROUT	—	—
BACKFILL	natural	
WATER USED	—	—
STEAM CLEANER	—	—
Road box protective casing		

Ground Water of Vermont

FIELD SUPERVISOR Bob Ross
CONTRACTOR American Drilling, Inc
DRILLERS mike Hayes

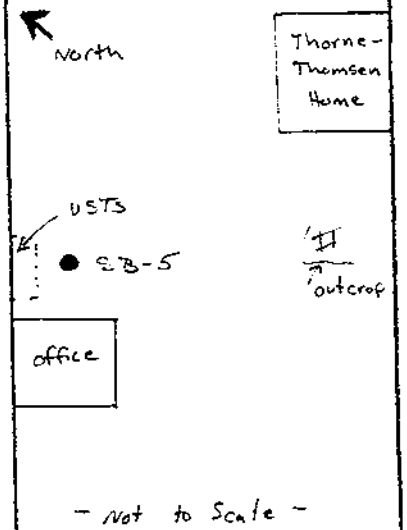
JOB LOCATION V96-093
Londonderry Citgo
DATE 10/31/96

DRILLING METHOD HSA
BORING DIAMETER 4 1/4"

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

BORING LOCATION BORING # SB-5
sketch on back or on-site plan with measurements
TOTAL DEPTH 2 1/2'

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
								drk brown silty SAND		PID (ppm)		
								refusal at 2 1/2'		1.0		
								Possible Bedrock				
5'												5'
10'												10'
15'												15'
20'												20'
25'												25'
30'												30'
35'												35'
40'												40'



MATERIALS USED	SIZE/TYPE	QUANTITY
WELL SCREEN		
SLOT SIZE		
RISER PIPE		
GRADED SAND		
PELLET BENTONITE		
GRANULAR BENTONITE		

MATERIALS USED	SIZE/TYPE	QUANTITY
GROUT		
BACKFILL		
WATER USED		
STEAM CLEANER		

Ground Water of Vermont

FIELD SUPERVISOR Bob Ross
CONTRACTOR American Drilling, Inc
DRILLERS mike Hayes

JOB LOCATION V96-093
Londonderry Citgo
DATE 10/31/96

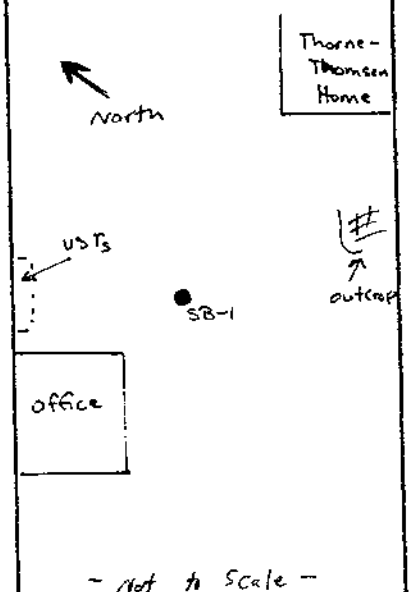
DRILLING METHOD HSA
BORING DIAMETER 4 1/4"

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

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

BORING # SB-1
TOTAL DEPTH 2½'

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
		SS-1	48	10						PID (ppm)		
					50/2"		n/h	fine to medium SAND, some Gravel		NR		
5'								Refusal at 2½' – Possible bedrock –		NR = No Response		5'
10'								Bedrock outcrop located ~ 30' east of boring location				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			GROUT		
SLOT SIZE			BACKFILL		
RISER PIPE			WATER USED		
GRADED SAND			STEAM CLEANER		
PELLET BENTONITE					
GRANULAR BENTONITE					

APPENDIX E

Laboratory Report Forms

ENDYNE, INC.

Laboratory Services

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

EPA METHOD 8020--PURGEABLE AROMATICS

CLIENT: GroundWater of Vermont
PROJECT NAME: Londonderry Citgo
CLIENT PROJ. #: V96-093

DATE RECEIVED: November 15, 1996
REPORT DATE: November 19, 1996
PROJECT CODE: GWVT1025

Ref. #:	96,769	96,770	96,771	96,772	96,773
Site:	Trip Blank	Th.-Th. Before	Th.-Th. Mid	Th.-Th. After	Church
Date Sampled:	11/14/96	11/14/96	11/14/96	11/14/96	11/14/96
Time Sampled:	5:50	9:00	9:05	9:10	9:25
Sampler:	B. Ross	B. Ross	B. Ross	B. Ross	B. Ross
Date Analyzed:	11/15/96	11/18/96	11/15/96	11/15/96	11/16/96
UIP Count:	0	9	0	0	0
Dil. Factor (%):	100	10	100	100	100
Surr % Rec. (%):	94	122	103	95	93
Parameter	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
Benzene	<1	451.	<1	<1	<1
Chlorobenzene	<1	<10	<1	<1	<1
1,2-Dichlorobenzene	<1	<10	<1	<1	<1
1,3-Dichlorobenzene	<1	<10	<1	<1	<1
1,4-Dichlorobenzene	<1	<10	<1	<1	<1
Ethylbenzene	<1	<10	<1	<1	<1
Toluene	<1	<10	<1	<1	<1
Xylenes	<1	<10	<1	<1	<1
MTBE	<1	14.4	<1	<1	<1

Ref. #:	96,774	96,775	96,776	96,777	96,778
Site:	Rowley	Church Store	Junker	Galpin	Rogers
Date Sampled:	11/14/96	11/14/96	11/14/96	11/14/96	11/14/96
Time Sampled:	9:35	9:50	10:02	10:17	10:35
Sampler:	B. Ross	B. Ross	B. Ross	B. Ross	B. Ross
Date Analyzed:	11/16/96	11/16/96	11/16/96	11/16/96	11/16/96
UIP Count:	0	0	0	0	0
Dil. Factor (%):	100	100	100	100	100
Surr % Rec. (%):	95	93	94	95	100
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	<1	<1	<1	<1	<1

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 8020--PURGEABLE AROMATICS

CLIENT: GroundWater of Vermont
PROJECT NAME: Londonderry Citgo
CLIENT PROJ. #: V96-093

DATE RECEIVED: November 15, 1996
REPORT DATE: November 19, 1996
PROJECT CODE: GWVT1025

Ref. #:	96,779	96,780	96,781	96,782	96,783
Site:	P.O. Building	Allen	Platt	Abbott (Home)	Gordon
Date Sampled:	11/14/96	11/14/96	11/14/96	11/14/96	11/14/96
Time Sampled:	10:50	11:00	11:07	11:20	11:32
Sampler:	B. Ross	B. Ross	B. Ross	B. Ross	B. Ross
Date Analyzed:	11/16/96	11/18/96	11/16/96	11/18/96	11/16/96
UIP Count:	0	0	0	0	0
Dil. Factor (%):	100	100	100	100	100
Surr % Rec. (%):	95	95	108	94	106
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	<1	<1	<1	<1	<1

Ref. #:	96,784	96,785	96,786	96,787	96,788
Site:	IGA Well-Before	IGA Well-After	Main Well-Mid	Main Well-After	Main Well-Before
Date Sampled:	11/14/96	11/14/96	11/14/96	11/14/96	11/14/96
Time Sampled:	11:52	11:55	12:25	12:30	12:35
Sampler:	B. Ross	B. Ross	B. Ross	B. Ross	B. Ross
Date Analyzed:	11/18/96	11/16/96	11/16/96	11/18/96	11/19/96
UIP Count:	0	0	10	4	10
Dil. Factor (%):	100	100	100	100	10
Surr % Rec. (%):	94	96	95	95	95
Parameter	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
Benzene	<1	<1	15.0	TBQ <1	146.
Chlorobenzene	<1	<1	<1	<1	<10
1,2-Dichlorobenzene	<1	<1	<1	<1	<10
1,3-Dichlorobenzene	<1	<1	<1	<1	<10
1,4-Dichlorobenzene	<1	<1	<1	<1	<10
Ethylbenzene	<1	<1	<1	<1	<10
Toluene	<1	<1	<1	<1	<10
Xylenes	<1	<1	<1	<1	<10
MTBE	TBQ <1	<1	11.3	13.6	15.2

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 8020-PURGEABLE AROMATICS

CLIENT: GroundWater of Vermont
PROJECT NAME: Londonderry Citgo
CLIENT PROJ. #: V96-093

DATE RECEIVED: November 15, 1996
REPORT DATE: November 19, 1996
PROJECT CODE: GWVT1025

Ref. #:	96,789	96,790	96,791	96,792	96,793
Site:	Duplicate	Center Service	Merrill	Egan	MW-1
Date Sampled:	11/14/96	11/14/96	11/14/96	11/14/96	11/14/96
Time Sampled:	NI	13:05	13:12	13:27	14:20
Sampler:	B. Ross	B. Ross	B. Ross	B. Ross	B. Ross
Date Analyzed:	11/18/96	11/18/96	11/18/96	11/18/96	11/18/96
UIP Count:	>10	6	0	0	10
Dil. Factor (%):	0.5	100	100	100	100
Surr % Rec. (%):	89	96	95	95	105
Parameter	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
Benzene	1,480.	<1	<1	<1	TBQ <1
Chlorobenzene	<200	<1	<1	<1	<1
1,2-Dichlorobenzene	<200	<1	<1	<1	<1
1,3-Dichlorobenzene	<200	<1	<1	<1	<1
1,4-Dichlorobenzene	<200	<1	<1	<1	<1
Ethylbenzene	2,930.	<1	<1	<1	<1
Toluene	10,800.	TBQ <1	<1	<1	<1
Xylenes	7,910.	2.0	<1	<1	<1
MTBE	2,420.	8.8	6.8	<1	1.9

Ref. #:	96,794	96,795	96,796	96,797	
Site:	MW-2	MW-3	Duplicate	Jelly	
Date Sampled:	11/14/96	11/14/96	11/14/96	11/14/96	
Time Sampled:	14:33	14:26	NI	15:00	
Sampler:	B. Ross	B. Ross	B. Ross	B. Ross	
Date Analyzed:	11/17/96	11/17/96	11/19/96	11/17/96	
UIP Count:	>10	>10	10	0	
Dil. Factor (%):	0.5	10	10	100	
Surr % Rec. (%):	95	108	88	94	
Parameter	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	
Benzene	1,360.	95.7	145.	<1	
Chlorobenzene	<200	<10	<10	<1	
1,2-Dichlorobenzene	<200	<10	<10	<1	
1,3-Dichlorobenzene	<200	<10	<10	<1	
1,4-Dichlorobenzene	<200	<10	<10	<1	
Ethylbenzene	2,540.	<10	<10	<1	
Toluene	9,540.	TBQ <10	<10	<1	
Xylenes	6,850.	17.2	10.8	<1	
MTBE	2,840.	211.	13.3	<1	

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

ENDYNE, INC.

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

19935A

CHAIN-OF-CUSTODY RECORD

Project Name: Londonderry cats u96-093 Site Location: Londonderry VT	Reporting Address: Box C-5 one mill St Burlington, VT	Billing Address:
Endyne Project Number:	Company: Ground water of Vermont Contact Name/Phone #: B. Ross 860-6065	Sampler Name: B. Ross Phone #: 860-6065

Lab #	Sample Location	Matrix	GRAB	COMP	Date/Time	Sample Containers No.	Sample Containers Type/Size	Field Results/Remarks	Analysis Required	Sample Preservation	Rush
	Pl9th	water	X		11/14/96 1107	2	40ml s/less	Del. Sink	19	HCl	
	Abbott (Home)				1120			Kitchen	BTEX & MTBE		
	Gordon				1132			Kitchen			
	IGA well - Before				1152			Basement			
	IGA well - After				1155			Del. Sink			
	main well - mid				1225			Hard wire Basement			
	Main well - After				1230			" "			
	Main well - Before				1235			" "			
	Duplicate				—			—			
	Center Service				1305			Garage faucet			
	Merrill				1312			Kitchen faucet			
	Egan	water	X		1327			Kitchen faucet		HCl	

Relinquished by: Signature	Received by: Signature	Date/Time 11/15/96 1105
Relinquished by: Signature	Received by: Signature	Date/Time 11/15/96 11:30

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):										

ENDYNE, INC.

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

19935 B

CHAIN-OF-CUSTODY RECORD

Project Name: Londonderry Citgo VT96-093 Site Location: Londonderry, VT	Reporting Address: Box C-5 1 mill St Burlington, VT	Billing Address:
Endyne Project Number:	Company: Ground water of VT Contact Name/Phone #: B. Ross 860 6065	Sampler Name: B. Ross Phone #: 860 -6065

Lab #	Sample Location	Matrix	GRAB	COMP	Date/Time	Sample Containers No.	Sample Containers Type/Size	Field Results/Remarks	Analysis Required	Sample Preservation	Rush
	mw-1	water	X		11/14/96 1420	2	glass/40ml		19	HCl	
	mw-2		X		1433	2		slight odor	BTEX + MTBE	HCl	
	mw-3		X		1426	2				HCl	
	Duplicate	water	X		—	2	glass/40ml			HCl	
	Jelly	water	X		1500	2	" "			ACl	

Relinquished by: Signature	Received by: Signature	Date/Time 11/15/96 1105
Relinquished by: Signature	Received by: Signature	Date/Time 11/15/96 11:30

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):										

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

19935 C

CHAIN-OF-CUSTODY RECORD

Project Name: Londonderry, Citgo V96-093	Reporting Address: Box C-5 One Mill St Burlington, VT	Billing Address:
Site Location: Londonderry Center		
Endyne Project Number: GWVT1025	Company: Groundwater of Vermont	Sampler Name: B. Ross
	Contact Name/Phone #: BRoss 860-6065	Phone #: 860-6065

Lab #	Sample Location	Matrix	GRAB	COMP	Date/Time	Sample Containers No.	Sample Containers Type/Size	Field Results/Remarks	Analysis Required	Sample Preservation	Rush
96,769	Trip blank	water	X		11/14/96 0550	2	glass/40ml	BTEX + MTBE	19	HCl	
96,770	Thorne-Thomsen Before				0900	2		slight odor			
96,771	Thorne-Thomsen mid				0905	2					
96,772	Thorne-Thomsen After				0910	2		Kitchen			
96,773	church				0925	2		Kitchen			
96,774	Rowley				0935	2		Kitchen			
96,775	Church Stone				0950	2		Kitchen			
96,776	Junker				1002	2		Kitchen			
96,777	Galpin				1017	2		Kitchen			
96,778	Rogers				1035	2		Kitchen			
96,779	P.O. Building				1050	2		Bathroom			
96,780	Allen		X		1100	2		outside faucet	19	HCl	

Relinquished by: Signature	Received by: Signature	Date/Time	11/15/96 1105
Relinquished by: Signature	Received by: Signature Roseann Bacon	Date/Time	11/15/96 1130

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):										