



FINAL
SOIL GAS SURVEY ADDENDUM TO THE
PHASE I REMEDIAL INVESTIGATION
DOVER MUNICIPAL WELL #4 SITE
DOVER, NEW JERSEY

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1.0 INTRODUCTION

TRC Environmental Consultants, Inc. (TRC) was contracted by the New Jersey Department of Environmental Protection and Energy (NJDEPE) to conduct a soil gas investigation at Dover, New Jersey in the vicinity of Dover Municipal Well Number 4 (DMW #4). The soil gas survey was conducted as a follow-up or addendum to TRC's Phase I Remedial Investigation/Feasibility Study of DMW #4 as part of contract number A614096. The soil gas survey was implemented as a screening method to identify the subsurface presence of chlorinated hydrocarbon compounds which may act as potential sources of contamination for DMW #4. A description of the program, including procedures, results and recommendations, follows.

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2.0 SITE BACKGROUND

Dover Municipal Well Number 4 (DMW #4) is located in the Town of Dover, New Jersey, situated in the Rockaway River valley (Figure 1). Drilled in 1962, it commenced pumping in June 1965, and was one of the town's primary water-supply wells. DMW #4 was shut down in September 1980, after ground water sampling identified concentrations of total volatile organic compounds (VOCs), specifically chlorinated solvents, in excess of 250 parts per billion (ppb). Subsequent subsurface investigations at two industrial facilities in the vicinity of DMW #4, Howmet Turbine (Howmet) and New Jersey Natural Gas (NJNG), determined that soil and ground water contamination were present at each of these sites and each of these industries were named potentially responsible parties (PRPs).

Site investigations related to the RI/FS at Dover Municipal Well #4 were conducted by TRC between June 24, 1987 and December 17, 1987, and during May 15-17, 1989. The purposes of these investigations were: to determine the nature and extent of contamination, to assess whether the identified PRPs were the source of the contamination of DMW #4 and to determine if other sources of contamination exist. The site investigations included: surface and borehole geophysics, test borings, installation of shallow, intermediate and deep monitoring wells, subsurface soil sampling, a 9-day pumping test, and three rounds of ground water sampling. Surface and borehole geophysics and test borings were used to obtain geologic information. Monitoring wells were installed and the pumping test conducted to collect hydrogeologic information. Samples were collected to provide soil and water quality data.

The data generated in the Phase I study yielded the following interpretation: Although both of the PRPs, Howmet and NJNG, have documented contamination problems on their sites, neither appeared to be responsible for the chlorinated solvent contamination of DMW #4. The Howmet site is beyond

the zone of capture for DMW #4. NJNG is within the zone of capture, but did not have chlorinated solvents on its site. The NJNG site may pose a potential threat to DMW #4 from the migration of other contaminants should pumping of DMW #4 ever resume.

The data generated from the Phase I field activities were not sufficient to identify the specific source of contamination to DMW #4. The original list of 54 commercial/industrial sites identified in the Task 1 Background Investigation as potential users of chlorinated solvents was decreased to 50 sites on the basis of Phase I data. Chlorinated hydrocarbon compounds such as 1,1,1-TCA, TCE and PCE are typically used in solvents, degreasing compounds, dry cleaning fluids, manufacturing printing inks and paint removers, textile processing and other related applications. The list of sites was divided into 27 high-priority and 23 low-priority sites, based on the nature of their operations, as well as an interpretation of the ground water flow patterns and contaminant distribution based on Phase I information. Although the data indicated a source of PCE to the north of DMW #4 as well as a source of 1,1,1-TCA somewhere to the south, further field activities were recommended to more precisely locate the contaminant sources. A final report titled "Phase I Sampling Report of the Dover Municipal Well #4 Site in Dover, New Jersey Final Technical Report" was submitted in September 1990.

At the conclusion of Phase I activities TRC prepared a Phase II work plan which included recommendations for a soil gas survey to screen the sites and to determine likely source areas. The NJDEPE elected to proceed with the soil gas survey as an addendum to Phase I activities. The list of sites was reduced to 22, as some sites were eliminated from consideration based on their locations, analytical results from Phase I ground water samples, ground water flow directions and additional background information.

3.0 SOIL GAS SURVEY

A soil gas survey was conducted to aid in the further identification of potential sources of chlorinated hydrocarbon contamination within the influence of DMW #4. The soil gas survey technique utilizes on-site gas chromatography to detect and quantify trace levels of volatile organic compounds present within the interstitial pore spaces of soil. Under suitable site conditions, volatile compounds will diffuse upwards from the underlying soil and ground water and can be evaluated by soil gas survey methodology.

3.1 Objectives

The objectives of the soil gas survey were to identify sources of subsurface chlorinated hydrocarbons at specific sites within the influence of DMW #4, and to provide data to guide subsequent investigative efforts, including the selection of test boring and monitoring well locations. The soil gas survey would be useful in screening sites for contamination in the shallow aquifer which could result from surficial spillage, disposal or improper storage of chlorinated hydrocarbons.

3.2 Approach

Based on the results of the Phase I Remedial Investigation (TRC, September 1990), a total of 50 industrial/commercial sites were identified as having some potential for using chlorinated compounds in their site operations. These 50 sites were subsequently reduced to a list of 29 sites (Table 1), on the basis of Phase I hydrogeologic and contaminant distribution data. MKT Geotechnical, Inc. (TRC Site Number 5), Emerson Quiet Kool (Site 9), Polyfil Corporation (Site 31), L.O. Koven and Brother (Site 32) and Rockaway Tank, Inc. (Site 45) were then eliminated from the soil gas study due to the

availability of current analytical soil and ground water data for these sites (Section 5.0). Landice Converttech (Site 27) received an Environmental Cleanup Responsibility Act (ECRA) negative declaration and is adjacent to study Site 26, so was therefore removed from the study. Highland Products (Site 1) was not included in the soil gas study because the NJDEPE could not gain legal access to the property. A map of the remaining 22 study site locations is presented as Figure 2.

3.2.1 Site Markout

Prior to the initiation of the soil gas survey, utility services were contacted to locate underground utility lines at each of the 22 study sites. The New Jersey Utility Markout Service was contacted on June 12, 1991 for the regional utilities operated by New Jersey Bell, New Jersey Central Power and Light, and New Jersey Natural Gas. Additional arrangements were made with the Dover Engineering Department, Dover Water Commission and Rockaway Valley Sewerage Authority for local service markout.

Once underground utilities were marked out, arrangements were made with the 22 property owners or tenants to walk over each site. Sites were visited between June 19 and 25 and on July 5 and 9, 1991. Site walkovers permitted the following: verification of underground utility markout completion; examination of site features and potential restrictions on accessibility to portions of the site; selection of soil gas sampling point locations; and the obtainment of information regarding additional underground hazards (unmarked site utilities, underground storage tanks, etc.) and past and current site operations.

3.2.2 Soil Gas Sampling Point Locations

A total of one to seven soil gas sampling points were located at each of the 22 study sites. Three to four survey points were selected at most sites.

Legal access restrictions at Creative Coachworks (26) and Steve's Service Center (4) limited the survey to one point at these sites. The selection of sampling point locations was based on the anticipated shallow ground water flow direction (based on topography and results of the Phase I Investigation), location of DMW #4 relative to the site, site orientation, adjacent site operations, information on site-specific activities, and site-specific features such as soil staining, stressed vegetation and the presence of backfill material. When locating soil gas points, an effort was made at each site to adequately cover all regions of the site and to provide a sampling point hydraulically upgradient from site operations. Rationale for the selection of the number and location of soil gas sampling points at each of the study sites is provided in Table 2. A map of sampling point locations is provided as Figure 3, and individual site sketch maps are presented in Appendix A.

3.3 Procedures

The soil gas investigation was conducted by Tracer Research Corporation, under the oversight of TRC, between June 25 and July 10, 1991 at 22 properties within the area of influence of DMW #4. Soil gas survey methodology employs on-site gas chromatography to detect and quantify trace levels of volatile organic compounds in the subsurface environment. The method involves pumping a small volume of soil gas out of the ground through a hollow probe driven into the ground, and analyzing the gas for the presence of volatile organic compounds (VOC)s. The presence of VOCs in the shallow soil gas indicates that the observed compounds may either be in the ground water below the probe or in the overlying vadose zone. Soil gas technology is most effective in mapping low molecular weight halogenated solvent compounds and petroleum hydrocarbon compounds possessing high vapor pressures and low aqueous solubilities. These

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compounds readily partition out of the ground water and into the soil gas as a result of their high gas/liquid partitioning coefficients. Once in the soil gas, VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. Generally, the contaminated soil or ground water acts as a source and the above ground atmosphere acts as a sink. The concentration gradient in soil gas between the source and ground surface may be locally distorted by hydrologic and geologic anomalies (e.g. clays, perched water, underground tanks); however, soil gas mapping generally remains effective because distribution of the contamination is usually broader in areal extent than the local geologic barriers. Specific procedures employed during the soil gas survey are presented in the following sections.

3.3.1 Sampling Equipment

A one-ton Ford van equipped with a hydraulic mechanism consisting of two cylinders and a set of jaws was used to drive and withdraw the probes at each of the soil gas sampling locations. A hydraulic hammer mechanism was used to assist in driving the probes past cobbles and through unusually hard soil. The van contained the analytical equipment, and was also equipped with two built-in gasoline-powered generators to provide electrical power (110 volts AC) for the operation of the analytical instruments and field equipment.

Sampling probes consisted of seven- to 14-foot lengths of 3/4-inch diameter steel pipe that were fitted with detachable drive tips. Soil gas probes were advanced to the water table and then withdrawn approximately six inches. Where sampling locations were inaccessible to the van, probes were driven by hand. Probe depths ranged between two and 9.5 feet below grade. Once inserted into the ground, the above-ground end of the sampling probe was fitted with a steel reducer and polyethylene tubing connected to a vacuum

pump. Gas flow was monitored by a vacuum gauge to insure that a proper vacuum (which affects flow rate) was obtained, ranging from two to five inches of mercury.

To adequately purge the volume of air within the probe, two to five liters of gas were evacuated with the vacuum pump. Once purging was complete, samples were collected from the air stream by inserting a syringe needle through a silicone rubber segment in the evacuation line and into the steel probe. Ten milliliters of gas were collected for immediate analysis in the analytical field van. Soil gas was subsampled (duplicate injections) in volumes ranging from 1 ul to 2 ml, depending on the VOC concentration at any particular location.

3.3.2 Analytical Procedures

Soil gas samples were analyzed with a Varian 300 gas chromatograph (GC), equipped with an electron capture detector (ECD). A 6-foot by 1/8-inch packed column was used with OV-101 as a stationary phase in a temperature-controlled oven. Nitrogen was used as the carrier gas.

Each of the soil gas samples was analyzed for the five chlorinated hydrocarbons (halocarbons) of interest: 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), 1,1,1-trichloroethane (1,1,1-TCA or TCA), trichloroethene (TCE) and tetrachloroethene (PCE). Halocarbon compounds detected in the samples were identified by chromatographic retention time. Quantification of compounds was achieved by comparison of the detector response of the sample with the response measured for calibration standards (external standardization). Detection limits for the compounds of interest were a function of the injection volume as well as detector sensitivity for individual compounds. Generally, the larger the injection size the greater

the sensitivity. However, peaks for compounds of interest were kept within the linear range of the analytical equipment. If a relatively high concentration of a compound was detected, it was necessary to use small injections, and in some cases to dilute the sample to keep it within linear range. Importantly, this may cause decreased detection limits for other compounds in the sample analysis.

In general, the detection limits for the halocarbon compounds were approximately 0.0004 ug/l. Detection limits were dependent upon the conditions of the measurement, particularly the sample size. If any component being analyzed was not detected, the detection limit for that compound in that analysis was given a "less than" value (e.g. <0.01 ug/l). Detection limits obtained from GC analyses were calculated from the current response factor, the sample size, and the estimated minimum peak size (area) that would have been visible under the conditions of the measurement.

The detection limits for 1,1-DCA were recalculated during data QA/QC evaluations. The minimum area detectable under the field conditions was larger than calculated in the field. This resulted in final data showing a higher detection limit for 1,1-DCA for all of the samples analyzed.

Ambient air samples were collected during the course of the investigation to help evaluate the level of significance for the selected VOCs. The level of significance was defined as the level above which concentrations are considered to be significant in terms of ground water or soil contamination. Detected concentrations of TCA in ambient air samples ranged from 0.0008 to 0.02 ug/l, and that of PCE ranged from 0.00007 to 0.3 ug/l. 1,1-DCA, 1,1-DCE and TCE were not detected in any of the ambient air samples. The level of significance for each target compound was based on several factors, including concentration in the ambient air, background level and method detection

limit. Based on the evaluation of these factors, the level of significance for the selected target compounds was determined by the soil gas survey contractor to be approximately 0.1 ug/l. In other words, soil gas concentrations of 1,1-DCE, 1,1-DCA, TCA, TCE and PCE exceeding 0.1 ug/l are likely to indicate subsurface VOC contamination in the vicinity of the sampling probe. However, because the PCE concentrations in the ambient air samples collected at Sites 20 and 22 were somewhat higher than 0.1 ug/l (0.3 and 0.2 ug/l, respectively), these concentrations may reflect more accurate levels of significance at these locations.

3.3.3 Quality Assurance/Quality Control Program

A strict quality assurance/quality control (QA/QC) program was followed in order to prevent any cross-contamination of soil gas samples and to ensure reproducible results. The procedures described below are modified slightly from those presented in Tracer's report, and accurately reflect the field QA/QC program:

- Steel probes were used only once during the day and then washed with high pressure soap and hot water spray or steam-cleaned to eliminate the possibility of cross-contamination. Enough probes were carried on each van to avoid the need to reuse any during the day.
- Probe adaptors, designed to eliminate the possibility of exposing the sample stream to any part of the adaptor, were used to connect the sample probe to the vacuum pump. Associated tubing connecting the adaptor to the vacuum pump was replaced periodically as needed during the job to insure cleanliness and a secure fit. At the end of each day of sampling the adaptor was cleaned with soap and water and baked in the GC oven prior to reuse.
- Silicone tubing, which acts as a septum for the syringe needle, was replaced as needed to insure proper sealing around the syringe needle. This tubing does not directly contact soil gas samples.
- Glass syringes were generally used for only one sample per day and are washed and baked out at night. If they were used more than once, they were purged with carrier gas (nitrogen) and baked out between probe samplings.

- Injector port septa through which soil gas samples were injected into the chromatograph were replaced on a daily basis to prevent possible gas leaks from the chromatographic column.
- Analytical instruments were calibrated at the beginning and end of each day by analytical standards from Chem Service, Inc. Calibration checks were also run after approximately every five soil gas sampling points.
- Subsampling syringes were checked for contamination on a periodic basis by injecting nitrogen carrier gas into the gas chromatograph.
- Prior to sampling each site, system blanks were run to check the sampling apparatus (probe, adaptor, 10 cc syringe) for contamination by drawing ambient air from above ground through the sampling system and comparing the analysis to a concurrently sampled local air analysis.
- Duplicate samples, collected from the same sampling probe, were collected every ten soil gas samples to ensure data reproducibility.
- All sampling and subsampling syringes were decontaminated each day and no such equipment was reused before being decontaminated each day. Microliter size subsampling syringes were reused only after a nitrogen carrier gas blank was run to insure it was not contaminated by the previous sample.
- The soil gas pumping rate was monitored by a vacuum gauge to insure that a suitable gas flow from the vadose zone was maintained. A soil gas sample was obtained if the vacuum gauge reading was between two and five inches of mercury.

4.0 RESULTS

A total of 86 soil gas samples were collected and analyzed from the 22 sites in the area of DMW #4. Originally over 90 sampling points were planned but legal access problems forced reduction in the number of points allowed at some sites. Each sample was analyzed on-site for the compounds 1,1-DCA, 1,1-DCE, 1,1,1-TCA, TCE, and PCE. A summary of analytical results is presented in Table 3 and locations of the sampling points are shown in Figure 3. A more complete analytical data summary, which includes local air blanks and specific detection limits, is provided in Appendix B.

4.1 Site-Specific Results

The compounds 1,1-DCA and 1,1-DCE were absent from most of the soil gas samples obtained from the DMW #4 sites. 1,1-DCA was detected in only one sample (40A) and 1,1-DCE was detected in only four samples (4A, 15A, 21C and 47D). Neither of these compounds was detected above the designated level of significance of 0.1 ug/l in any of the samples analyzed.

The compounds 1,1,1-TCA, TCE and PCE were identified at thirteen study sites above the level of significance of 0.1 ug/l. Of these thirteen sites, five contained soil gas levels of these compounds which met or exceeded ten times the level of significance. These sites included: Consolidated Metals Corporation (Site No. 2), Ed Doll's Dry Cleaners (Site 20), Walt's Auto Radiator (Site 21), Creative Coachworks (Site 26) and H & W Tool Company (Site 47). A summary of the soil gas survey results is provided below.

Consolidated Metals Corporation (Site 2) contained a moderately high soil gas concentration of TCE (21 ug/l) at point 2F and a moderately high concentration of TCA (16 ug/l) at point 2G. Soil gas point 2F was located near a side doorway where a drum storage area and stained soils were noted.

Point 2G was located at the southeast corner of the site. The five remaining points (2A, 2B, 2C, 2D and 2E) were at or below the level of significance for all compounds analyzed for. Based on the local topography, the shallow ground water is likely to flow towards the northeast. No topographically upgradient locations from points 2F and 2G were sampled. A site map showing sampling point concentrations is presented as Figure 4.

Ed Doll's Dry Cleaners (Site 20) contained a relatively high soil gas concentration of PCE (3700 ug/l) at sampling point 20B and somewhat lesser PCE levels (5 to 33 ug/l) at points 20A, 20C and 20D. TCE was also identified at sampling point 20B, at a level of 2 ug/l. Although the hydraulically upgradient sample (point 20A) at this site also contained PCE, the upgradient site, Johnson Oil Company (Site 19) did not contain significant levels. A site map showing sampling point concentrations is presented as Figure 5.

Walt's Auto Radiator (Site 21), located adjacent to Ed Doll's Dry Cleaner, contained a soil gas concentration of PCE (7 ug/l) at point 21B. Sampling point 21B was located adjacent to point 20B at Ed Doll's Dry Cleaner, where a high concentration of PCE (3700 ug/l) was detected. The remaining sampling points (21A, 21C and 21D) contained only trace levels of PCE (0.1 to 0.4 ug/l). A trace level of TCE (0.6 ug/l) was identified at the upgradient point, 21B. A site map showing sampling point concentrations is presented in Figure 5.

Creative Coachworks (Site 26) contained a moderately low soil gas concentration of 1,1,1-TCA (1 ug/l) at the single sampling point 26A. This point was located adjacent to the area where solvent drums may have been stored in the past and where impacted soils have been removed (J.C. Anderson

Associates, 1989). No other compounds of interest were detected above the level of significance at this sampling location. A site map showing sampling point concentrations is presented as Figure 6.

H & W Tool Company (Site 47) contained a moderate level of 1,1,1-TCA (8 ug/l) in the soil gas at point 47C, located along Richards Avenue on the north side of the study site. However, 1,1,1-TCA was only present in trace concentrations (0.002 to 0.01 ug/l) at points 47A and 47D, located hydraulically downgradient from point 47C. This would suggest that the 1,1,1-TCA impact is localized in the are of point 47D and is relatively small in nature. None of the other compounds of interest were detected above the level of significance at this study site. A map showing sampling point concentrations is presented as Figure 7.

The eight other sites where halocarbons were detected in the soil gas at concentrations above the level of significance are: Steve's Service Center (Site 4), Axel's (Roger Coss) Auto Body (Site 12), Instant Printing (Site 15), Regional/Spartan Oil (Site 17), Dover Body & Fender (Site 22), Prestige (Jay Lyon's) Auto Body (Site 24), Kenvil Auto Body (Site 28) and Tinny's Auto Body (Site 42). At all eight locations, the highest concentration reported was less than 1 ug/l.

The one soil gas sampling point installed at Steve's Service Center was located upgradient from site operations. Based on the lack of soil gas data for the other areas of the site, it is not known whether the trace level of PCE (0.1 ug/l) is from site activities or from an off-site area.

Axel's Auto Body, Region/Spartan Oil, Dover Body & Fender and Tinny's Auto Body sites all contained soil gas points where trace levels of chlorinated hydrocarbons were detected downgradient from site operations. Although

upgradient sampling points provided relatively clean background levels at Axel's Auto Body and Region/Spartan Oil suggesting that the sources may originated from the sites, it appears that both sites are sufficiently covered with soil gas points to rule out the presence of significant site sources. Dover Body & Fender and Tinny's Auto Body both lack upgradient points to verify whether compounds originate from on or off site.

Likewise, at Instant Printing, Prestige Auto Body and Kenvil Auto Body, it is not clear whether the source of trace soil gas levels is from on or off site. The local ground water flow direction at Instant Printing is not readily discernible; therefore it is not clear whether Point B, where trace levels of TCA and PCE were identified, is downgradient from the site.

Although Prestige Auto Body contained trace levels of PCE at Point C, Point E installed adjacent to Point C and Point A located somewhat downgradient, did not contain significant PCE levels. This would suggest that the PCE at Prestige Auto Body is limited to a relatively small area.

Kenvil Auto Body contained trace levels of TCA and PCE in the northeast portion of the site. Because Point B, located directly downgradient from site operations in that portion of the site did not contain significant levels, the source of PCE appears to be either limited to a small area or located off site.

4.2 Area-Wide Results

A total of five of the study site properties located within the DMW #4 site contained soil gas concentrations which met or exceeded ten times the designated level of significance for the compounds of interest. Eight other sites had one or more sample points which showed halocarbon concentrations between the level of significance and ten times the level of significance. Figure 8 shows the distribution of sampling points with sample concentrations

above the level of significance. Although the total number of sampling points and sampling pattern was not designed to delineate a large shallow plume, if present, the pattern of positive results does not appear to indicate a widespread halocarbon plume in the shallow ground water. Elevated soil gas levels appear to be confined primarily to individual sites. The reasons for this may include: 1) the soil gas does not migrate far from the impacted area; 2) the degree of subsurface contamination is relatively small and is confined primarily to the vadose zone soils with little impact to the underlying ground water; or 3) ground water contamination does not extend far from the locally impacted area in the shallow aquifer, due to hydraulic advection and dispersion, biological degradation, chemical adsorption, sinking of the relatively dense compounds to the bottom of the shallow aquifer, or vertical transport to deeper aquifer(s). It should also be noted that upgradient soil gas sampling points were not available for all impacted sites; this would indicate that the sites: Consolidated Metals Corporation (Site 2), Creative Coachworks (Site 26) and H & W Tool Company (Site 47) may not act as actual contaminant sources.

The highest levels of PCE detected at the DMW #4 site were identified at Ed Doll's Dry Cleaners (Site 20) located to the northwest of DMW #4, and the highest levels of 1,1,1-TCA were identified at Consolidated Metals Corporation (Site 2) located to the southwest of DMW #4. This would be consistent with the conclusions of TRC's Phase I investigation, which indicated a source of PCE to the north and 1,1,1-TCA somewhere to the south of DMW #4. Based on the information available at this time, however, it is not known whether the compounds have impacted the ground water at these sites or whether other sites identified by the soil gas survey may also act as contaminant sources within the influence of DMW #4.

5.0 REVIEW OF ADDITIONAL DATA

The NJDEP provided to TRC the results of site-specific sampling and site investigation programs conducted at five area sites, including: UltraPoly/Polyfil/Jan Packaging, Inc.; Emerson Quiet Kool; L.O. Koven & Brother; Rockaway Tank, Inc.; and MKT Corporation, Inc. TRC has reviewed the information and provides the following comments.

Ultra Poly Corporation/Polyfil Corporation/Jan Packaging, Inc. (Site 31)

The report consisted of a negative declaration prepared by a consulting firm (Geo Engineering, Inc.) to satisfy Environmental Cleanup Responsibility Act (ECRA) requirements titled, "Final Report and Negative Declaration Affidavit Ultra Poly Corporation ECRA Case No. 87732, Polyfil Corporation ECRA Case No. 87734, Jan Packaging, Inc. ECRA Case No 88132, 55-75 Harrison Street, Dover, New Jersey". Nine specific areas were investigated. These areas included non-contact cooling water discharge points, catch basin and concrete slab, areas of stained soil (4), floor drain, fuel oil tanks and gasoline tanks. In addition, a limited ground water investigation of the site was conducted. The non-contact cooling water discharge, floor drain and ground water investigations all included sampling and analysis for volatile organic compounds (VOCs). The investigation of other areas focussed primarily on petroleum hydrocarbons and base/neutral load extractables.

The investigation of the cooling water discharge points consisted of the collection of soil samples from two locations. The report states that at one location all targeted analytical results were below ECRA guidelines. (The results for the VOC analysis of the sample from the second location were presented in an earlier report and were not recapitulated in the final report.)

Soil samples collected as part of Phase II investigation of the floor drain discharge were subjected to VOC analysis. All analytical results were reportedly below ECRA action levels.

The ground water investigation consisted of the installation of six shallow monitoring wells. Five monitoring wells were located downgradient of fuel oil tanks (2), gasoline tanks (2) and the floor drain outlet (1), and one well was located upgradient. No significant concentrations of chlorinated hydrocarbons were reportedly detected.

Emerson Quiet Kool (Site 9)

An extensive quantity of data was provided to document ECRA site investigations performed at Emerson Quiet Kool, consisting of a two-volume report proposed by the Berger Consulting Group that included a proposed ground water sampling plan. Four areas of the on-site investigation addressed areas of potential interest to the DMW #4 study: solvent USTs, piping and pump pads; septic system, paint room area and solvent tank fills. The results are summarized below.

- The solvents stored in the USTs were petroleum or mineral-spirit based solvents. However, one sample of soil from below the pump pad floor contained tetrachloroethylene and 1,1,1-trichloroethene.
- Several subsurface samples from the septic tank area contained VOCs, primarily petroleum hydrocarbons (benzene, toluene, xylenes, and ethylbenzene).
- No detectable concentrations of VOCs were reported in the soil samples from the paint room area.
- The VOCs detected near the solvent fill pipes were primarily xylenes.

A ground water sampling plan was included for future implementation. Six wells are proposed for installation at the site. The ground water sampling plan includes analysis of soil and water samples for VOCs.

L.O. Koven & Brother (Site 32)

The information provided on the L.O. Koven & Brother (L.O. Koven) site included a Discharge Investigation and Corrective Action Report (DICAR) prepared by Envirosciences, Inc., for Case Number 89-07-21-1516 dated November 30, 1989. The DICAR addressed the spillage/discharge of approximately five gallons of #2 fuel oil.

The monitoring actions included the collection of soil samples from the tank grave and the installation and sampling of one ground water monitoring well. The ground water analysis included VOCs and no chlorinated hydrocarbons were detected.

Rockaway Tank, Inc. (Site 45)

A limited amount of information was provided on the Rockaway Tank site consisting of a well location/site map, a summary of ground water level elevations in on-site monitoring wells, a summary of ground water sample analytical data, and an ECRA case summary.

The map indicates that four monitoring wells were installed on-site. In conjunction with the water level elevations provided, ground water flow to the south is suggested. The ground water analytical results were not complete, but suggested that toluene was the only VOC detected.

MKT Corporation (Site 5)

The information provided on MKT Corporation (MKT) included analytical data and two ground water contour maps. The maps indicated the presence of eight monitoring wells, although only seven are numbered and used for contouring purposes. These wells are located downgradient of some on-site operations; the remainder appear to be hydraulically upgradient of site operations. [It

should be noted that the direction of the shallow ground water gradient presented in the information is away from, rather than toward the Rockaway River, as would be expected. The data should be carefully reviewed for this and for the location of any ground water withdrawal points in the area.] There are no wells located downgradient of the entire facility, presumably because the building line and property line are at Richards Avenue. Trace concentrations of chlorinated hydrocarbons (including TCA, TCE and PCE) were reported in ground water samples from most locations.

Summary

Review of data from the five site investigation reports do not indicate what appear to be any large source of chlorinated hydrocarbons to the environment. Chlorinated hydrocarbons were detected at the Emerson Quiet Kool (soil) and MKT Corporation (ground water) sites, and trace concentrations may have been present on the Ultra Poly/Polyfil/Jan Packaging site, but specific results were not provided.

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6.0 SUMMARY AND CONCLUSIONS

Review of the soil gas survey and available background information provides the following conclusions:

- The soil gas survey examined 22 sites and detected chlorinated hydrocarbons in samples at 13 sites at concentrations at or above the level of significance.
- The sites of primary interest on the basis of soil gas survey results are Consolidated Metals Corporation (2), Ed Doll's Dry Cleaners (20), Creative Coachworks (26) and H & W Tool Company (47). The highest concentrations were observed in samples from the Ed Doll's Dry Cleaner site.
- Soil gas sampling was not permitted on the Highland Products (1) site and was restricted on the Steve's Service Center (4) and Creative Coachworks (26) sites. Positive results were obtained in one sample at the Creative Coachworks site. However, due to restrictions at Steve's Service Center which did not permit free selection of a sampling point, and denial of access to Highland Products, these sites cannot be ruled out as possible sources at this time.
- Reports and information were provided and reviewed for environmental investigations at five area sites. Chlorinated hydrocarbons were reportedly detected at two sites, in soil at Emerson Quiet Kool (9) and in ground water at MKT Corporation (5). Follow up work at the Emerson Quiet Kool site will include a ground water investigation. The results of this investigation should be thoroughly reviewed. The MKT report should be reexamined for completeness and accuracy.

7.0 RECOMMENDATIONS

The work performed as part of this addendum to Phase I and the file research performed by NJDEP has reduced the list of sites to six, thereby accomplishing the primary objective of the proposed Phase II Stage 1 activities. Four of the six sites are locations where soil gas readings equalled or exceeded the level of significance of the survey and where further investigation is recommended: Consolidated Metals Corporation (2), Ed Doll's Dry Cleaner (20), Creative Coachworks (26) and H & W Tool Company (47). [One sample point on Walt's Radiator (21) was above the level of significance but, at this time, this is attributed to the high results at the adjacent Ed Doll's Dry Cleaner (20)]. Two other sites, Highland Products (1) and Steve's Service Center (4), remain under consideration, as free access to survey these properties was not granted by the owners.

Soil gas samples from the Ed Doll's Dry Cleaner site (20) showed the highest halocarbon concentrations and, as a result, should be given a high priority for additional site investigation and possible source removal. The five other sites fall into two groups: those where halocarbons were detected in soil gas (Consolidated Metals, Creative Coachworks and H&W Tool) and those where site access was denied or restricted (Steve's Service Center and Highland Products).

Two other sites not sampled during the soil gas survey, MKT Corporation and Emerson Quiet Kool, are currently undergoing site investigations to comply with other NJDEPE regulatory programs. Data from both sites showed the presence of traces of chlorinated solvents.

If sources of chlorinated solvents are confirmed at these sites in the future, remediation would most likely be performed on a site-by-site basis. General aquifer remediation within the capture zone of DMW #4 by withdrawal and treatment of ground water from the existing DMW #4 will be the focus of the Feasibility Study.

8.0 REFERENCES

- Burger Consulting Group, Inc., December 1990, Remedial Investigation Report: Completion of Excavation of "Conditionally" Approved Sampling Plan Involving Investigative Sampling, Soil Excavation and Post-Excavation Soil Sampling at: Emerson Quiet Kool Division, 88 King Street, Dover, New Jersey, 54 p. + attachments.
- Environmental Consultants Research Analytical Laboratories, Inc., November 1989, Analytical Data Report for Enviro-Sciences, Inc., L.O. Koven, 108 p.
- Environmental Waste Management Associates, 1990, unknown title, MKT Corporation incomplete report.
- Enviro-Sciences, Inc., 1987, unknown title, Rockaway Tank, Inc., incomplete report.
- Enviro-Sciences, Inc., November 1989, Discharge Investigation and Corrective Action Report, L.O. Koven and Brother, 58 Harding Avenue, Dover, New Jersey, 6 p. + attachments.
- GeoEngineering, Inc., June 1989, Final Report and Negative Declaration Affidavit, Ultra Poly Corporation ECRA Case No. 87732, Polyfil Corporation ECRA Case No. 88132 and Jan Packaging, Inc. ECRA Case No. 88132, 55-75 Harrison Street, Dover, New Jersey, 36 p.
- J.C. Anderson Associates, Inc., 1989-1990, Unknown title, Creative Coachworks, incomplete report.
- Shakti Consultants, Inc., December 1990, Phase 2: Site Investigation Ground Water Sampling Plan, Emerson Quiet Kool, 30 p.
- TRC Environmental Consultants, Inc., Sept. 1990, Final Phase I Remedial Investigation Report of the Dover Municipal Well #4 Site, Dover, New Jersey, 172 p.

TABLE 1
 COMMERCIAL/INDUSTRIAL SITES NEAR DMW #4
 WITH RELATIVELY HIGH PROBABILITY OF
 USING CHLORINATED HYDROCARBONS

DOVER MUNICIPAL WELL #4 RI/FS
 DOVER, NEW JERSEY

I.D. Number	Block #/ Lot #	Name of Business	Nature of Current Site Operations
1*	1329/7A	Highland Products	mfg. plastic products
2	1214/12,14, 21,22,23	Consolidated Metals Corp.	mfg. stainless steel pipe
4	1904/29	Steve's Service Center	auto body repair
5*	1904/33	MKT Geotechnical, Inc.	abandoned factory
9*	2020/5	Emerson Quiet Kool	metal stamping
12	2029/18	Axel's (Roger Coss) Auto Body	auto body repair
14	1904/12	Lambert's Auto Collision	auto body repair
15	1904/9A	Instant Printing	offset printing
16	2023/2,3,8	Artic Waters Radiators	radiator servicing
17	1904/50	Regional/Spartan Oil	heating oil
19	2308/1	Johnson Oil Co.	heating oil
20	2310/8A	Ed Doll's Dry Cleaner	dry cleaning
21	2310/10	Walt's Auto Radiator	radiator servicing
22	2310/14,15	Dover Body & Fender	auto body repair
23	2315/6	Johnny's Auto Body	auto body repair
24	2315/24	Prestige (Jay Lyon's) Auto Body	auto body repair
26	2316/1	Creative Coachworks	auto body repair
27*	2316/1	Landice Converttech	treadmills
28	2201/7	Kenvil Auto Body	auto body repair
31*	2204/7	Polyfil Corp.	additives
32*	2204/4A	L.O. Koven & Brother, Inc.	steel fabricators
37	2318/1	Neptune Products	unknown
39	2310/24	Carlson's Auto Repair	auto body repair
40	2310/27	Dover Offset Printing	offset printing
42	2303/11	Tinny's Auto Body	auto body repair
45*	10202/29	Rockaway Tank, Inc.	mfg. tanks & metal products
47	2313/9	H&W Tool Company	molds and dies
49	10202/36	Schroeder's Car Wash	car wash
50	10202/37	Best (Sunshine) Car Wash	car wash

*site was omitted from study

TABLE 2
SUMMARY OF SOIL GAS SAMPLING
POINT LOCATION RATIONALE

DOVER MUNICIPAL WELL #4
DOVER, NEW JERSEY

TRC Site No .	Business Name	Sampling Point Location Rationale
2	Consolidated Metals Corp.	Large site required 7 points. Point A in backfill material, Point B downgradient from office area, Point F near stained soils and drum storage area at side doorway, Point G at SE corner, remaining points along downgradient side of production building.
4	Steve's Service Center	Legal site access restrictions permitted only 1 point. Point A selected by owner in front of facility, upgradient from site operations.
12	Axel's Auto Body	Relatively small congested site permitted 3 points. Point A near USTs, Point B in SW portion of site, Point C near abandoned cars in rear, upgradient from site operations.
14	Lambert's Auto Collision	3 points due to limited site access. Point A likely upgradient from site, Points B and C near storage shed in rear.
15	Instant Printing	Large accessible site permitted 5 points. Point A upgradient from much of site, Point C near side alley, Points B, D and E downgradient from site.
16	Artic Waters Radiator	4 points sampled. Point A upgradient from site, Points B, C and D downgradient from site, Point D near stained soil.

TABLE 2
(continued)
SUMMARY OF SOIL GAS SAMPLING
POINT LOCATION RATIONALE

DOVER, NEW JERSEY

TRC Site No.	Business Name	Sampling Point Location Rationale
17	Regional/Spartan Oil	Large accessible site permitted 5 points. Point A upgradient from site, Point B in NE portion of site, Point C downgradient from storage tank area, Point D near drum storage, Point E near adjacent scrap metal yard property.
19	Johnson Oil Co.	4 points sampled. Points A and B downgradient from site, Point C downgradient from former radioactive spill at property to NW, Point D near USTs, upgradient from building.
20	Ed Doll's Drycleaner	4 points sampled. Point A upgradient from site, Point B located near possible former drum storage, Point C located in fill, Point D located near rear doorway.
21	Walt's Auto Radiator	4 points sampled. Point A upgradient from site, Point B near high soil gas levels at site 20, Point C near former waste oil tank, Point D downgradient from site.
22	Dover Body and Fender	4 points sampled. Point A upgradient from site, Point B downgradient from facilities across street, Points C and D downgradient from site.
23	Johnny's Auto Body	4 points sampled. Point A upgradient from site, Point B near scrap metal pile on adjacent property, Point C downgradient from site operations, Point D near shed where solvents stored in past.

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TABLE 2
(continued)
SUMMARY OF SOIL GAS SAMPLING
POINT LOCATION RATIONALE

DOVER, NEW JERSEY

TRC Site No.	Business Name	Sampling Point Location Rationale
24	Prestige Auto Body	Large site permitted 5 points. Point A downgradient from shop, Point B near drum storage area, points C, D and E near old cars and near scrap metal yard on adjacent property.
26	Creative Coachworks	Legal site access restrictions permitted only 1 point. Point A located in rear near possible former solvent drum storage and former impacted soils.
28	Kenvil Auto Body	5 points installed. Point A in NE portion of site, Points B, C and D downgradient from site, Point C near drums and trash cans, Point D near rear storage sheds, Point E upgradient from Point A where soil gas levels detected.
37	Neptune Products	4 points installed. Points A, B and C near abandoned field and woods, Point B near stressed vegetation, Point D upgradient from site, near production building.
39	Carlson's Auto Repair	Small congested site permitted 3 points. Points A, B and C near site operations.
40	Dover Offset Printing	Small site with limited access permitted 2 points. Point A downgradient from drum storage areas, Point B near shop.
42	Tinny's Auto Body	Large site required 6 points. Point A near drum/scrap metal storage, Point F near abandoned UST, remaining points located along downgradient side of site.

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TABLE 2
(continued)
SUMMARY OF SOIL GAS SAMPLING
POINT LOCATION RATIONALE

DOVER, NEW JERSEY

TRC Site No.	Business Name	Sampling Point Location Rationale
47	H & W Tool Company	4 points installed. Point A near side entranceway and solvent storage area, Point B at NE portion of site, Point C upgradient, Point D at SW corner of site.
49	Schroeder's Car Wash	3 points installed. Point A in eastern portion of site, Point B downgradient from site, Point C located near storage shed upgradient from site.
50	Best Car Wash	5 points installed. Point A upgradient from site, Point B in NE portion of site, Points C and D located near woods and discarded drums, Point E downgradient from gas company lot across street.

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2143

TABLE 3
SOIL GAS SURVEY RESULTS
DOVER, NEW JERSEY

TRC SITE No.	BUSINESS NAME	SAMPLE ID #	SAMPLE DEPTH (ftbg)	COMPOUND CONCENTRATION				
				1,1-DCA (ug/l)	1,1-DCE (ug/l)	1,1,1-TCA (ug/l)	TCE (ug/l)	PCE (ug/l)
2	Consolidated Metals Corp.	Ambient	NA	--	--	0.0007	--	--
		2A	3.5	--	--	0.002	--	0.0008
		2B	5.0	--	--	0.07	--	0.006
		2C	4.0	--	--	0.05	0.1	0.06
		2D	4.0	--	--	0.02	0.01	0.02
		2E	4.0	--	--	0.01	0.1	0.002
		2F	4.0	--	--	0.05	21	0.05
		2G	4.0	--	--	18	--	0.02
4	Steve's Service Center	Ambient	NA	--	--	0.001	--	--
		4A	4.0	--	0.05	0.007	0.02	0.1
12	Axel's (Roger Coss) Auto Body	Ambient	NA	--	--	0.009	--	--
		12A	4.5	--	--	0.04	0.03	0.2
		12B-1	2.0	--	--	0.004	0.008	0.04
		12B-2	2.5	--	--	0.005	0.008	0.05
		12C	3.5	--	--	0.008	--	0.004
14	Lambert's Auto Collision	Ambient	NA	--	--	0.004	--	0.0009
		14A	3.0	--	--	0.0003	0.004	0.005
		14B	2.5	--	--	0.009	--	0.002
		14C	2.5	--	--	0.002	--	0.002
15	Instant Printing	15A-1	4.0	--	0.03	0.01	0.02	0.003
		15A-2	4.0	--	0.05	0.01	--	0.0023
		15B	4.0	--	--	0.2	0.001	0.2
		15C	4.5	--	--	0.005	--	0.005
		15D	4.0	--	--	0.009	--	0.02
		15E	4.0	--	--	0.007	--	0.02
16	Artic Waters Radiators	Ambient	NA	--	--	0.004	--	--
		16A	9.5	--	--	0.01	--	0.09
		16B	5.5	--	--	0.002	--	0.0007
		16C	5.5	--	--	0.003	--	--
		16D	5.5	--	--	0.003	--	0.002
17	Regional/Spartan Oil	17A	4.0	--	--	0.006	--	0.002
		17B	3.5	--	--	0.002	--	0.004
		17C	3.5	--	--	0.1	0.005	0.003
		17D	3.0	--	--	0.04	0.008	0.2
		17E	4.5	--	--	0.004	0.01	0.02
18	Johnson Oil Co.	Ambient	NA	--	--	0.0009	--	0.0007
		18A	4.0	--	--	0.004	--	--
		18B	5.0	--	--	0.003	--	0.06
		18C	4.0	--	--	0.003	--	0.06
		18D	4.5	--	--	0.002	--	0.003

ftbg = Feet Below Grade

"--" = Compound was not detected. Detection limit varied between 0.0004 and 0.2 ug/l.

D = Compound was identified below method detection limit.

* = Interference from adjacent peaks.

1,2 = Duplicate samples.

ug/l = micrograms per liter

NA = Not Applicable

**TABLE 3 (continued)
SOIL GAS SURVEY RESULTS
DOVER, NEW JERSEY**

TRC SITE No.	BUSINESS NAME	SAMPLE ID #	SAMPLE DEPTH (ftbg)	COMPOUND CONCENTRATION				
				1,1-DCA (ug/l)	1,1-DCE (ug/l)	1,1,1-TCA (ug/l)	TCE (ug/l)	PCE (ug/l)
20	Ed Doll's Dry Cleaner	Ambient	NA	---	---	0.002	---	0.3
		20A-1	5.0	---	---	0.009	0.02	10
		20A-2	5.0	---	---	0.004	0.02	5
		20B	5.0	---	---	0.09	2	3700
		20C	5.0	---	---	D	0.2	33
		20D	5.0	---	---	0.004	0.05	11
21	Walt's Auto Radiator	Ambient	NA	---	---	0.0004	---	0.01
		Ambient	NA	---	---	---	---	---
		21A	4.0	---	---	0.09	0.6	0.2
		21B	5.0	---	---	0.06	0.02	7
		21C	4.0	---	0.07	0.008	0.01	0.4
		21D	4.0	---	---	0.04	---	0.1
22	Dover Body & Fender	Ambient	NA	---	---	0.01	---	0.2
		22A	5.0	---	---	0.01	---	0.07
		22B	4.5	---	---	0.2	---	0.7
		22C	4.0	---	---	0.005	---	0.03
		22D	5.0	---	---	0.2	---	0.04
23	Johnny's Auto Body	23A	4.0	---	---	0.001	---	0.001
		23B	4.0	---	---	0.0009	---	0.01
		23C	4.0	---	---	0.03	0.002	0.005
		23D	4.0	---	---	0.01	---	0.03
24	Prestige (Jay Lyon's) Auto Body	Ambient	NA	---	---	0.001	---	0.007
		24A	4.0	---	---	0.02	---	0.001
		24B	4.5	---	---	0.002	---	0.004
		24C	2.0	---	---	0.09	0.05	0.3
		24D	5.0	---	---	0.008	0.001	0.002
		24E	4.5	---	---	0.002	---	0.0007
26	Creative Coachworks	Ambient	NA	---	---	---	---	---
		26A	4.0	---	---	1	---	0.01
28	Kenvil Auto Body	Ambient	NA	---	---	0.02	---	0.004
		Ambient	NA	---	---	0.003	---	---
		28A	4.5	---	---	0.3	---	0.5
		28B	4.5	---	---	0.02	---	0.003
		28C	5.0	---	---	0.008	---	---
		28D	5.0	---	---	0.01	---	0.003
37	Neptune Products	Ambient	NA	---	---	0.001	---	---
		37A	5.0	---	---	0.05	---	---
		37B	4.0	---	---	---	---	---
		37C	3.5	---	---	---	---	---
		37D	5.0	---	---	0.03	---	0.006

ftbg = Feet Below Grade

"--" = Compound was not detected. Detection limit varied between 0.0004 and 0.2 ug/l.

D = Compound was identified below method detection limit.

* = Interference from adjacent peaks.

1,2 = Duplicate samples.

ug/l = micrograms per liter

NA = Not Applicable

TABLE 3 (continued)
SOIL GAS SURVEY RESULTS
DOVER, NEW JERSEY

TRC SITE No.	BUSINESS NAME	SAMPLE ID #	SAMPLE DEPTH (ftbg)	COMPOUND CONCENTRATION				
				1,1-DCA (ug/l)	1,1-DCE (ug/l)	1,1,1-TCA (ug/l)	TCE (ug/l)	PCE (ug/l)
39	Carlson's Auto Repair	Ambient	NA	--	--	0.0008	--	0.004
		Ambient	NA	--	--	0.001	--	0.0004
		39A	3.5	--	--	0.002	--	0.006
		39B	2.0	--	--	0.003	--	0.001
		39C	2.0	--	--	0.0005	--	--
40	Dover Offset Printing	40A	4.5	--	--	0.002	--	--
		40B	3.5	0.02	--	0.001	0.002	0.001
42	Tinny's Auto Body	42A	5.0	--	--	0.004	--	0.009
		42B	5.0	--	--	0.005	--	0.004
		42C	4.0	--	--	0.01	--	0.008
		42D	4.0	--	--	0.006	0.006	0.1
		42E	5.0	--	--	0.007	--	0.2
		42F-1	5.0	--	--	0.003	--	0.03
		42F-2	5.0	--	--	0.005	--	0.05
47	H & W Tool Company	Ambient	NA	--	--	0.008	--	0.0007
		47A	2.0	--	--	0.002	0.0008	0.005
		47B	4.0	--	--	0.001	--	0.0005
		47C	4.0	--	--	^a	0.003	0.04
		47D	3.5	--	0.02	0.01	--	0.004
49	Schroeder's Car Wash	Ambient	NA	--	--	0.001	--	--
		49A	3.0	--	--	0.05	--	0.001
		49B	4.0	--	--	0.003	--	0.005
		49C	4.0	--	--	0.003	0.05	0.01
50	Best (Sunshine) Car Wash	Ambient	NA	--	--	0.001	--	--
		50A	4.0	--	--	0.001	--	0.006
		50B	4.0	--	--	0.004	0.0008	0.02
		50C	3.0	--	--	0.001	--	0.002
		50D	5.0	--	--	0.008	--	0.002
		50E	3.5	--	--	0.002	--	--

ftbg = Feet Below Grade

"--" = Compound was not detected. Detection limit varied between 0.0004 and 0.2 ug/l.

D = Compound was identified below method detection limit.

* = Interference from adjacent peaks.

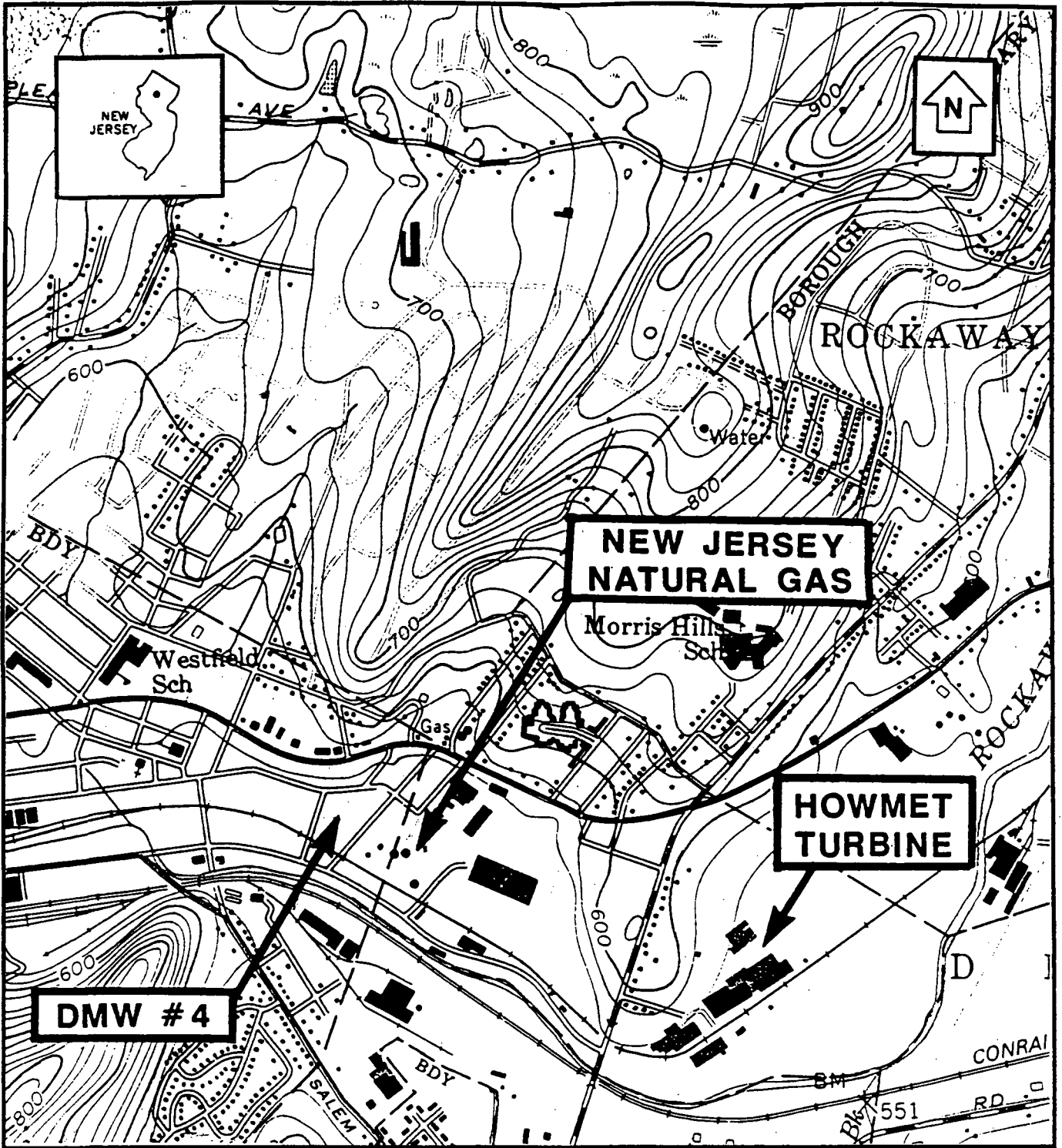
1,2 = Duplicate samples.

ug/l = micrograms per liter

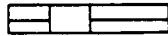
NA = Not Applicable

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2146

000 001 2147



0 1000 FT



SCALE

TRC

TRC Environmental Consultants, Inc.

5 Waterside Crossin.
Windsor, CT 06095
(203) 289-8631

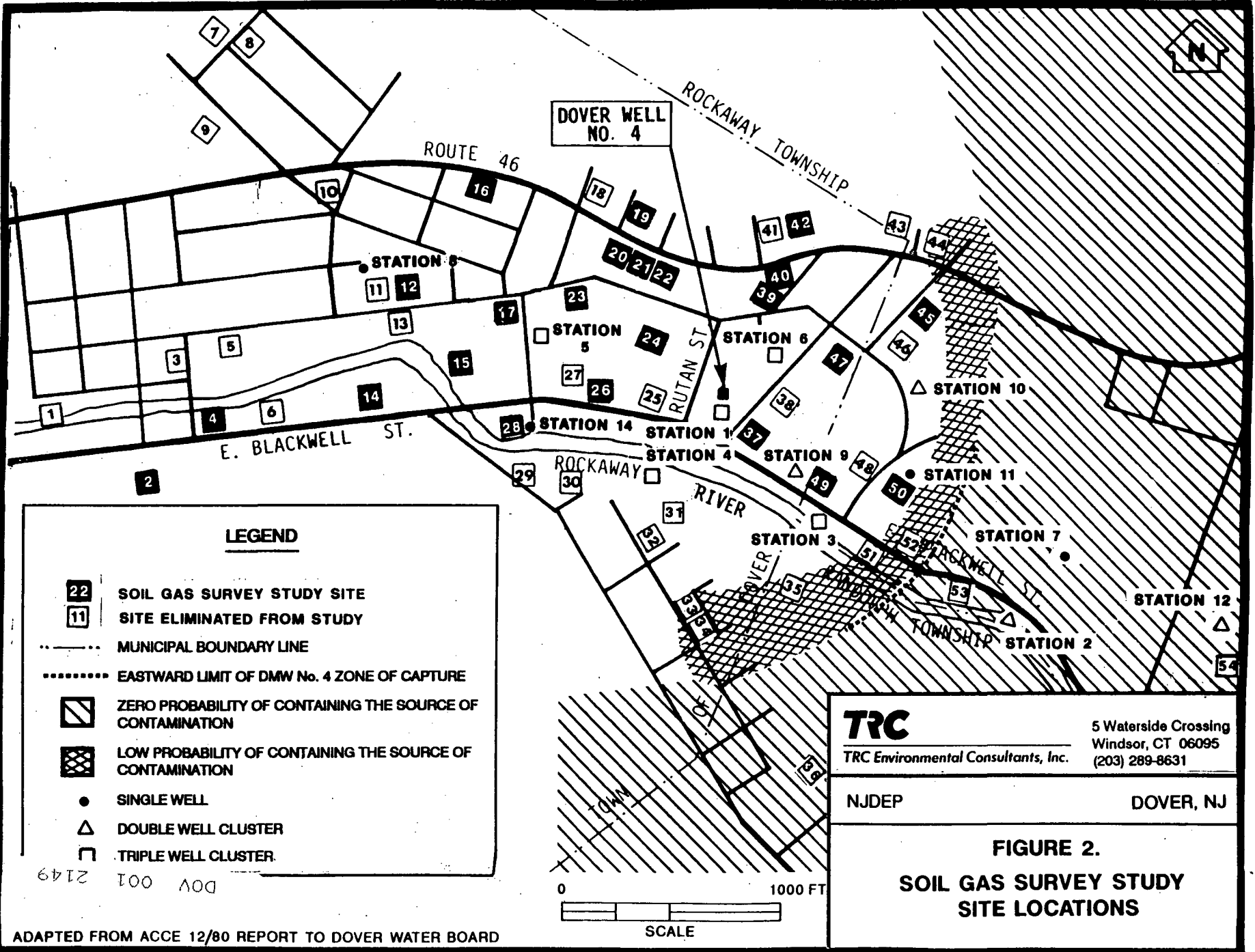
NJDEP

DOVER, N.

FIGURE 1.

DMW #4 SITE LOCATION

DOV 001 2148



LEGEND

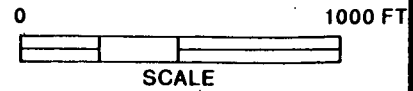
- 22 SOIL GAS SURVEY STUDY SITE
- 11 SITE ELIMINATED FROM STUDY
- MUNICIPAL BOUNDARY LINE
- EASTWARD LIMIT OF DMW No. 4 ZONE OF CAPTURE
- ZERO PROBABILITY OF CONTAINING THE SOURCE OF CONTAMINATION
- LOW PROBABILITY OF CONTAINING THE SOURCE OF CONTAMINATION
- SINGLE WELL
- △ DOUBLE WELL CLUSTER
- TRIPLE WELL CLUSTER

DOV 001 2149

TRC
 TRC Environmental Consultants, Inc.
 5 Waterside Crossing
 Windsor, CT 06095
 (203) 289-8631

NJDEP DOVER, NJ

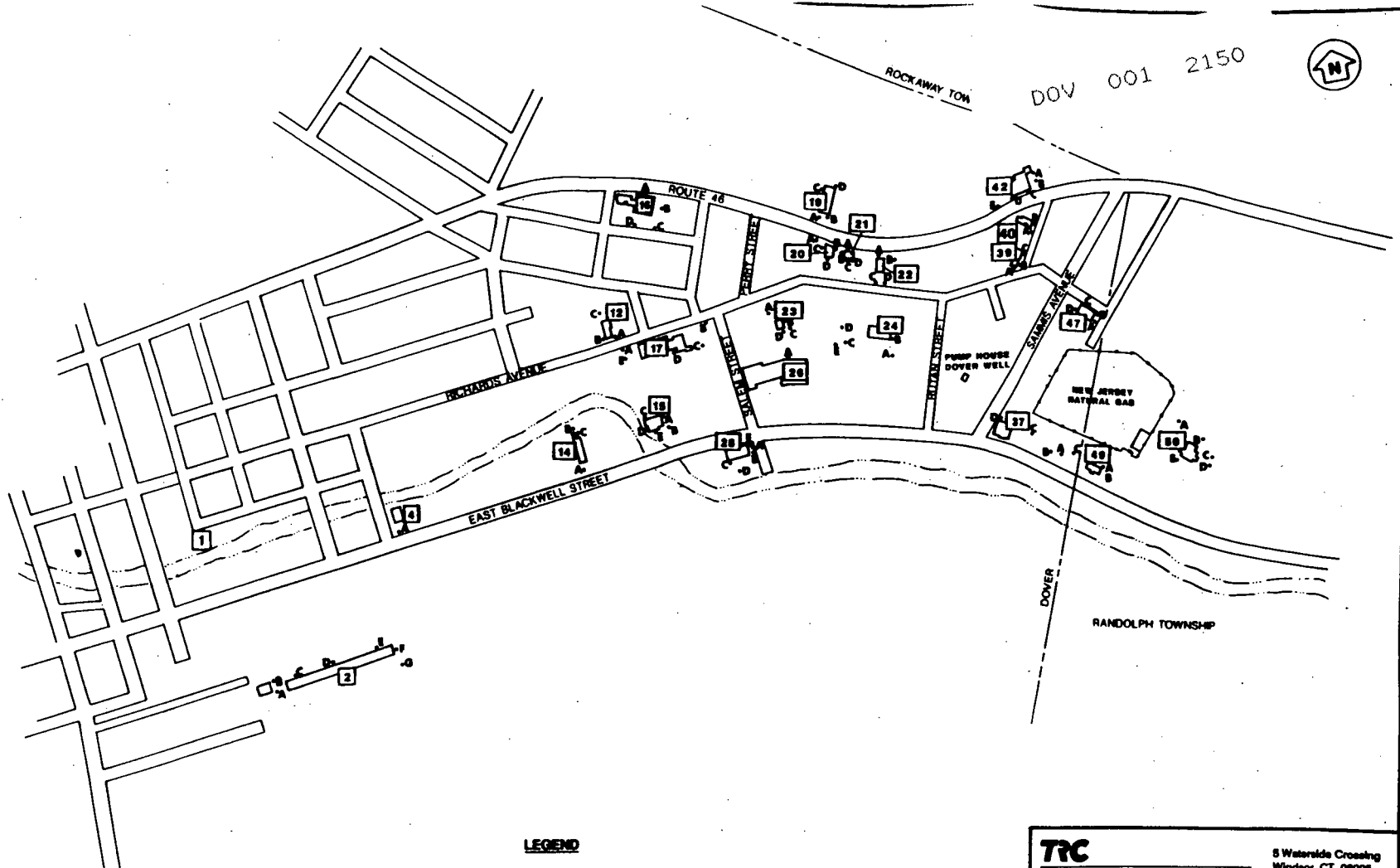
FIGURE 2.
SOIL GAS SURVEY STUDY
SITE LOCATIONS



ADAPTED FROM ACCE 12/80 REPORT TO DOVER WATER BOARD

ROCKAWAY TOWNSHIP

DOV 001 2150

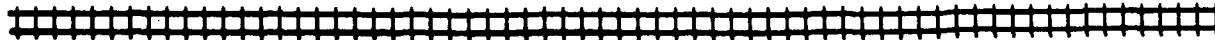


LEGEND

- 19 SOIL GAS SURVEY STUDY SITE
- BUILDING
- A* SOIL GAS SAMPLING POINT



TRC TRC Environmental Consultants, Inc.	5 Waterside Crossing Windsor, CT 06095 (203) 269-8631
NJDEPE	DOVER, NJ
FIGURE 3.	
SOIL GAS SAMPLING POINT LOCATIONS	

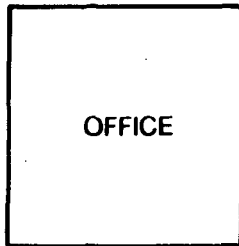


LACKAWANNA RR



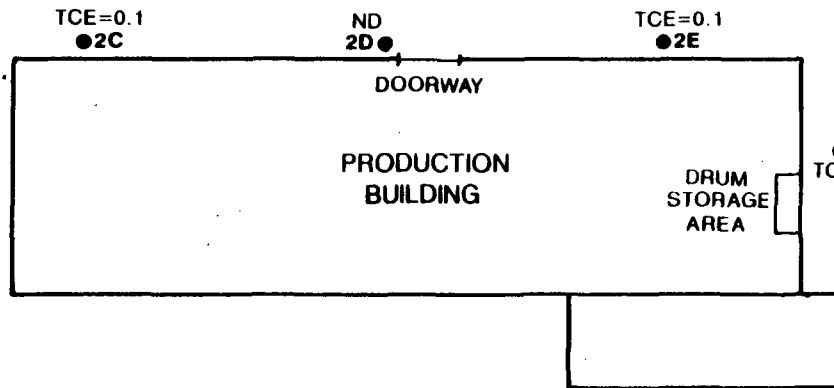
SOUTH DICKERSON ST

●2B
ND



OFFICE

●2A
ND



TCE=0.1
●2C

ND
●2D

TCE=0.1
●2E

DOORWAY

PRODUCTION
BUILDING

DRUM
STORAGE
AREA

●2F
TCE=21

●2G
TCA=16

LEGEND

●2A SOIL GAS SAMPLING POINT LOCATION
TCE=0.1 WITH COMPOUND CONCENTRATION ($\mu\text{g/l}$)

ND NO COMPOUNDS DETECTED ABOVE LEVEL
OF SIGNIFICANCE

NOT TO SCALE

TRC

TRC Environmental Consultants, Inc.

5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

NJDEP

DOVER, NJ

FIGURE 4.
CONSOLIDATED METALS (SITE 2)
COMPOUNDS DETECTED IN SOIL GAS
ABOVE LEVEL OF SIGNIFICANCE ($0.1\mu\text{g/l}$)

DOV 001 2151



ROUTE 46

●20A
PCE=7.5*

TCE=0.2
PCE=33
●20C

EMBANKMENT
(FILL)

ED DOLLS
DRY CLEANER

●20B
TCE=2
PCE=3700

REAR
DOOR

●20D
PCE=11

TCE=0.6
PCE=0.2
21A●

WALT'S AUTO
RADIATOR

DRIVEWAY

●21B
PCE=7

RETAINING WALL

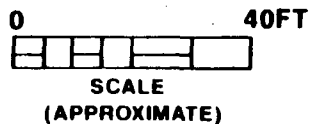
PCE=0.4●21C

●21D
PCE=0.1

LEGEND

●20D SOIL GAS SAMPLING POINT LOCATION
PCE=11 WITH COMPOUND CONCENTRATION (µg/l)

* VALUE IS AVERAGE OF TWO DUPLICATE SAMPLES



TRC

TRC Environmental Consultants, Inc.

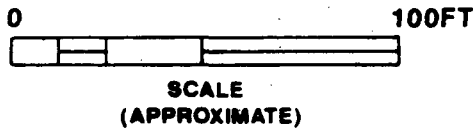
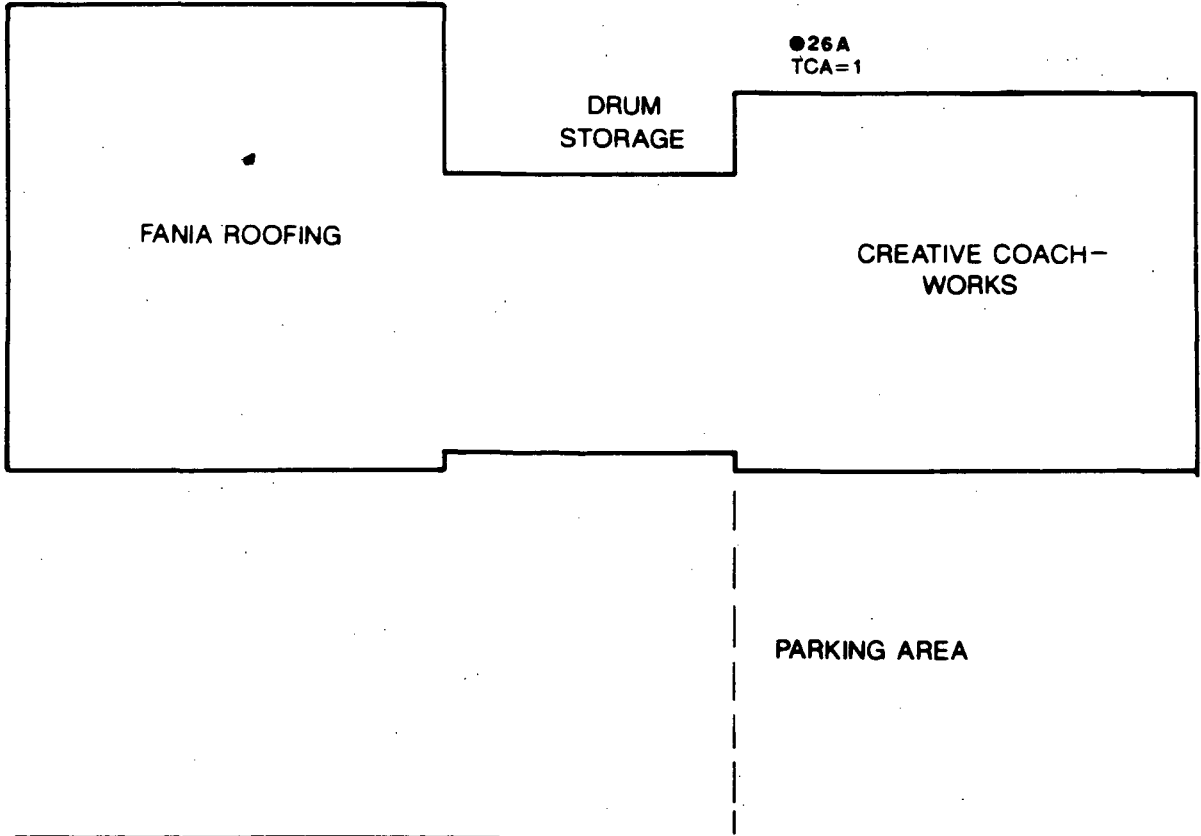
5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

NJDEP.

DOVER, NJ

FIGURE 5.

**ED DOLL'S DRY CLEANER (SITE 20)
AND WALT'S AUTO RADIATOR (SITE 21)
COMPOUNDS DETECTED IN SOIL GAS
ABOVE LEVEL OF SIGNIFICANCE (0.1 µg/l)**



BLACKWELL STREET

LEGEND

●26A SOIL GAS SAMPLING POINT LOCATION
TCA=1 WITH COMPOUND CONCENTRATION ($\mu\text{g}/\text{l}$)

SOURCE:
J.C. ANDERSON ASSOCIATES, INC., 1989

TRC

TRC Environmental Consultants, Inc.

5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

NJDEP

DOVER, N

FIGURE 6.
CREATIVE COACHWORKS (SITE 26)
COMPOUNDS DETECTED IN SOIL GAS
ABOVE LEVEL OF SIGNIFICANCE ($0.1 \mu\text{g}/\text{l}$)

DOV 001 2153



RICHARDS AVE

TCA=8 ●47C

●47B
ND

H&W TOOL
COMPANY

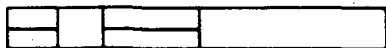
LEE ST

47D ●
ND

SIDE
DOOR
STEP

●47A
ND

0 50FT



SCALE
(APPROXIMATE)

LEGEND

●47C SOIL GAS SAMPLING POINT LOCATION
TCA=8 WITH COMPOUND CONCENTRATION (ug/l)

ND NO COMPOUNDS DETECTED ABOVE
LEVEL OF SIGNIFICANCE

TRC

TRC Environmental Consultants, Inc.

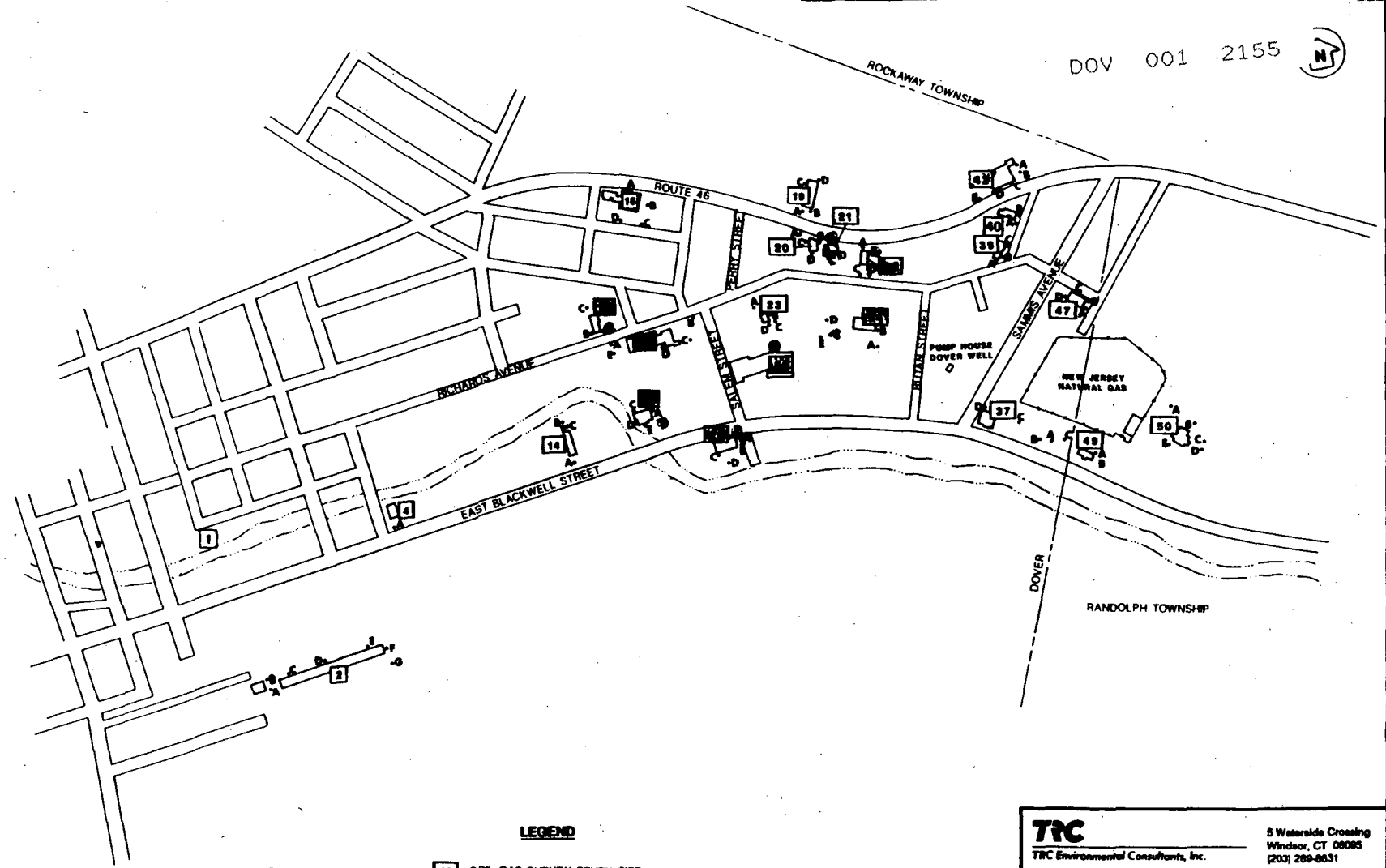
5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

NJDEP

DOVER, NJ

FIGURE 7.
H&W TOOL COMPANY (SITE 47)
COMPOUNDS DETECTED IN SOIL GAS
ABOVE LEVEL OF SIGNIFICANCE (0.1 ug/l)

DOV 001 2154



LEGEND

- 19 SOIL GAS SURVEY STUDY SITE
- BUILDING
- A• SOIL GAS SAMPLING POINT
- 4 OVER LEVEL OF SIGNIFICANCE
- 2 OVER 10x LEVEL OF SIGNIFICANCE



<p>TRC TRC Environmental Consultants, Inc.</p>	<p>5 Waterside Crossing Windsor, CT 06095 (203) 269-8631</p>
<p>NJDEP</p>	<p>DOVER, NJ</p>
<p>FIGURE 8. SOIL GAS SURVEY SITES EXCEEDING THE LEVEL OF SIGNIFICANCE (0.1ug/l)</p>	

DOV 001 2156

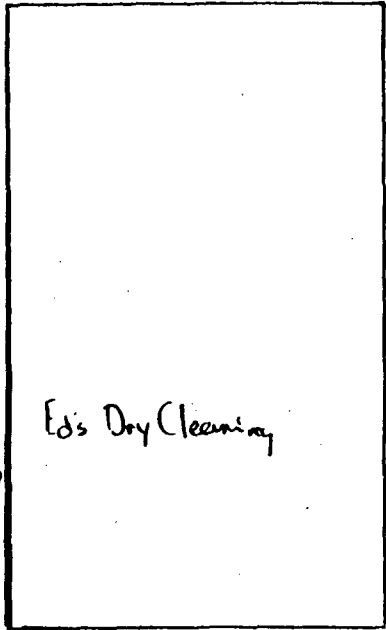
APPENDIX A
SOIL GAS SURVEY SITE SKETCH MAPS

Yard

Fence

SG-20D

Area 20



Ed's Dry Cleaning

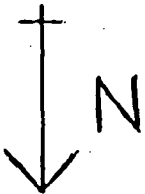
SG-20B

SG-20C

Used Cars (rusted = gravel lot)

Fence

SG-20A



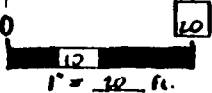
NOV 001 2158

R1.46

R1.46

R1.46

R1.46



12 ft.

Map Checklist

Date: 06/27/91

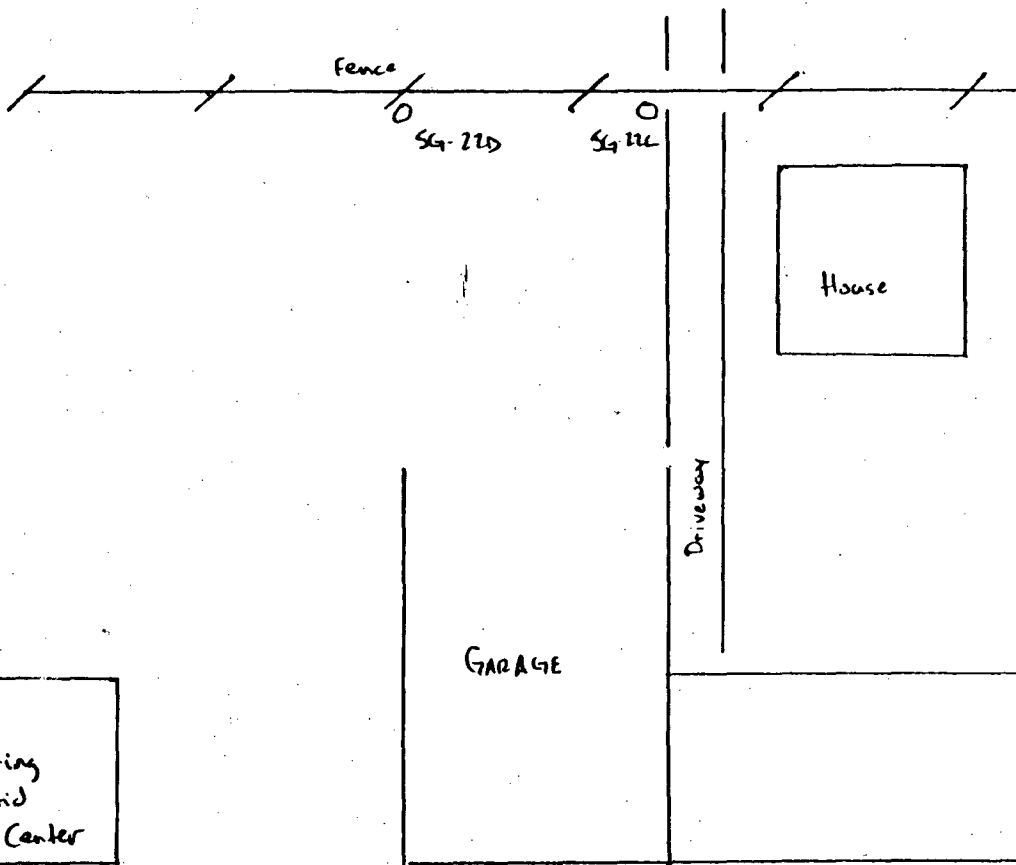
INS. #

2-41-0111-5

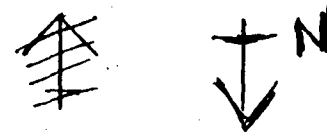
- | | | | |
|---|---|---|---|
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| <input checked="" type="checkbox"/> Tank Volume | <input type="checkbox"/> FILL Pipes | <input type="checkbox"/> Manifolds | <input checked="" type="checkbox"/> North Direction |
| <input checked="" type="checkbox"/> Tank Dims. | <input type="checkbox"/> Vent Pipes | <input type="checkbox"/> Dispensers | <input checked="" type="checkbox"/> Scale |
| <input checked="" type="checkbox"/> Product In Tank | <input type="checkbox"/> Piping Locations | <input type="checkbox"/> Monitoring Wells | <input type="checkbox"/> Other |
| <input checked="" type="checkbox"/> Tracer In Tank | <input type="checkbox"/> Spill Yards | <input type="checkbox"/> Ground Cover | |



Technician: Michael J. Gervasio
 Client: JRE Environmental Consultants
 Site Name: Deer, NJ
 City/State: Deer, N.J.



Area 22



curing
Acid
Center

GARAGE

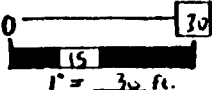
House

Driveway

SG-22B

DOV 001 2159

SG-22A



Rt. 46

Rt. 46

Date: 06/23/94 Rt. 46

TRC: 0017

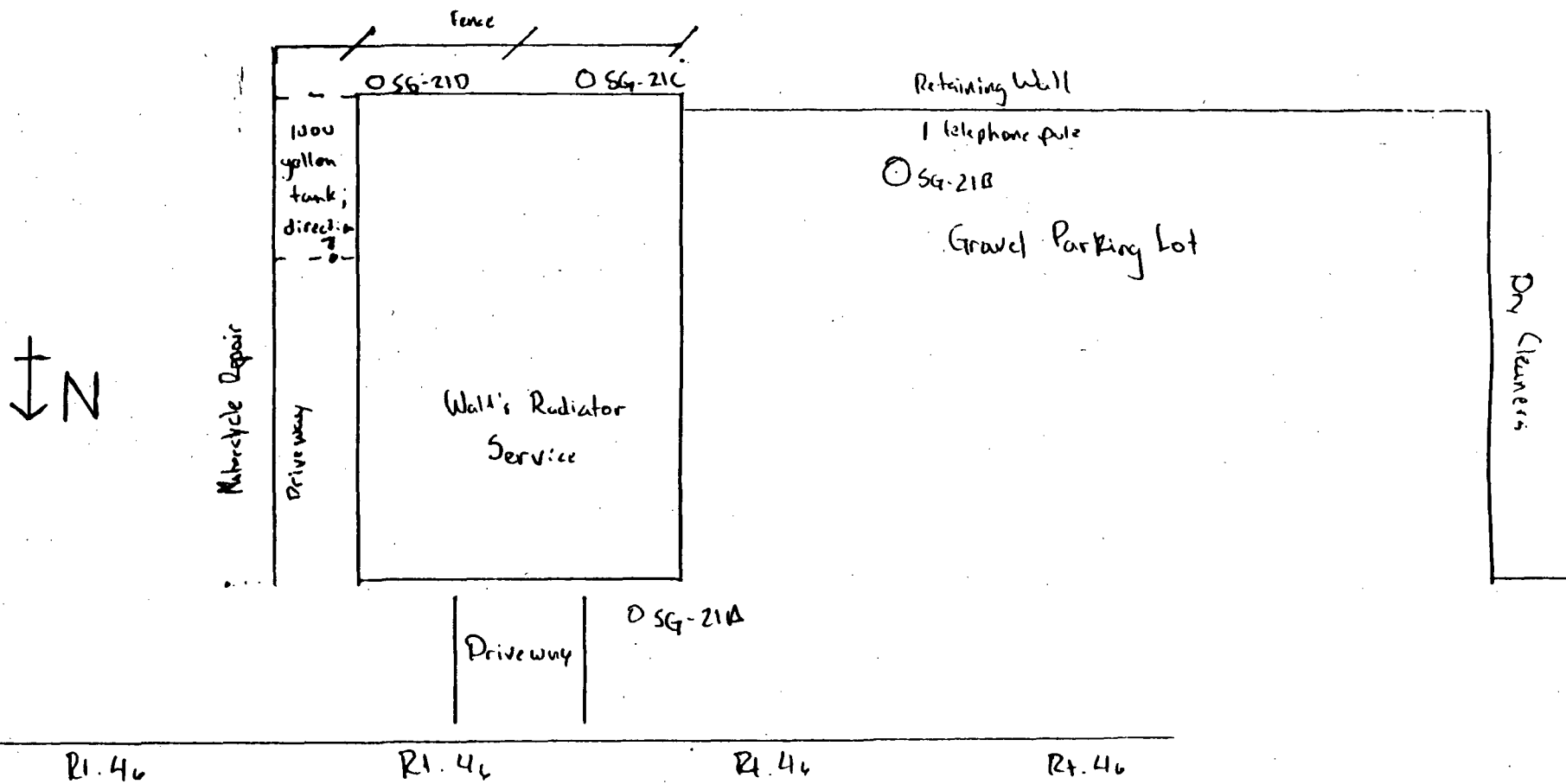
2-41-0117-5

Map Checklist			
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<input checked="" type="checkbox"/> Tank Volume	<input type="checkbox"/> Fill Pipes	<input type="checkbox"/> Manifolds	<input checked="" type="checkbox"/> North Direction
<input checked="" type="checkbox"/> Tank Dims.	<input type="checkbox"/> Vent Pipes	<input type="checkbox"/> Dispensers	<input checked="" type="checkbox"/> Scale
<input checked="" type="checkbox"/> Product in Tank	<input type="checkbox"/> Piping Locations	<input type="checkbox"/> Monitoring Wells	<input type="checkbox"/> Other
<input checked="" type="checkbox"/> Pressure in Tank	<input type="checkbox"/> Ground Water	<input type="checkbox"/> Other	

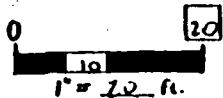


Technician: Michael J. Gervasio
 Client: TRC Environmental Consultants
 Site Name: Deer, Nj
 City/State: Deer, Nj

Area 21



0912 100 A00



Map Checklist

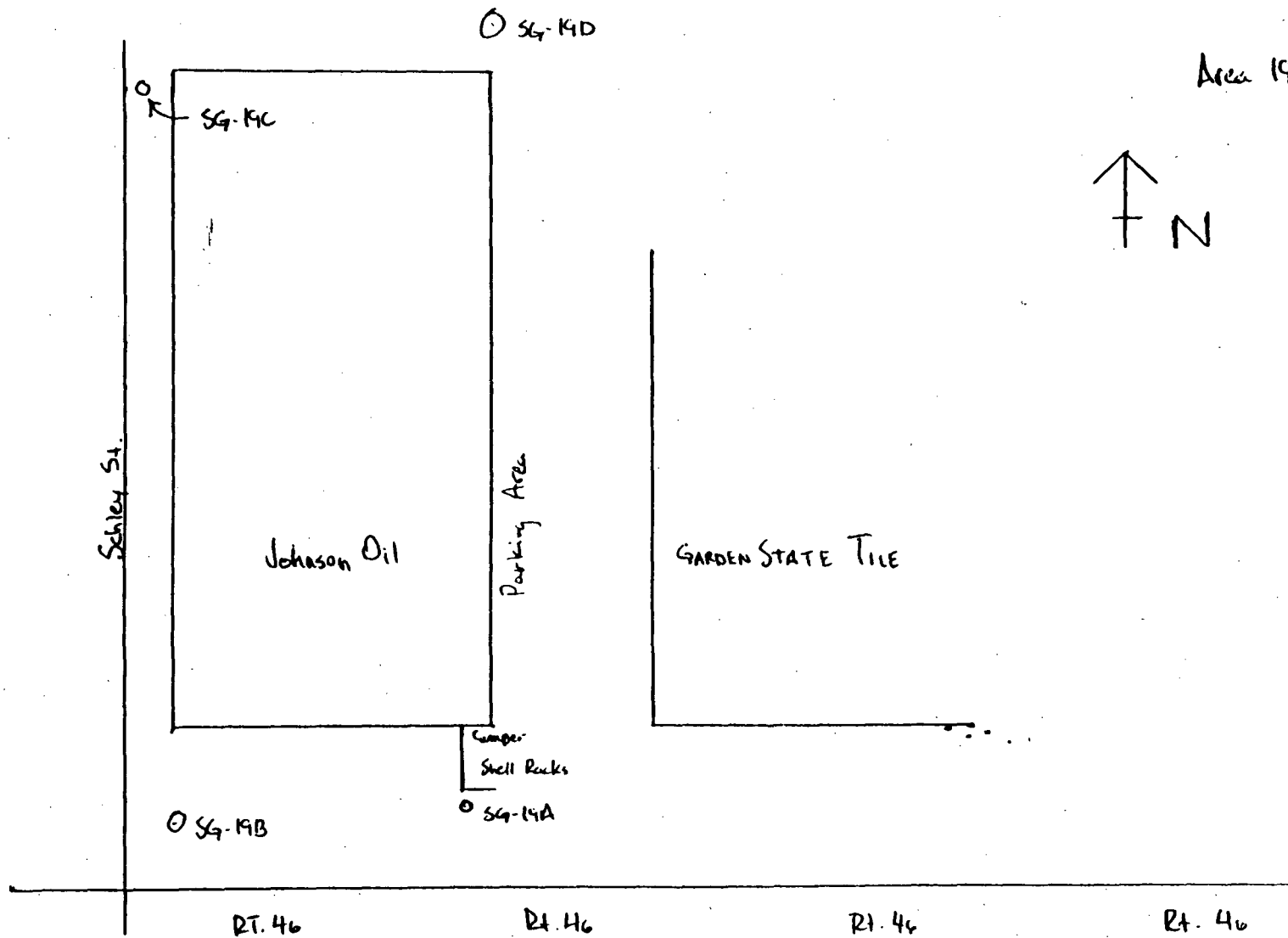
Date: 6/28/91

TRC JOB # []-[]-[]-[]-[]-[]

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|---|---|---|--|
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| <input checked="" type="checkbox"/> Tank Volume | <input type="checkbox"/> FILL Pipes | <input type="checkbox"/> Manifolds | <input checked="" type="checkbox"/> North Direction |
| <input checked="" type="checkbox"/> Tank Dims. | <input type="checkbox"/> Vent Pipes | <input type="checkbox"/> Dispensers | <input checked="" type="checkbox"/> Scale |
| <input checked="" type="checkbox"/> Product In Tank | <input type="checkbox"/> Piping Locations | <input type="checkbox"/> Monitoring Wells | <input checked="" type="checkbox"/> Other oil work |
| <input checked="" type="checkbox"/> Tracer In Tank | <input type="checkbox"/> Ground Cover | | |



Technician: _____
 Client: _____
 Site Name: _____
 City/State: _____



1912 100 100

0 15 30
1" = 30 ft.

Map Checklist

Date: 06/27/91

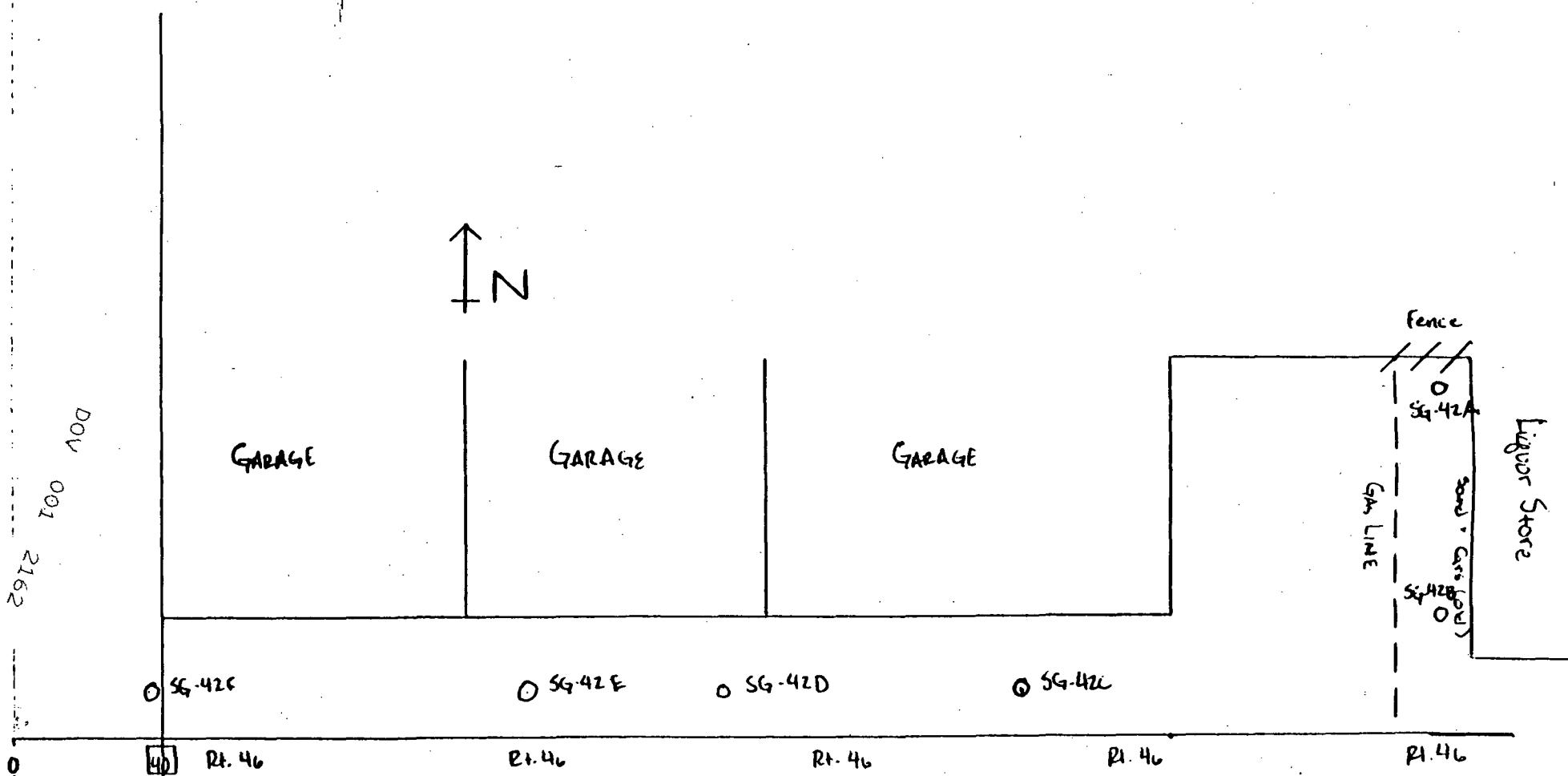
TRC JOB # 2-91-0117-5

- | | | | |
|--|---|---|--|
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| <input type="checkbox"/> Tank Volume | <input type="checkbox"/> FILL Pipes | <input type="checkbox"/> Manifolds | <input checked="" type="checkbox"/> North Direction |
| <input type="checkbox"/> Tank Dims. | <input type="checkbox"/> Vent Pipes | <input type="checkbox"/> Dispensers | <input checked="" type="checkbox"/> Scale |
| <input type="checkbox"/> Product In Tank | <input type="checkbox"/> Piping Locations | <input type="checkbox"/> Monitoring Wells | <input checked="" type="checkbox"/> Other |
| <input type="checkbox"/> Tracer In Tank | <input type="checkbox"/> Other | <input type="checkbox"/> Other | |



Technician: Michael J. Gervasio
 Client: TBC Environmental Consultants
 Site Name: Dover, Nj
 City/State: D. N. J.

Area 42



- Map Checklist
- | | | | |
|--|---|---|--|
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| <input type="checkbox"/> Tank Volume | <input type="checkbox"/> Fill Pipes | <input type="checkbox"/> Manifolds | <input type="checkbox"/> North Direction |
| <input type="checkbox"/> Tank Dims. | <input type="checkbox"/> Vent Pipes | <input type="checkbox"/> Dispensers | <input checked="" type="checkbox"/> Scale |
| <input type="checkbox"/> Product In Tank | <input type="checkbox"/> Piping Locations | <input type="checkbox"/> Monitoring Wells | <input checked="" type="checkbox"/> Other ops line |



Date: 06/27/91

TRC JOB # 2-41-0117-5

Technician: Michael J. Gervasio
 Client: Tec Environmental Consultants
 Site Name: Dover, Nj
 City/State: Dover, NJ

Rt. 46

Rt. 46

Rt. 46

Rt. 46

~~var 59~~ X SG-16A

Area # 16

Artic Water's Radiators

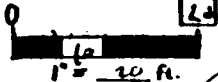
Parked Cars X SG-16B

000 001 2163

Gravel Lot

Fence (60')
Gravel Lot

CAR
Pental



SG-16D

SG-16C

Map Check List

Date: 06/27/91

TRC JOB # [2-91-117]-S

- | | | | |
|--|---|---|--|
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| <input type="checkbox"/> Tank Volume | <input type="checkbox"/> FILL Pipes | <input type="checkbox"/> Manifolds | <input checked="" type="checkbox"/> North Direction |
| <input type="checkbox"/> Tank Dims. | <input type="checkbox"/> Vent Pipes | <input type="checkbox"/> Dispensers | <input checked="" type="checkbox"/> Scale |
| <input type="checkbox"/> Product in Tank | <input type="checkbox"/> Piping Locations | <input type="checkbox"/> Monitoring Wells | <input type="checkbox"/> Other |



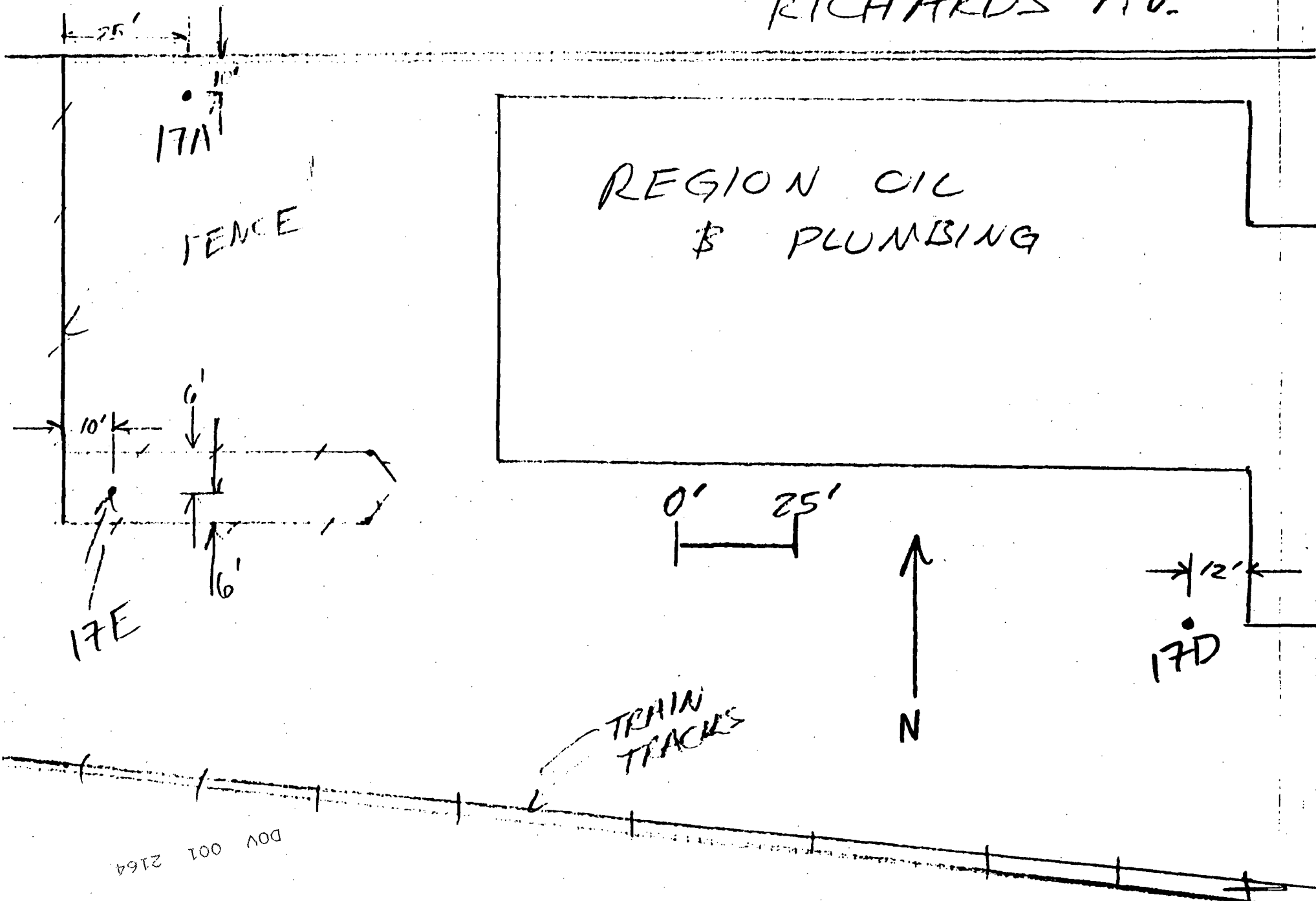
Technician Michael Gervasio

Client: TRC Environmental Consultants

Site Name: Dover, NJ

City/State: Dover NJ

RICHARDS AV.



REGION OIL
& PLUMBING

17A

FENCE

17E

17D

TRAIN
TRACKS

N

DOV 001 2164

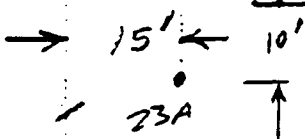
RICHARD AV.

CONCRETE
SIDEWALK

GRASS

GRASS

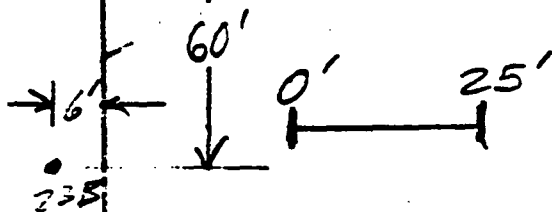
HOUSE



ASPHALT



PLAT 23
DOVER, NJ
TRC ENVIOR.
2-91-117-S



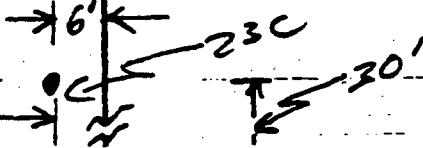
JOHANNY'S
AUTO.
BODY

CHAIN
LINK
FENCE

DIRT

23D

60'



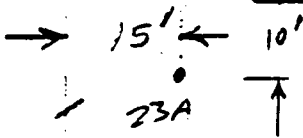
RICHARD AVE.

CONCRETE SIDEWALK

GRASS

GRASS

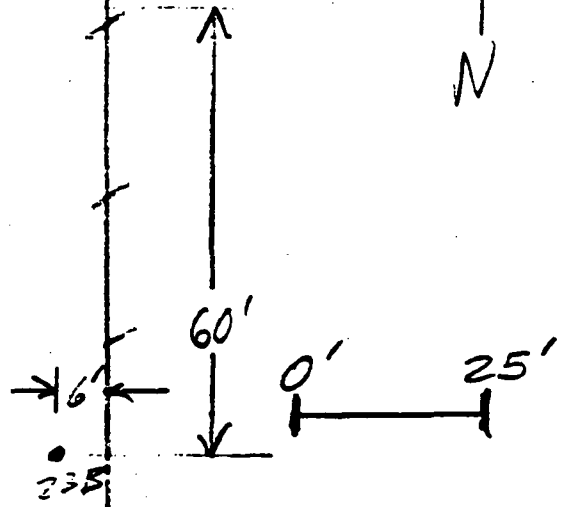
HOUSE



ASPHALT



PLOT 23
 DOVER, NJ
 TRC ENVIOR.
 2-91-117-S



JEHANY'S
 AUTO.
 BCDY

CHAIN
 LINK
 FENCE

DIRT

23D

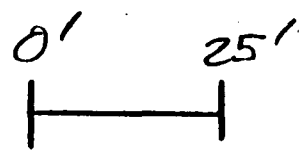
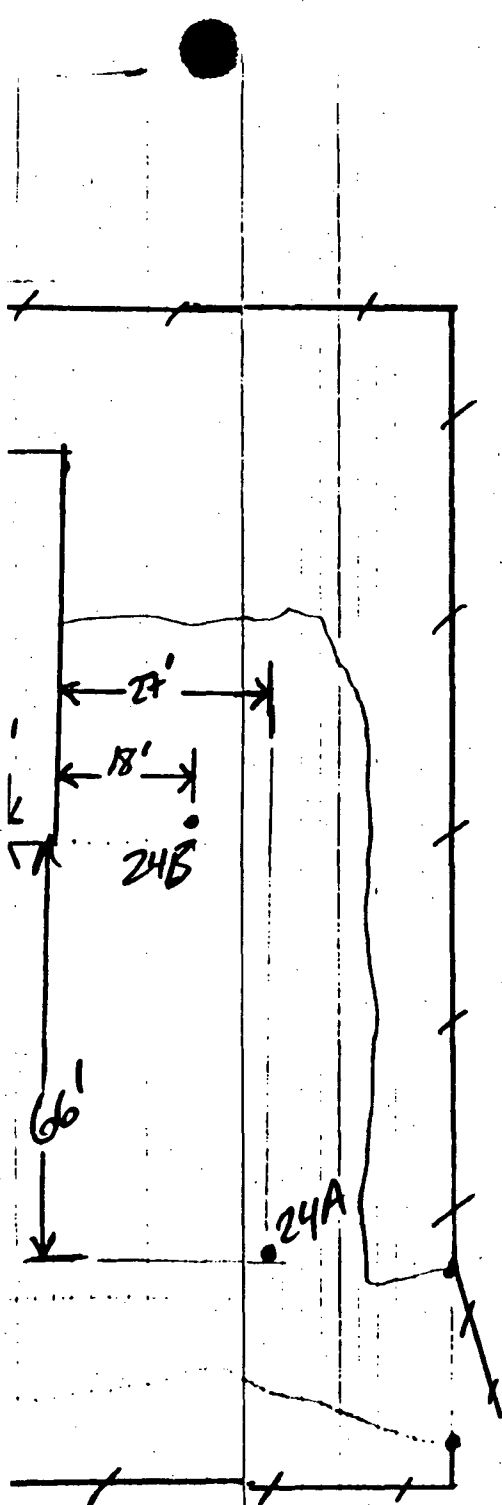
60'

6'

23C

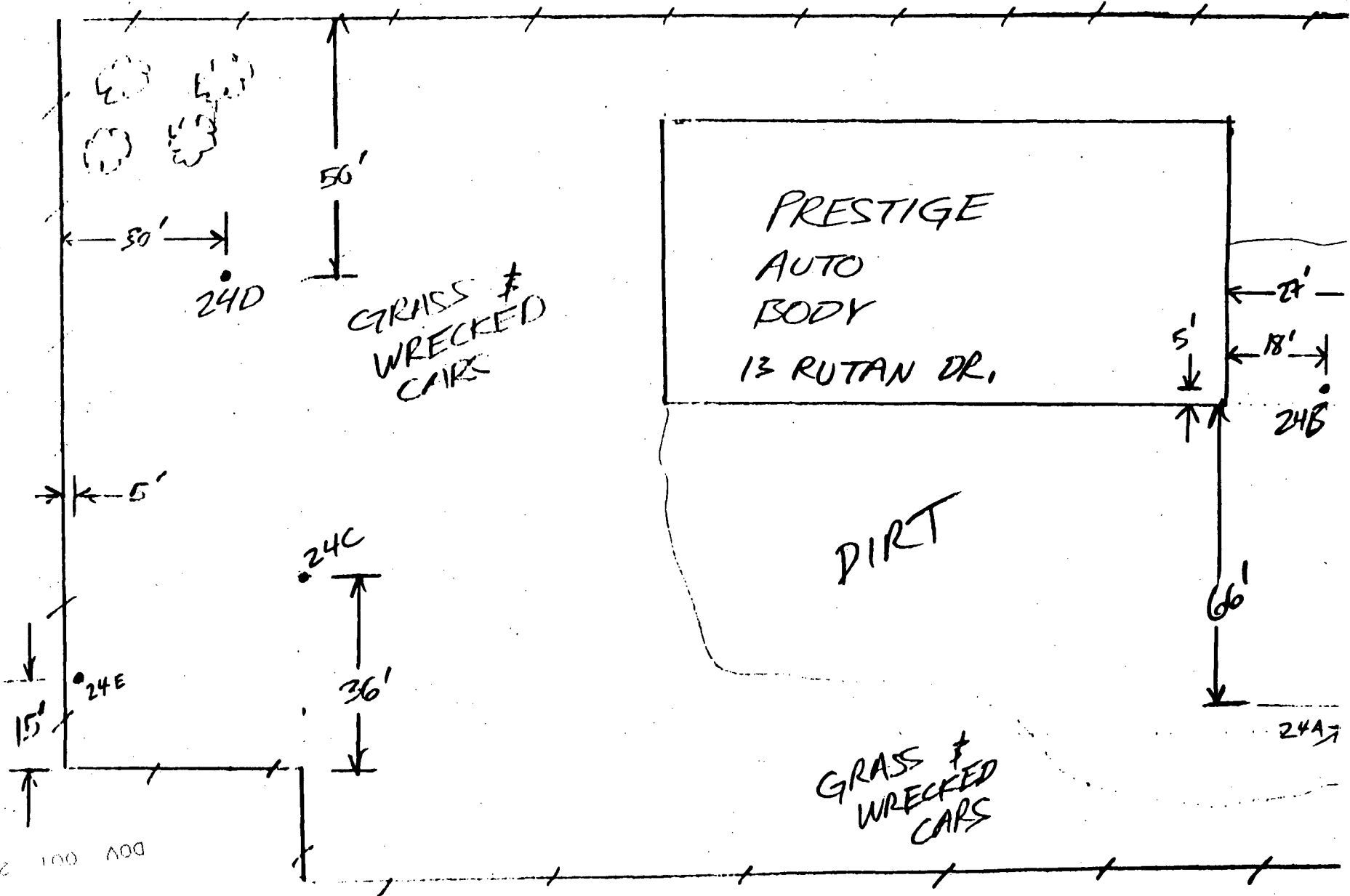
30'

40'



PLOT 24
 DOVER, NJ
 TRC ENVIRON.
 2-91-117-S

DOV 001 2167



8912 100 100
 2168 00V

2-91-117-S

7-10-91

1" = 100 ft.

Pfaff, Gervasio, Graessinger

VAN # B

TRC ENV 1160

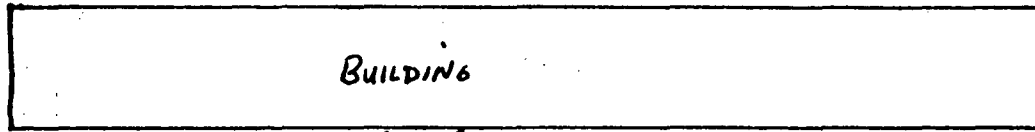
Dover, NJ



RAILROAD TRACK

• 56-26

• 56-2F



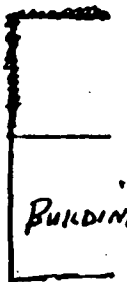
BUILDING

• 56-2E

• 56-2D

• 56-2C

• 56-2A



BUILDING

• 56-2B

GRASS, NOOPS, BUSH

DOV 001 2169



ROAD

31'

61'

• 56-5DB

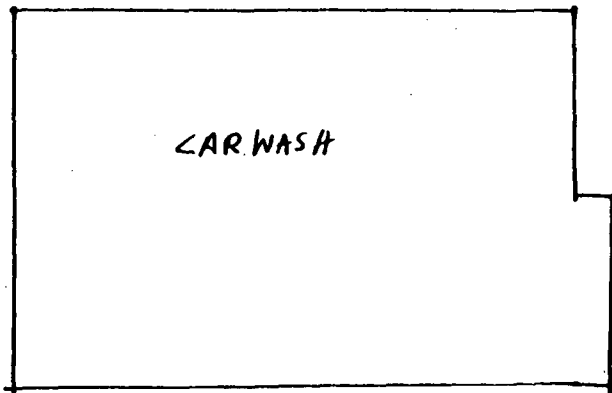
WOODS



2-91-117-5
7-10-91

1/2" = 30'

Pfeil, GRIESINER,
VAN #8
TRC ENVIRO
DOVER, NJ



CARWASH

ASPHALT

• 56-5AC

WOODS

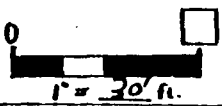
• 56-5B

ASPHALT

• 56-5DE

ROAD

DOV 001 2170



1" = 30' ft.

Map Checklist

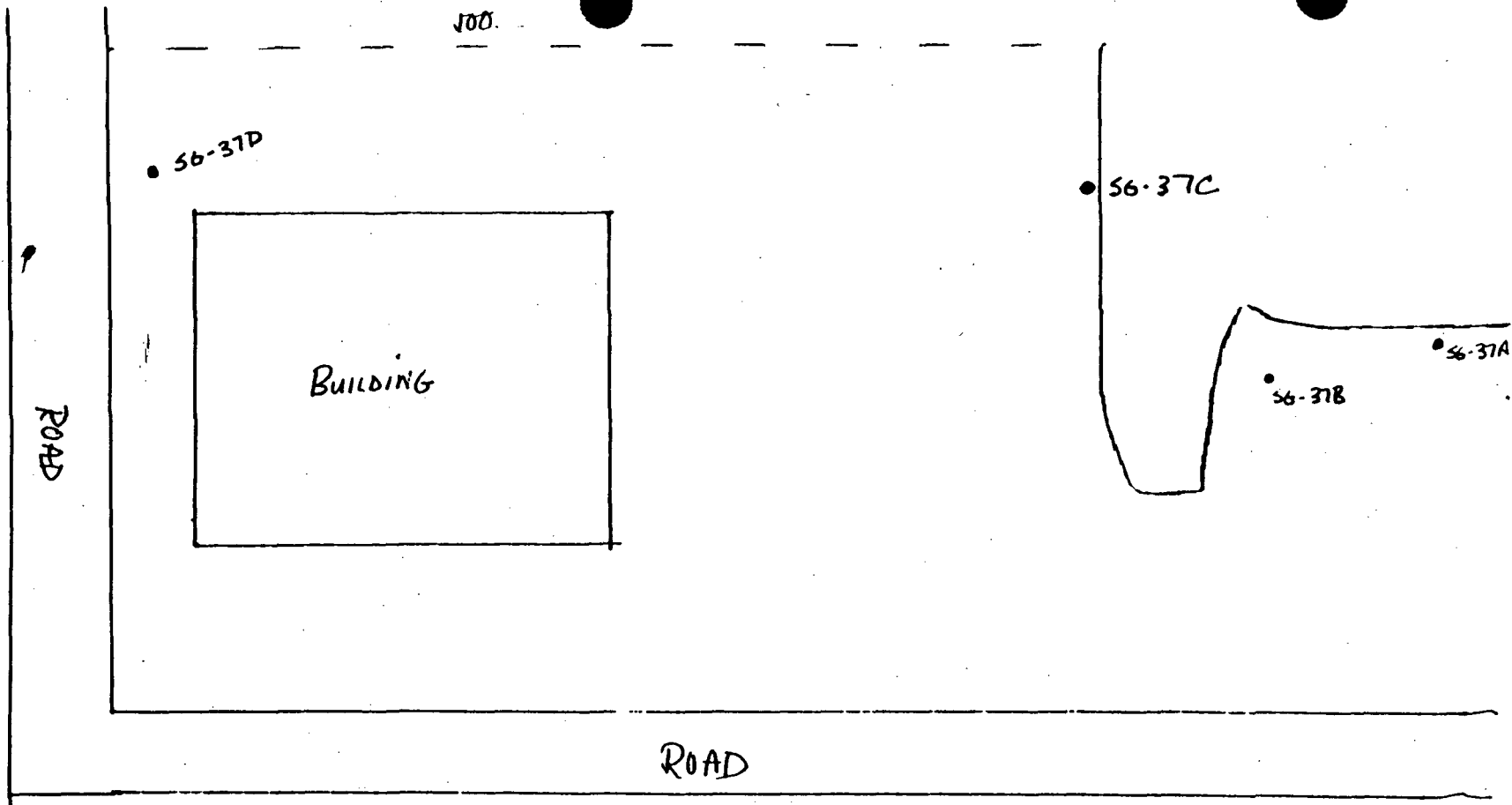
Date: 7/10/91

TRC JOB # 2-91-117-5

- | | | | |
|---|---|---|---|
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| <input type="checkbox"/> Tank Volume | <input type="checkbox"/> FILL Pipes | <input type="checkbox"/> Manifolds | <input type="checkbox"/> North Direction |
| <input type="checkbox"/> Tank Dims. | <input type="checkbox"/> Vent. Pipes | <input type="checkbox"/> Dispensers | <input type="checkbox"/> Scale |
| <input type="checkbox"/> Product In Tank | <input type="checkbox"/> Piping Locations | <input type="checkbox"/> Monitoring Wells | <input type="checkbox"/> Other |
| <input type="checkbox"/> Pressure In Tank | <input type="checkbox"/> Ground Cover | | |

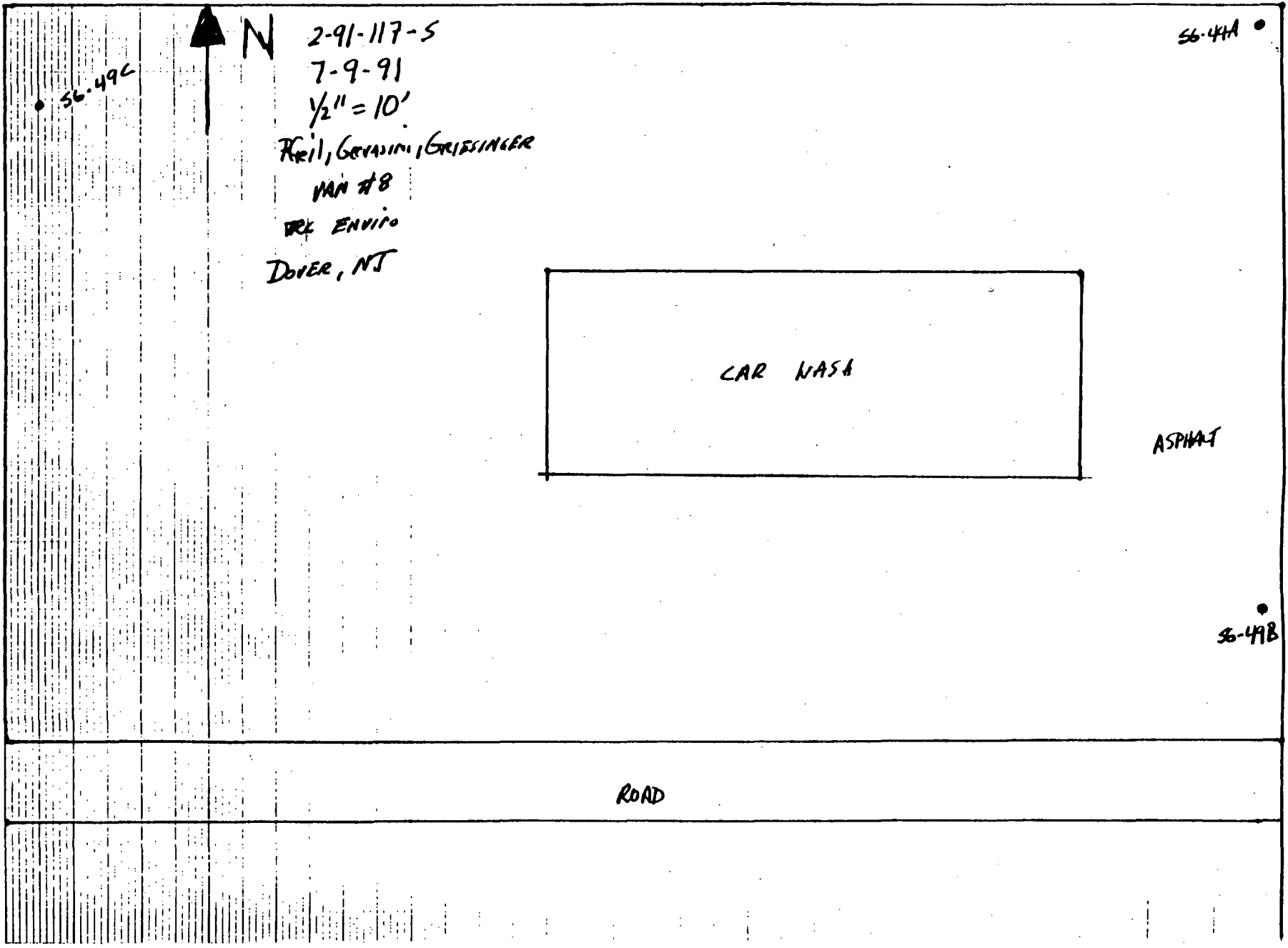


Technician: GRIESINER
 Client: TRC ENVIRO
 Site Name: DOV, NJ
 City/State: DOVER NJ



2-91-117-5
7-9-91
Pfeil, Garavito, Geringer
VAN #B
VRC Envir
DOVER, NJ

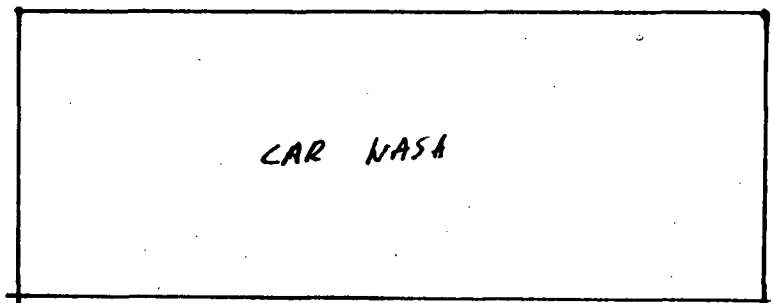
DOV 001 2171



2-91-117-5
7-9-91
1/2" = 10'
KRIL, GERASINI, GRIESINGER
VAN #8
ORL ENVIRO
DOVER, NJ

56-41A •

56-41B •



ASPHALT

WOODS

ROAD

56-49C •





2-91-117-S

7-9-91

1/2" = 10'

Pfeil, Giovanni, Griessinger

VAN #8

TRL ENVIRO

Dover, NJ

SITE #4

ROAD



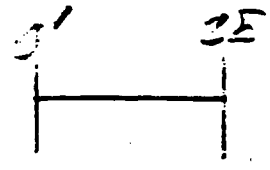
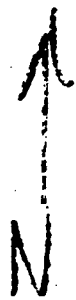
BUILDING

• 56-4A

ROAD



DOV 001 2173



BLACKWELL ST.

CONCRETE SIDEWALK

Various Shops

Auto Body

Towne Billiard

28A

30'

45'

5'

10'

28B

Asphalt parking lot

2'

Gravel

CHAIN LINK FENCE

PLOT 28
DOVER, NJ
TRC ENVIOR.
2-91-117-S

RIVER

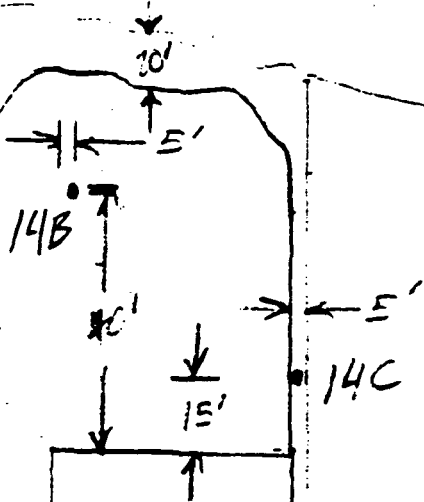
DOV 001 2174

RIVER

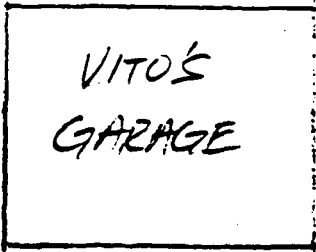
PLOT 74
DOVER, NJ
RECEIVED
2-9-17-5



GRASS

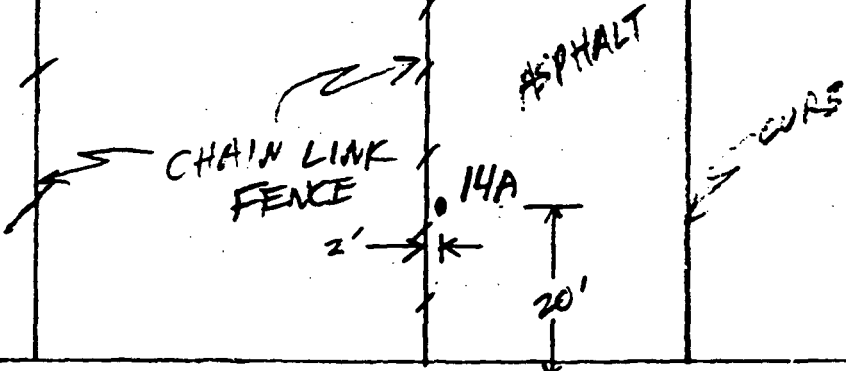


LANBER'S
COLLISION
REPAIR



VITO'S
GARAGE

GRASS
ASPHALT
PARKING LOT



BLACKWELL ST

CONCRETE
SIDEWALK 5'

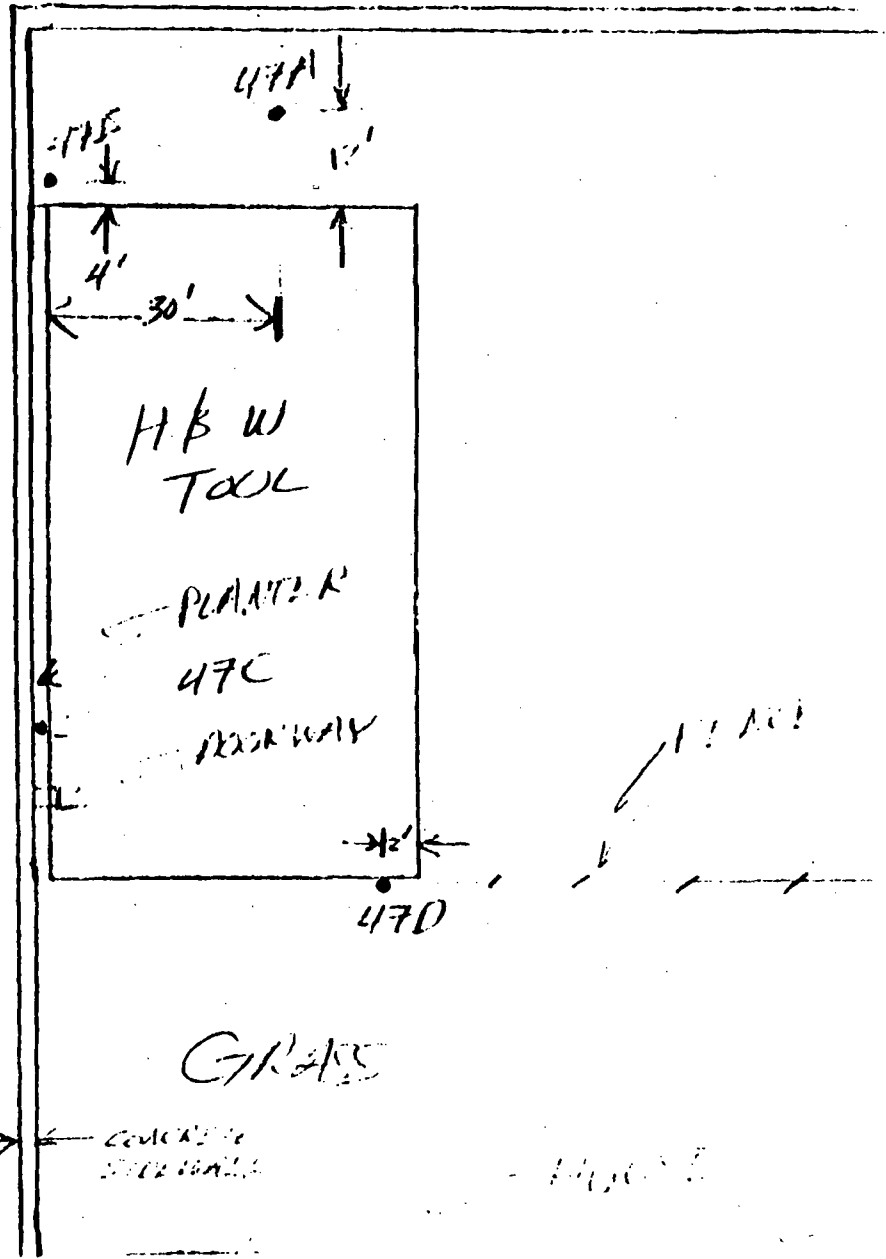
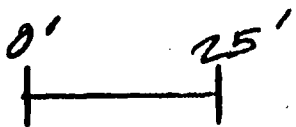
DOV 001 2175

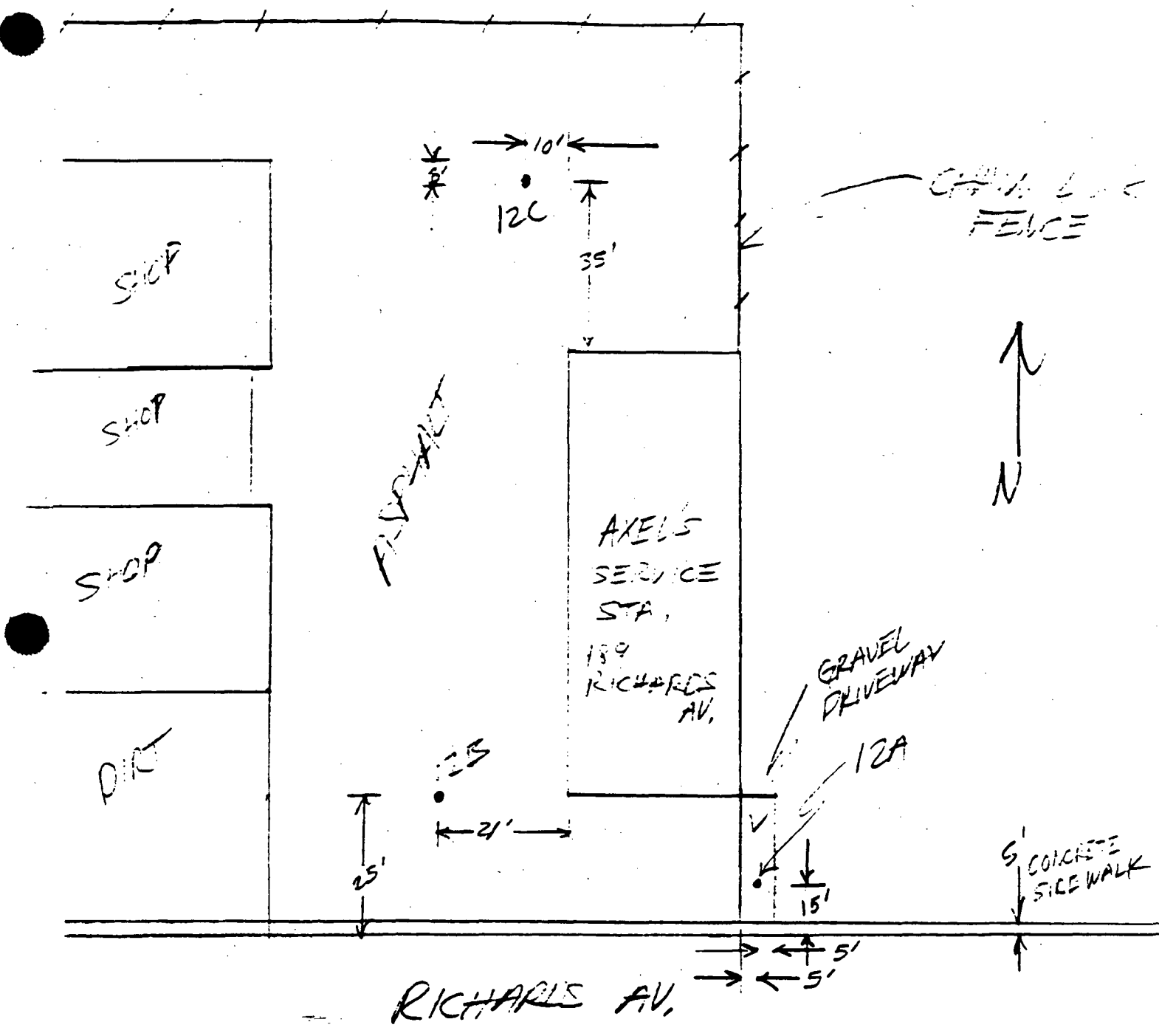
LEE ST.

RICHARDS AV.

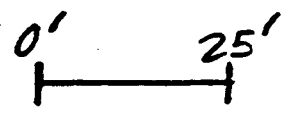
PLOT 47
DOVER, NJ
TRC ENVIOR.
2-91-117-S

NORTH



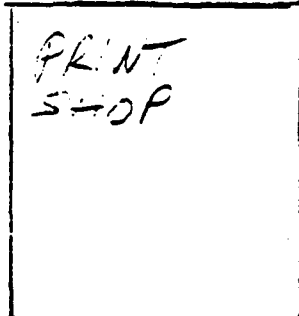


PLOT 12
 DOVER, NJ
 TRC ENVIOR.
 2-91-117-S

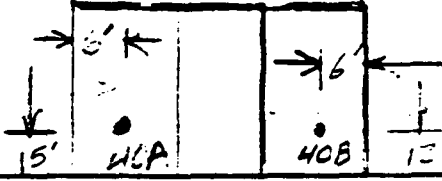


DOV 001 2177

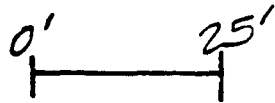
RT. 46



~~PRINT SHOP~~
DR



FALM DR,
ASPHALT

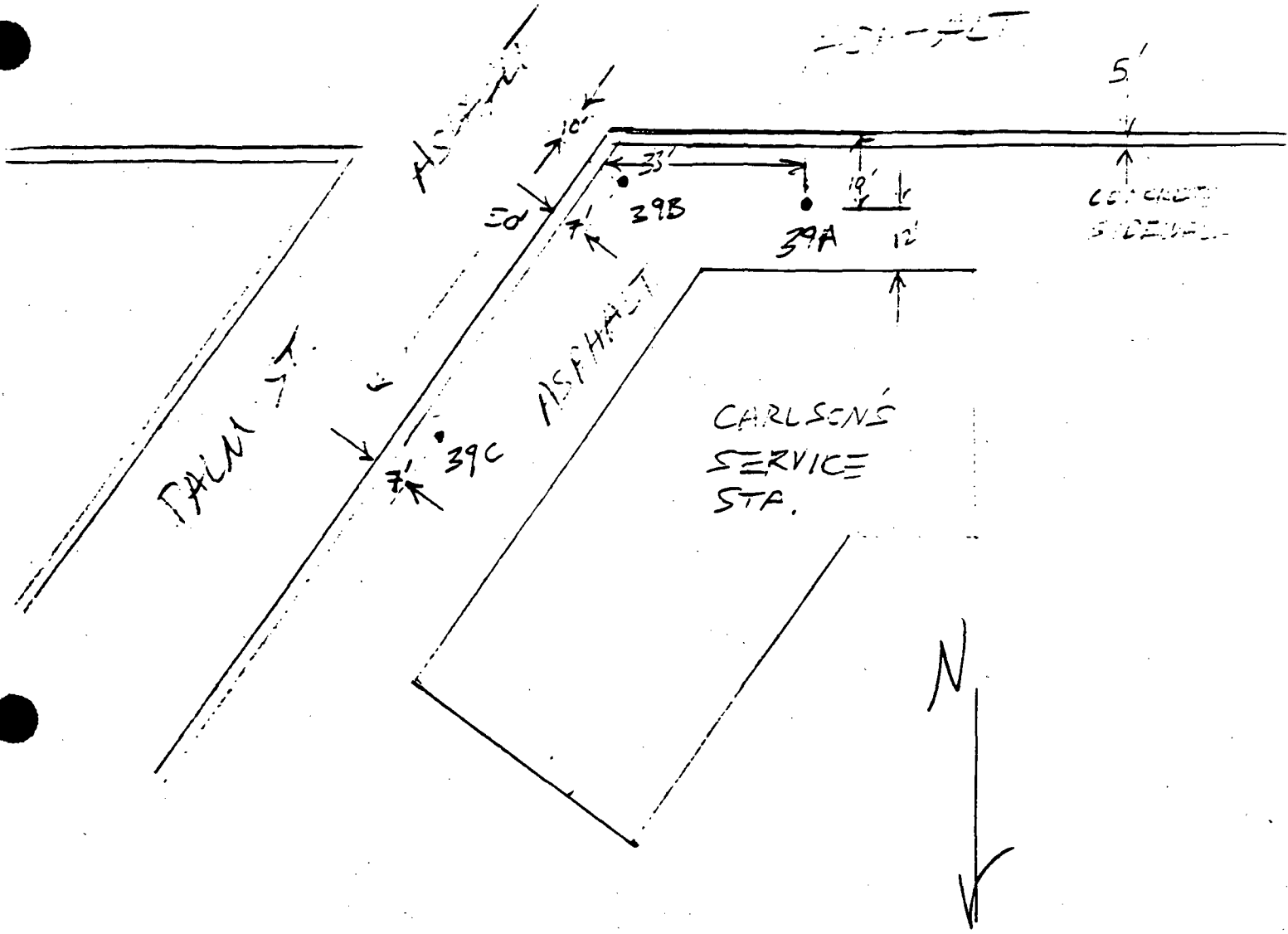


PLOT 40
DOVER, NJ
TRC ENVIOR.
2-91-117-S

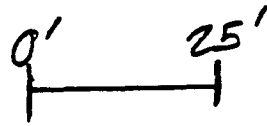
DOV 001 2178

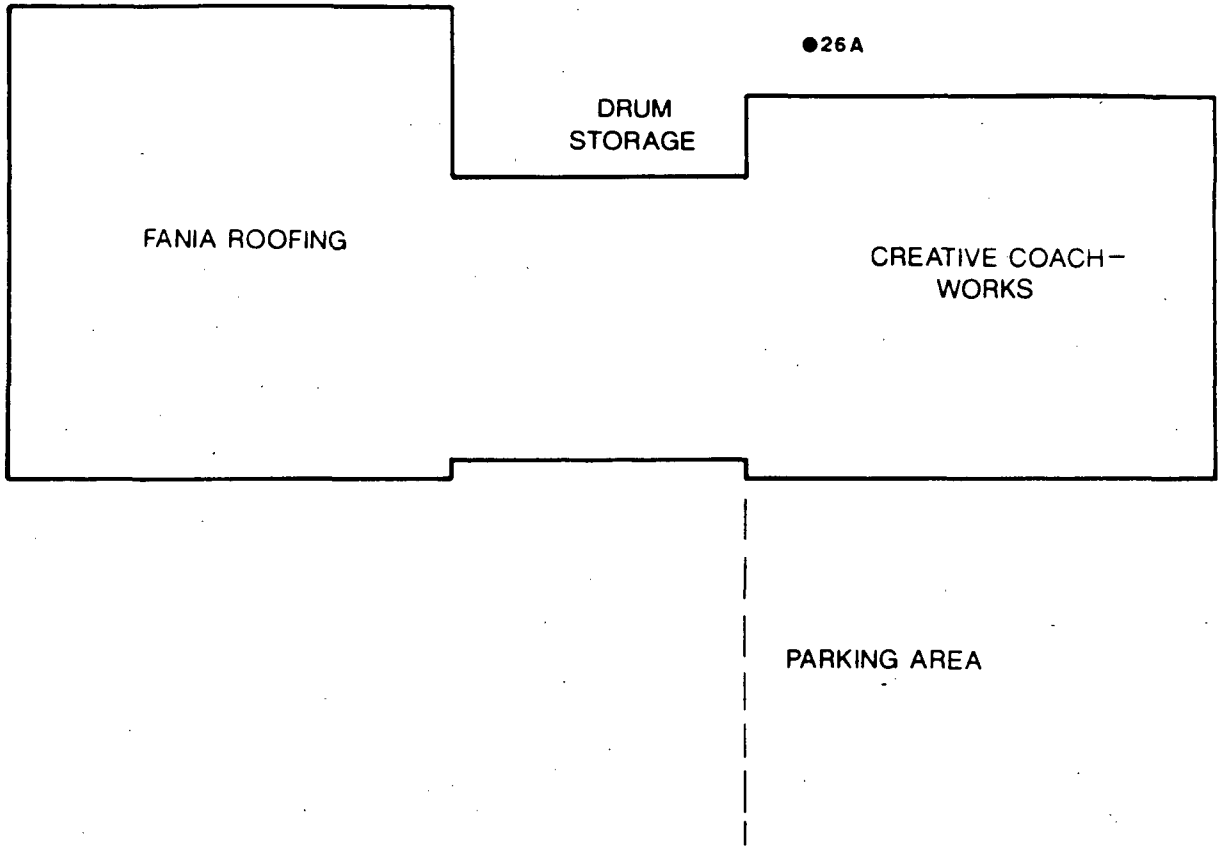
RICHARDS AV.

ASPHALT



PLOT 39
DOVER, NJ
TRC ENVIOR.
2-91-117-S





BLACKWELL STREET

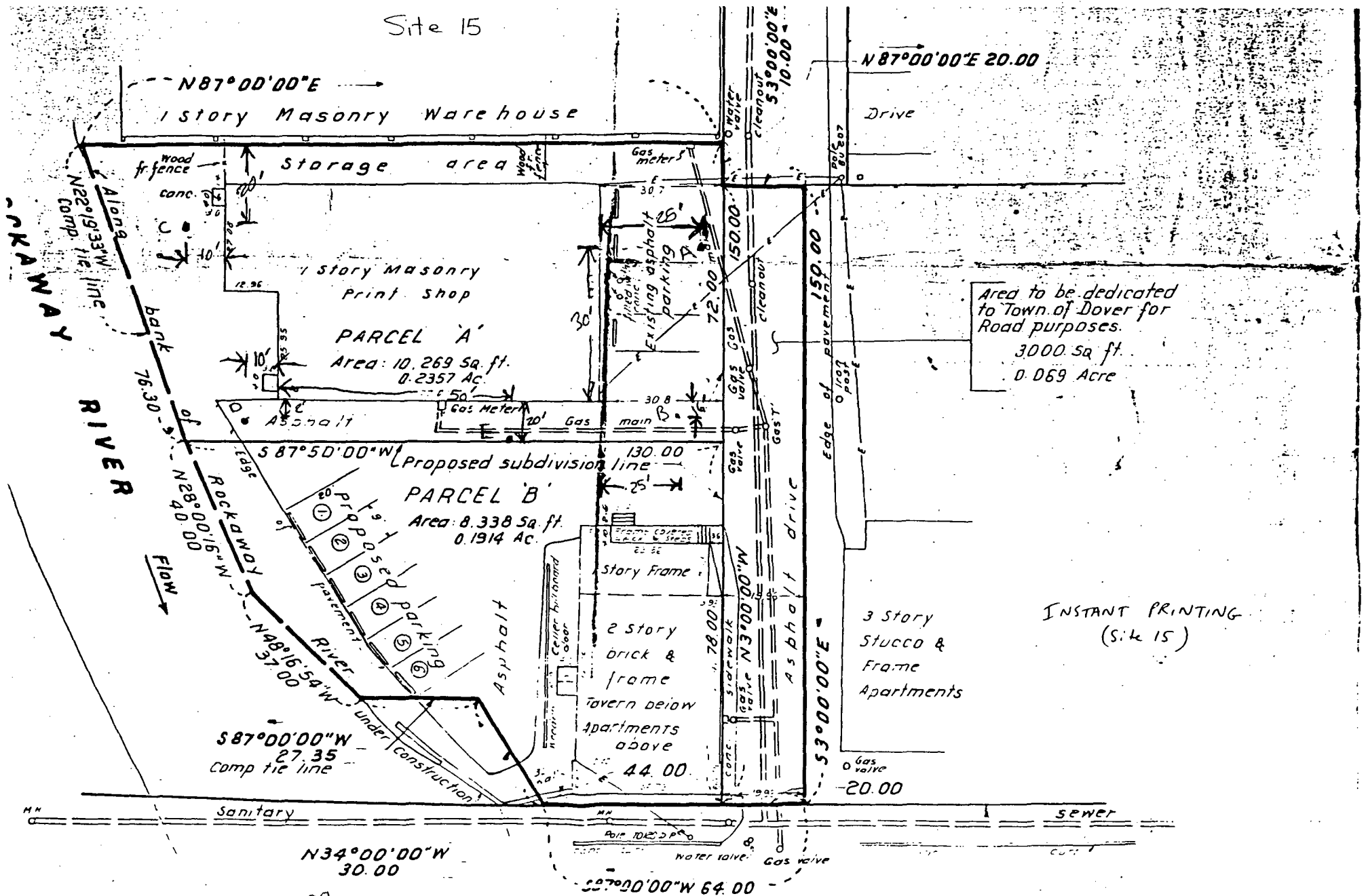


SCALE
(APPROXIMATE)

CREATIVE COACHWORKS
(site 26)

DOV 001 2180

Site 15



Area to be dedicated
to Town of Dover for
Road purposes.
3000 Sq. ft.
0.069 Acre

INSTANT PRINTING
(Site 15)

DOV 001 2182

DOV 001 2182

APPENDIX B

TRACER RESEARCH CORPORATION SOIL GAS REPORT AND ANALYTICAL RESULTS

DOV 001 2183



PREPARED FOR:

TRC Environmental Consultants, Inc.

**800 Connecticut Blvd
East Hartford, Connecticut 06108
(203)289-8631**

**SHALLOW SOIL GAS INVESTIGATION
DOVER MUNICIPAL WELL #4 SITE**

DOVER, NEW JERSEY

JUNE/JULY 1991

SUBMITTED BY:

Karen L. Luss
Tracer Research Corporation

**117TRC#4.MSG
2-19-117-S**

DOV
100
218A



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INTRODUCTION

A shallow soil gas investigation was performed by Tracer Research Corporation (TRC) at the Dover Municipal Well #4 Site located in Dover, New Jersey. The investigation was conducted June 25, 1991 to July 10, 1991 under contract to TRC Environmental Consultants, Inc. The purpose of the investigation was to determine possible source areas and to delineate the extent of possible contamination in the subsurface at 23 sites.

During this survey, a total of 86 soil gas samples were collected and analyzed. Samples were analyzed for volatile organic compounds from the following suite:

<u>COMPOUND</u>	<u>DETECTOR</u>
1,1-dichloroethene (1,1-DCE)	ECD
1,1-dichloroethane (1,1-DCA)	ECD
1,1,1-trichloroethane (TCA)	ECD
trichloroethene (TCE)	ECD
tetrachloroethene (PCE)	ECD

The compounds in this suite were chosen as target compounds because of their suspected presence in the subsurface and amenability to soil gas technology. Soil gas samples were screened on a gas chromatograph equipped with an electron capture detector (ECD).



SHALLOW SOIL GAS INVESTIGATION - METHODOLOGY

Shallow soil gas investigation refers to a method developed by TRC for investigating underground contamination from volatile organic chemicals (VOCs) such as industrial solvents, cleaning fluids and petroleum products by looking for their vapors in the shallow soil gas. The method involves pumping a small amount of soil gas out of the ground through a hollow probe driven into the ground and analyzing the gas for the presence of volatile contaminants. The presence of VOCs in shallow soil gas indicates the observed compounds may either be in the vadose zone near the probe or in groundwater below the probe. The soil gas technology is most effective in mapping low molecular weight halogenated solvent chemicals and petroleum hydrocarbons possessing high vapor pressures and low aqueous solubilities. These compounds readily partition out of the groundwater and into the soil gas as a result of their high gas/liquid partitioning coefficients. Once in the soil gas, VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. The contamination acts as a source and the above ground atmosphere acts as a sink, and typically a concentration gradient develops between the two. The concentration gradient in soil gas between the source and ground surface may be locally distorted by hydrologic and geologic anomalies (e.g. clays, perched water); however, soil gas mapping generally remains effective because distribution of the contamination is usually broader in areal extent than the local geologic barriers and is defined using a large database. The presence of geologic obstructions on a small scale tends to create anomalies in the soil gas-groundwater correlation, but generally does not obscure the broader areal picture of the contaminant distribution.

Soil gas contaminant mapping helps to reduce the time and cost required to delineate underground contamination by volatile contaminants. The soil gas investigation does this by outlining the general areal extent of contamination. Conventional bore holes or observation wells are used to verify both the presence and extent of the subsurface



contamination as indicated in the soil gas survey. In this manner, soil gas contaminant mapping can assist in determining the placement of monitoring wells. Thus the likelihood of drilling unnecessary monitoring wells is reduced. The soil gas survey is not intended to be substitute for conventional methodology, but rather to enable conventional methods to be used efficiently.

EQUIPMENT

Tracer Research Corporation utilized a one ton Ford analytical van that was equipped with one gas chromatograph and two Spectra Physics computing integrators. In addition, the van had two built-in gasoline powered generators that provide the electrical power (110 volts AC) to operate all of the gas chromatographic instruments and field equipment. A specialized hydraulic mechanism consisting of two cylinders and a set of jaws was used to drive and withdraw the sampling probes. A hydraulic hammer was used to assist in driving probes past cobbles and through unusually hard soil.

SOIL GAS SAMPLING PROCEDURES

Sampling probes consisted of 7-14 foot lengths of 3/4 inch diameter hollow steel pipe that were fitted with detachable drive tips. Soil gas probes were advanced 2-9.5 feet below grade. Once inserted into the ground, the above-ground end of the sampling probes were fitted with a steel reducer and a length of polyethylene tubing leading to a vacuum pump. Gas flow was monitored by a vacuum gauge to insure that an adequate flow was obtained.

To adequately purge the volume of air within the probe, 2 to 5 liters of gas was evacuated with a vacuum pump. During the soil gas evacuation, samples were collected in a glass syringe by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the steel probe. Ten milliliters of gas were collected for immediate analysis in the TRC analytical field van. Soil gas was subsampled (duplicate



injections) in volumes ranging from 1 uL to 2 mL, depending on the VOC concentration at any particular location.

Sample probe vacuums ranged from 2-4 inches Hg. The maximum pump vacuum was measured at 25 inches Hg.

ANALYTICAL PROCEDURES

A Varian 3300 gas chromatograph was used for the soil gas analyses. It was equipped with an electron capture detector (ECD). Compounds were separated on a 6' by 1/8" OD packed column with OV-101 as the stationary phase in a temperature controlled oven. Nitrogen was used as the carrier gas.

Halocarbon compounds detected in the samples were identified by chromatographic retention time. Quantification of compounds was achieved by comparison of the detector response of the sample with the response measured for calibration standards (external standardization). Instrument calibration checks were run periodically throughout the day and system blanks were run at the beginning of the day to check for contamination in the soil gas sampling equipment. Air samples were also routinely analyzed to check for background levels in the atmosphere.

Detection limits for the compounds of interest were a function of the injection volume as well as the detector sensitivity for individual compounds. Thus the detection limit varied with the sample size. Generally, the larger the injection size the greater the sensitivity. However, peaks for compounds of interest were kept within the linear range of the analytical equipment. If any compound had a high concentration, it was necessary to use small injections, and in some cases to dilute the sample to keep it within linear range. This may have caused decreased detection limits for other compounds in the analyses.

The detection limits for the halocarbon compounds were approximately 0.0004 ug/L. Detection limits were dependant upon the conditions of the measurement, in particular, the



sample size. If any component being analyzed was not detected, the detection limit for that compound in that analysis is given as a "less than" value (e. g. < 0.1 ug/L). Detection limits obtained from GC analyses were calculated from the current response factor, the sample size, and the estimated minimum peak size (area) that would have been visible under the conditions of the measurement.

The detection limits for 1,1-DCA were recalculated during data QA/QC evaluations. The minimum area detectable under the field conditions was larger than calculated in the field. This resulted in final data showing a higher detection limit for all of the samples collected.

QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Tracer Research Corporation's normal quality assurance procedures were followed in order to prevent any cross-contamination of soil gas samples. These procedures are described below:

- Steel probes are used only once during the day and then washed with high pressure soap and hot water spray or steam-cleaned to eliminate the possibility of cross-contamination. Enough probes are carried on each van to avoid the need to reuse any during the day.
- Probe adaptors (TRC's patented design) are used to connect the sample probe to the vacuum pump. The adaptor is designed to eliminate the possibility of exposing the sample stream to any part of the adaptor. Associated tubing connecting the adaptor to the vacuum pump is replaced periodically as needed during the job to insure cleanliness and good fit. At the end of each day the adaptor is cleaned with soap and water and baked in the GC oven.



- . Silicone tubing (which acts as a septum for the syringe needle) is replaced as needed to insure proper sealing around the syringe needle. This tubing does not directly contact soil gas samples.
- . Glass syringes are usually used for only one sample per day and are washed and baked out at night. If they must be used twice, they are purged with carrier gas (nitrogen) and baked out between probe samplings.
- . Injector port septa through which soil gas samples are injected into the chromatograph are replaced on a daily basis to prevent possible gas leaks from the chromatographic column.
- . Analytical instruments are calibrated each day by analytical standards from Chem Service, Inc. Calibration checks are also run after approximately every five soil gas sampling locations.
- . Subsampling syringes are checked for contamination prior to sampling each day by injecting nitrogen carrier gas into the gas chromatograph.
- . Prior to sampling each day, system blanks are run to check the sampling apparatus (probe, adaptor, 10 cc syringe) for contamination by drawing ambient air from above ground through the system and comparing the analysis to concurrently sampled ambient air analysis.
- . All sampling and subsampling syringes are decontaminated each day and no such equipment is reused before being decontaminated each day. Microliter size subsampling syringes are reused only after a nitrogen carrier gas blank is run to insure it is not contaminated by the previous sample.
- . Soil gas pumping is monitored by a vacuum gauge to insure that an adequate gas flow from the vadose zone is maintained. A reliable gas sample can be obtained if the sample vacuum gauge reading is at least 2 inches Hg less than the maximum pump vacuum.



RESULTS

A total of 86 soil gas samples were collected and analyzed in the field. Analytical data is condensed in Appendix A.

Ambient air samples were collected during the course of the investigation to help evaluate the level of significance for the selected VOC's. The level of significance is simply the level above which concentrations are considered to be significant in terms of groundwater or soil contamination. Detected concentrations of TCA in ambient air samples ranged from 0.0008 to 0.02 ug/L and detected concentrations of PCE in ambient air samples ranged from 0.0007 to 0.3 ug/L. The level of significance for each target compound is based on several factors; concentrations in ambient air, background levels, and TRC's past experience. Based on the evaluation of these factors, the level of significance for the selected target compounds was determined to be approximately 0.1 ug/L. In other words, soil gas concentrations of 1,1-DCE, 1,1-DCA, TCA, TCE and PCE greater than 0.1 ug/L may indicate possible VOC contamination in the vicinity.



APPENDIX A: ANALYTICAL DATA

DOV 001 2193

TRC ENVIRONMENTAL/DOVER, NEW JERSEY/JOB #2-91-117-S

06/25/91

CONDENSED DATA

SAMPLE	1,1 DCA ug/l	1,1 DCE ug/l	TCA ug/l	TCE ug/l	PCE ug/l
AMBIENT AIR	<0.003	<0.008	0.004	<0.0007	<0.0004
LOCAL AIR	<0.003	<0.0008	0.01	<0.0007	0.03
SG-16A-9.5'	<0.008	<0.02	0.01	<0.002	0.09
SG-16B-5.5'	<0.008	<0.008	0.002	<0.0007	0.0007
SG-16C-5.5'	<0.09	<0.008	0.003	<0.0007	<0.0004
SG-16D-5.5'	<0.09	<0.005	0.003	<0.0004	0.002
LOCAL AIR	<0.2	<0.004	0.004	<0.0004	0.0009
SG-42A-5'	<0.008	<0.008	0.005	<0.0007	0.009
SG-42B-5'	<0.08	<0.004	0.005	<0.0004	0.004
SG-42C-4'	<0.1	<0.005	0.01	<0.0004	0.008
SG-42D-4'	<0.09	<0.008	0.006	0.006	0.1
SG-42E-5'	<0.08	<0.008	0.007	<0.0007	0.2
SG-42F1-5'	<0.08	<0.008	0.003	<0.0007	0.03
SG-42F2-5'	<0.07	<0.008	0.005	<0.0007	0.05
LOCAL AIR	<0.08	<0.004	0.003	<0.0004	0.001

Analyzed by: J. Maisch

Proofed by: PWR

DOV 001 2194



TRC ENVIRONMENTAL//DOVER, NEW JERSEY/JOB #2-91-117-S

06/26/91

CONDENSED DATA

SAMPLE	1,1 DCA ug/l	1,1 DCE ug/l	TCA ug/l	TCE ug/l	PCE ug/l
AMBIENT AIR	<0.08	<0.003	0.0009	<0.0004	0.0007
SG-19A-4'	<0.008	<0.01	0.004	<0.0008	<0.0005
SG-19B-5'	<0.09	<0.01	0.003	<0.0008	0.06
SG-19C-4'	<0.1	<0.01	0.003	<0.0008	0.06
SG-19D-4.5'	<0.06	<0.01	0.002	<0.0007	0.003
LOCAL AIR	<0.09	<0.008	0.02	<0.0005	0.2
AMBIENT AIR	<0.07	<0.01	0.01	<0.0008	0.2
SG-22A-5'	<0.07	<0.01	0.01	<0.0008	0.07
SG-22B-4.5'	<0.08	<0.01	0.2	<0.0008	0.7
LOCAL AIR	<0.1	<0.01	0.005	<0.0008	0.09
SG-22C-4'	<0.008	<0.01	0.005	<0.0008	0.03
SG-22D-5'	<0.008	<0.01	0.2	<0.0008	0.04
LOCAL AIR	<0.09	<0.01	0.003	<0.0008	0.1
SG-20A1-5'	<0.03	<0.03	0.009	0.02	10
SG-20A2-5'	<0.03	<0.07	0.004	0.02	5
SG-20B-5'	<0.02	<0.07	0.09	2	3700
LOCAL AIR	<0.1	<0.03	0.002	<0.002	0.02

Analyzed by: J. Maisch

Proofed by:

PWR

DOV 001 2195



TRC ENVIRONMENTAL/DOVER, NEW JERSEY/JOB #2-91-117-S

06/27/91

CONDENSED DATA

SAMPLE	1,1 DCA ug/l	1,1 DCE ug/l	TCA ug/l	TCE ug/l	PCE ug/l
AMBIENT AIR	<0.01	<0.04	0.002	<0.004	0.3
SG-20C-5'	<0.2	<0.6	D	0.2	33
SG-20D-5'	<0.2	<0.5	0.004	0.05	11
SG-21A-4'	<0.1	<0.02	0.09	0.6	0.2
SG-21B-5'	<0.01	<0.04	0.06	0.02	7
AMBIENT AIR	<0.007	<0.02	0.0004	<0.002	0.01

Analyzed by: J. Maisch

Proofed by: _____

PWR

DOV 001 2196



TRC ENVIRONMENTAL/DOVER, NEW JERSEY/JOB #2-91-117-S

06/28/91

CONDENSED DATA

SAMPLE	1,1 DCA ug/l	1,1 DCE ug/l	TCA ug/l	TCE ug/l	PCE ug/l
AMBIENT AIR	<0.01	<0.03	<0.0004	<0.003	<0.001
SG-21C-4'	<0.01	0.07	0.008	0.01	0.4
SG-21D-4'	<0.005	<0.01	0.04	<0.001	0.1
AMBIENT AIR	<0.01	<0.03	0.0008	<0.003	0.004

Analyzed by: J. Maisch
Proofed by: _____

PWR

DOV 001 2197



TRC ENVIRONMENTAL/DOVER, NEW JERSEY/JOB #2-91-117-S

07/01/91

CONDENSED DATA

SAMPLE	1,1 DCA ug/l	1,1 DCE ug/l	TCA ug/l	TCE ug/l	PCE ug/l
AMBIENT AIR	<0.005	<0.01	0.001	<0.001	0.0004
LOCAL AIR	<0.005	<0.01	0.005	<0.001	0.0004
SG-39A-3.5'	<0.005	<0.01	0.002	<0.001	0.006
SG-39B-2'	<0.002	<0.005	0.003	<0.0005	0.001
SG-39C-2'	<0.005	<0.01	0.0005	<0.001	<0.0004
LOCAL AIR	<0.005	<0.01	0.0003	<0.001	<0.0004
SG-40A-4.5'	<0.004	<0.009	0.002	<0.0008	<0.0004
SG-40B-3.5'	0.02	<0.009	0.001	0.002	0.001
LOCAL AIR	<0.005	<0.01	0.0008	<0.001	<0.0004
SG-47A-2'	<0.004	<0.009	0.002	0.0008	0.005
SG-47B-4'	<0.002	<0.005	0.001	<0.0005	0.0005
SG-47C-4'	<0.005	<0.03	8	0.003	0.04
SG-47D-3.5'	<0.005	0.02	0.01	<0.001	0.004
AMBIENT AIR	<0.004	<0.009	0.008	<0.0008	0.0007

Analyzed by: J. Maich
 Proofed by: _____

PWR

DOV 001 2198



TRC ENVIRONMENTAL/DOVER, NEW JERSEY JOB #2-91-117-S

07/02/91

CONDENSED DATA

SAMPLE	1,1 DCA ug/l	1,1 DCE ug/l	TCA ug/l	TCE ug/l	PCE ug/l
AMBIENT AIR	<0.03	<0.09	0.009	<0.008	<0.003
SG-12A-4.5'	<0.004	<0.01	0.04	0.03	0.2
SG-12B1-2'	<0.004	<0.01	0.004	0.006	0.04
SG-12B2-2.5'	<0.004	<0.01	0.005	0.006	0.05
SG-12C-3.5'	<0.004	<0.01	0.006	<0.001	0.004
SG-17A-4'	<0.004	<0.01	0.006	<0.001	0.002
SG-17B-3.5'	<0.002	<0.006	0.002	<0.0006	0.004
LOCAL AIR	<0.002	<0.006	0.003	<0.0006	0.01
SG-17C-3.5'	<0.004	<0.01	0.1	0.005	0.003
SG-17D-3'	<0.007	<0.02	0.04	0.006	0.2
SG-17E-4.5'	<0.004	<0.01	0.004	0.01	0.02
LOCAL AIR	<0.004	<0.01	0.002	<0.001	0.003
SG-23A-4'	<0.002	<0.006	0.001	<0.0006	0.001
SG-23B-4'	<0.003	<0.01	0.0009	<0.001	0.01
SG-23C-4'	<0.004	<0.01	0.03	0.002	0.005
SG-23D-4'	<0.002	<0.006	0.01	<0.0006	0.03
SG-24A-4'	<0.004	<0.01	0.02	<0.001	0.001
LOCAL AIR	<0.002	<0.006	0.002	<0.0006	0.002
SG-24B-4.5'	<0.002	<0.006	0.002	<0.0006	0.004
SG-24C-2'	<0.004	<0.01	0.09	0.05	0.3
SG-24D-5'	<0.004	<0.01	0.008	0.001	0.002
SG-24E-4.5'	<0.002	<0.006	0.002	<0.0006	0.0007
AMBIENT AIR	<0.004	<0.01	0.01	<0.001	0.007

Analyzed by: J. Maisch
 Proofed by: _____

PWR

6612 100 100



TRC ENVIRONMENTAL/DOVER, NEW JERSEY/JOB #2-91-117-S

07/03/91

CONDENSED DATA

SAMPLE	1,1 DCA ug/l	1,1 DCE ug/l	TCA ug/l	TCE ug/l	PCE ug/l
AMBIENT AIR	<0.2	<0.01	0.004	<0.0009	0.0009
SG-14A-3'	<0.2	<0.01	0.0003	0.004	0.005
LOCAL AIR	<0.2	<0.007	<0.002	<0.0006	0.001
SG-15A1-4'	<0.1	0.03	0.01	0.02	0.003
SG-15A2-4'	<0.2	0.05	0.01	<0.0009	0.003
SG-15B-4'	I	I	0.2	0.001	0.2
SG-15C-4.5'	<0.2	<0.01	0.005	<0.001	0.005
SG-15E-4'	<0.1	<0.01	0.007	<0.0009	0.02
SG-15D-4'	<0.2	<0.01	0.009	<0.0009	0.02
SG-14B-2.5'	<0.2	<0.007	0.009	<0.0006	0.002
SG-14C-2.5'	<0.2	<0.01	0.002	<0.0009	0.002
LOCAL AIR	<0.2	<0.01	0.002	<0.0009	0.003
SG-28A-4.5'	<0.05	<0.02	0.3	<0.002	0.5
SG-28B-4.5'	<0.1	<0.01	0.02	<0.0009	0.003
AMBIENT AIR	<0.2	<0.007	0.02	<0.0006	0.004

I = Interference from adjacent peaks

Analyzed by: J. Maisch

Proofed by:

PWR

DOV 001 2200



TRC ENVIRONMENTAL/DOVER, NEW JERSEY/JOB #2-91-117-S

07/09/91

CONDENSED DATA

SAMPLE	1,1 DCE ug/l	1,1 DCA ug/l	TCA ug/l	TCE ug/l	PCE ug/l
AIR @4	<0.02	<0.04	0.001	<0.002	<0.002
SG-4A-4'	<0.02	0.05	0.007	0.02	0.1
AIR @28	<0.02	<0.04	0.003	<0.002	<0.002
SG-28C-5'	<0.02	<0.04	0.008	<0.002	<0.002
SG-28D-5'	<0.02	<0.04	0.01	<0.002	0.003
SG-28E-4'	<0.02	<0.4	0.02	<0.02	0.2
AIR @49	<0.02	<0.04	0.001	<0.002	<0.002
SG-49A-3'	<0.02	<0.04	0.05	<0.002	0.001
SG-49B-4'	<0.02	<0.04	0.003	<0.002	0.005
SG-49C-4' #2	<0.02	<0.04	0.003	0.05	0.01
AIR @37	<0.02	<0.04	0.001	<0.002	<0.002
SG-37A-5'	<0.02	<0.04	0.05	<0.002	<0.002
SG-37B-4'	<0.02	<0.04	<0.001	<0.002	<0.002
SG-37C-3.5'	<0.02	<0.04	<0.001	<0.002	<0.002
AIR @26	<0.02	<0.04	<0.001	<0.002	<0.002
SG-26A-4'	<0.2	<0.4	1	<0.02	0.01
SG-37D-5'	<0.02	<0.04	0.03	<0.002	0.006

Analyzed by: B. Pfeil

Proofed by: _____

PWR

DOV 001 2201



TRC ENVIRONMENTAL/DOVER, NEW JERSEY/JOB #2-91-117-S

07/10/91

CONDENSED DATA

SAMPLE	1,1 DCE ug/l	1,1 DCA ug/l	TCA ug/l	TCE ug/l	PCE ug/l
SG-AIR @50	<0.03	<0.05	0.001	<0.002	<0.002
SG-50A-4'	<0.03	<0.05	0.001	<0.002	0.006
SG-50B-4'	<0.03	<0.05	0.004	0.0008	0.02
SG-50D-5'	<0.03	<0.05	0.008	<0.002	0.002
SG-50C-3'	<0.03	<0.05	0.001	<0.002	0.002
SG-50E-3.5'	<0.03	<0.05	0.002	<0.002	<0.002
AIR @2	<0.03	<0.05	0.0007	<0.002	<0.002
SG-2A-3.5'	<0.03	<0.05	0.002	<0.002	0.0008
SG-2B-5'	<0.03	<0.05	0.07	<0.002	0.006
SG-2C-4'	<0.03	<0.05	0.05	0.1	0.06
SG-2D-4'	<0.03	<0.05	0.02	0.01	0.02
SG-2E-4'	<0.03	<0.05	0.01	0.1	0.002
SG-2F-4' #2	<0.03	<0.05	0.05	21.0	0.05
SG-2G-4'	<0.03	<0.05	16.0	<0.002	0.02

Analyzed by: B. Pfeil
 Proofed by: _____

PWR

DOV 001 2202

