2.0 SITE HISTORY AND ADDITIONAL STUDIES CONDUCTED AT THE SITE

Wells G & H were developed by the City of Woburn in 1964 and 1967, respectively, in response to urban growth during the 1960's. The wells, screened in the Aberjona aquifer, were capable of supplying two million gallons of water per day, but were initially intended only for use during times of water shortage or emergencies. Local officials estimate that 27-28% of the community's water supply was provided by Wells G & H . The remainder of the water supply was provided by seven wells located near Horn Pond south of Salem Street. These wells are located in a different aquifer from Wells G & H and are not affected by contamination present in the study area. Local records indicate that the water from Wells G & H exhibited high concentrations of manganese and iron, which resulted in unpleasant taste and odor. Prompted by citizens' complaints concerning water quality, and in order to meet anticipated increased demand for water, the City of Woburn examined the feasibility of treating the water in 1974 (NUS, 1985). However, treatment was not implemented.

On May 4, 1979, 184 55-gallon drums containing polyurethane and toluene diisocyanate were found on a vacant lot located on Mishawum Road on property owned by the Massachusetts Bay Transit Authority (MBTA). The drums were removed by unknown parties during negotiations with the Massachusetts Department of Environmental Quality Engineering (DEQE) over removal of these drums. This incident prompted DEQE to sample the nearest downgradient water supply, Woburn's municipal water supply from Wells G & H, as a precautionary measure.

Several chlorinated volatile organic compounds including 1,1,1-trichloroethane (1,1,1-TCA), trans-1,2-dichloroethene (trans-1,2-DCE), tetrachloroethene (TETRA), trichloroethene (TCE), chloroform, and trichlorotrifluoroethane were detected by DEQE in water from Wells G & H at concentrations ranging from 1 to 400 part per billion (ppb). (Note that the endings "ylene" and "ene" are equivalent such that trichloroethylene and trichloroethene are the same compound. Similarly,

tetrachloroethylene, also commonly called perchloroethylene or perc and tetrachloroethene are the same compound). Wells G & H were subsequently shut down on May 21, 1979, forcing the City of Woburn to use Metropolitan District Commission (MDC) water to supplement its public water supply. Currently, the MDC supplies approximately one third of the city's water needs (approximately two million gallons per day). The remainder, approximately four million gallons per day, is supplied by the Horn Pond well field (NUS, 1985).

During the mid to late 1970's, the local community became concerned over the incidence of childhood leukemia, particularly in the Pine Street area of east Woburn. After DEQE detected volatile organic contamination in Wells G & H in 1979, some members of the local community suspected that the incidence of leukemia was linked to the possible exposure to volatile organic chemicals through the Wells G & H water supply. The Massachusetts Department of Public Health (MDPH) began investigating the problem in December, 1979. A higher than expected rate of childhood leukemia was confirmed by the MDPH in April, 1980.

Upgradient of Wells G & H, another area of waste disposal (the Industriplex site) came to the attention of local, state, and federal officials in the 1970's, when the owner began developing a portion of the site (Ecology and Environment, 1982b). Filling and excavating activities created noxious odors which prompted citizen complaints.

The Industriplex site, located north of Interstate 95 (state route 128), has a long history of chemical manufacturing activity. Robert B. Eaton's Chemical Works produced chemicals for the textile, leather, and paper industries of New England since beginning operation in 1853. Merrimac Chemical Company purchased the property in 1863 and produced lead-arsenic pesticides, acids, trinitrotoluene (TNT), and various inorganic compounds. By 1929, Merrimac Chemical was one of the largest chemical manufacturers in the country (Ecology and Environment, 1982b). New England Chemical began animal hide glue manufacturing on the site in 1934. The firm was purchased by Consolidated Chemical Company in 1936 and was subsequently purchased by Stauffer Chemical Company in the late 1950's. By

December 31, 1968, the bulk of the property was sold to the Mark Phillips Trust which subsequently began development of an industrial park (Industriplex) on the site (Roux, 1983b).

Soils contaminated with heavy metals and arsenic exist on the Industriplex site. Volatile organic contamination consisting of benzene, methylene chloride, toluene, trichloroethene (TCE), carbon tetrachloride, 1,2-dichloroethane, and 1,1,1-trichloroethane (1,1,1-TCA) has been found in the groundwater beneath the site (Roux, 1983a). A Remedial Investigation/Feasibility Study (RI/FS) of the Industriplex site has been completed by Stauffer Chemical Company under a consent agreement with EPA and is currently undergoing EPA review.

As a result of the detected contamination at Wells G & H and disposal problems discovered at the Industriplex site, the previous FIT contractor, Ecology and Environment, Inc. (E & E), was directed by EPA to conduct a hydrogeologic investigation and groundwater quality evaluation of a ten square mile portion of East and North Woburn (Ecology & Environment, Inc, 1982b). The purpose of this investigation was to determine the extent and degree of contamination, and to identify the sources of contamination. Based on the direction of groundwater flow, areal extent of groundwater contamination, and Site Inspections of seventeen active and inactive facilities within the ten square mile area, E & E identified the general source areas for TCE, trans-1,2-DCE, 1,1,1-TCA, and TETRA detected at Wells G & H to be within a one square mile area surrounding the wells. The contamination at the Industriplex site was not linked with that found at Wells G & H. EPA developed a Hazard Ranking System (HRS) score for the Wells G & H site utilizing E & E's preliminary investigations and the analytical information provided by DEQE. The site was listed on the National Priorities List (NPL) on December 21, 1982.

In May, 1983, as a result of E & E's investigations, three administrative orders pursuant to Section 3013 of the Resource Conservation and Recovery Act (RCRA) were issued to W.R. Grace and Co., Inc. (Cryovac Division), UniFirst Corporation (formerly Interstate Uniform Services Corporation), and Beatrice Foods, Inc..

These orders required submittal of proposals by each company for the sampling, analysis, monitoring, and reporting that would address the problem of possible groundwater contamination on or emanating from their properties. Groundwater monitoring programs were subsequently inititated by the three companies, and included:

- Investigations (geophysical surveys, test pit excavation, monitoring well installation, groundwater sampling) conducted at the W.R. Grace site by GeoEnvironmental Consultants.

- Investigations (monitoring well installations, groundwater sampling) conducted at the UniFirst Corporation site by Environmental Research and Technology, Inc. (ERT).

- Investigations (review of historical aerial photographs, soil sampling, monitoring well installations, groundwater sampling, performance of an aquifer test) conducted at the Wildwood Conservation Corporation site (Beatrice Foods site) by Woodward-Clyde Consultants.

In 1982, EPA directed Camp, Dresser, & McKee (CDM) to prepare a Remedial Action Master Plan (RAMP) for the Wells G & H site. The RAMP's purpose was "to identify the type, scope and sequence of activities to identify and implement a remedial action(s) to mitigate the effects of the contaminants in East Woburn" (Camp, Dresser, & McKee, 1983).

In May, 1982, a number of citizens whose children had developed leukemia filed a civil lawsuit against two companies (W.R. Grace/Cryovac Division and Beatrice Foods) suspected of contributing contamination to Wells G & H. In April, 1985, the same citizen's group brought civil lawsuits against a third company: UniFirst Corporation. The civil lawsuits brought against the first two companies in 1982 was recently settled out of court following part of what was planned as a three part trial. The civil lawsuit filed against UniFirst Corporation was settled out of court in October, 1985.

Since the initiation of the NUS/FIT Remedial Investigation in 1984, additional work has been conducted in the study area. An Environmental Site Assessment of 60 Olympia Avenue was conducted by Goldberg-Zoino and Associates (GZA), Inc. (Newton Falls, Massachusetts) for Juniper Development Group (Winchester, Massachusetts) in February, 1985. EPA conducted additional soil sampling on Juniper Development Group property in September, 1985. In the fall of 1985, EPA, through a cooperative agreement with the USGS, also designed and implemented an aquifer test of Wells G & H which included installation of groundwater monitoring wells.

A description of other studies conducted in the Remedial Investigation study area follows and is also summarized in Table 2-1. Locations of other studies are depicted in Figure 2-1. The studies conducted in North Woburn will be evaluated as they pertain to the Wells G & H aquifer area which is located downgradient of the Industriplex site.

Data collected by parties other than NUS/FIT underwent a limited quality control review (data validation) by either GCA of Bedford, Massachusetts (an EPA contractor) or by the Environmental Services Division of EPA. As the analyses were not conducted according to all EPA Contract Laboratory Program (CLP) requirements, a complete validation was not possible. In addition, this report does not address whether proper sampling plans, procedures or quality control were employed in collection of these samples, nor does it address the integrity of the sampling points themselves.

2.1 Investigations Conducted in North Woburn by Roux Associates for Stauffer Chemical Company

As previously discussed, North Woburn has a long history of chemical manufacturing and hazardous waste disposal. There are various waste disposal problems in North Woburn including: chromium and arsenic pits, decaying animal hide piles, heavy metal contamination, and groundwater contamination by volatile organic compounds. In general, metals tend to adsorb onto soil organic matter and

TABLE 2-1

SUMMARY OF PREVIOUS STUDIES

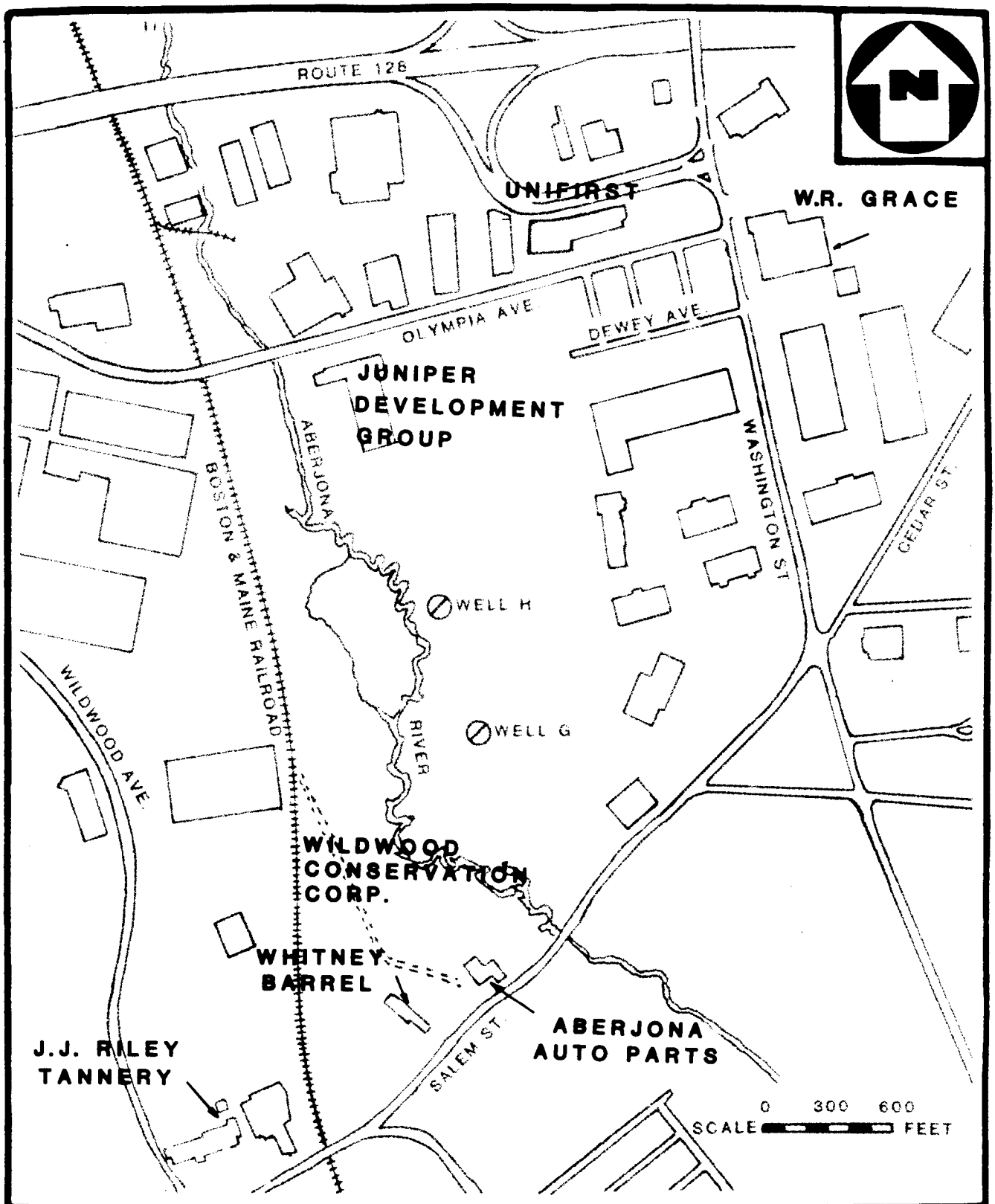
Date of Study	Conducted by	Objectives	Results/Conclusions
1980	Ecology & Environment (for EPA)	To conduct a Site Inspection (SI) of Aberjona Auto Parts.	Aberjona Auto Parts purchases wrecked autos, used autos and auto parts for reconditioning and resale. The operation uses a degreasing chemical and stores waste oil and transmission fluid in an underground tank.
1980	Ecology & Environment (for EPA)	To conduct a Site Inspection of John J. Riley Company	The John J. Riley Company consists of a tannery and an additional unused parcel of land. The unused property contained miscellaneous debris, empty oil tanks and rusted 55 gallon drums.
1980	Ecology & Environment (for EPA)	To conduct a Site Inspection of the Whitney Barrel Company	The Whitney Barrel Company reconditions drums, boiler tanks, and machinery, mainly from the food industry. The SI noted poor housekeeping with numerous containers stacked three to four containers high. Empty drums with labels for malathion, acrylic lacquer thinner, and methylene chloride were documented. A full drum of trichloroisocyanuric acid was found on site.
1981-1982	Ecology & Environment (for EPA)	Define extent and degree of contamination in North and East Woburn.	Major groundwater problem within study area was widespread. Contamination by chlorinated volatile organic compounds.
1983	Camp, Dresser & Mckee (for EPA)	To develop a Remedial Action Master Plan for the Well G&H site.	The RAMP reviewed potential application of various pump and treat technologies to Wells G&H, and proposed a Remedial Investigation.

TABLE 2-1
SUMMARY OF PREVIOUS STUDIES
PAGE TWO

Date of Study	Conducted by	Objectives	Results/Conclusions
1983-1985	GeoEnvironmental Consultants (for W.R. Grace/Cryovac Division)	Evaluate extent and degree of possible contamination on or emanating from W.R. Grace/Cryovac Division's property.	Onsite volatile organic groundwater contamination was detected. Buried drums were excavated and sampled. The contents of the drums contained volatile organic compounds.
1984-1985	Woodward-Clyde Consultants (for Beatrice Foods)	Evaluate extent and degree of possible groundwater contamination on or emanating from the Beatrice Foods site.	Onsite shallow overburden volatile organic groundwater contamination was detected. Soil contamination by volatile organic compounds was also detected. Aerial photography documented use of the property for storage of drums, tanks and miscellaneous debris.
1984	Environmental Research & Technology (for UniFirst)	To determine if a source of tetrachloroethene groundwater contamination existed upgradient of the UniFirst facility.	No upgradient source of tetrachloroethene groundwater contamination was detected.
1982-1985	Roux Associates (for Stauffer Chemical Company)	To determine extent and degree of contamination at the Industriplex site, North Woburn.	Volatile organic contamination of groundwater was detected. Surficial deposits of metals were also detected.
1985	Goldberg-Zoino and Associates (for Juniper Development Group)	Site assessment of 60 Olympia Avenue pursuant to Massachusetts General Laws 21E	Volatile organic contamination of groundwater by suspected gasoline constituents. High concentrations of a pesticide and PCBs were detected in soils adjacent to some abandoned rusted drums.

TABLE 2-1
SUMMARY OF PREVIOUS STUDIES
PAGE THREE

Date of Study	Conducted by	Objectives	Results/Conclusions
1985	EPA	Sampling of contents and soils surrounding abandoned drums on Juniper Development Group property.	Soil contamination by volatile organic compounds, pesticides, and PCBs.



SITE MAP
WELLS G AND H
WOBURN, MA

NUS CORPORATION
A Halliburton Company

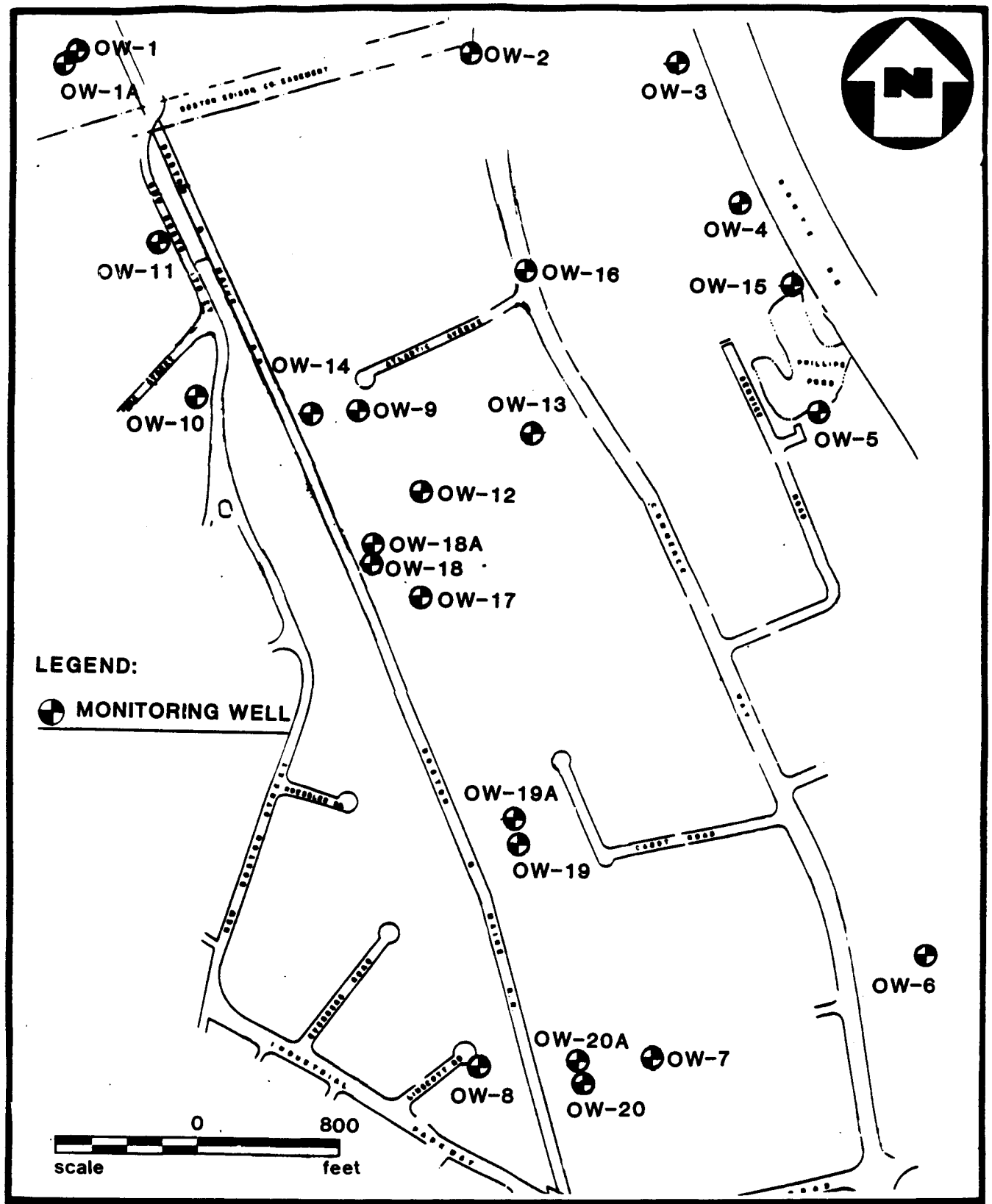
FIGURE 2-1

do not tend to migrate to groundwater. This has been demonstrated in North Woburn, where the waste disposal associated with metals is localized and has not migrated beyond the disposal areas. The metal waste problems are not expected to affect the Wells G & H site. However, volatile organic compounds in groundwater would tend to migrate downgradient towards Wells G & H (if no remedial action is taken) and could affect the site.

Roux Associates have conducted a hydrogeologic study of the Industriplex site in North Woburn for the Stauffer Chemical Company. Their work included (but was not limited to) the following: installation of twenty-four groundwater monitoring wells, an electrical conductivity survey, a soil boring program, and extensive sampling and chemical analysis (Roux, 1983a and 1984). The Industriplex site and the location of the Roux Associates' monitoring wells are depicted in Figure 2-2.

Roux Associates reported in 1982 that groundwater samples collected from five of the original fifteen monitoring wells contained concentrations of metals exceeding National Interim Primary Drinking Water Regulations Maximum Contaminant Levels (MCLS). In 1983, eight of the now twenty-four monitoring wells contained metals (arsenic, lead, zinc) in concentrations exceeding drinking water standards. Roux Associates concluded that the contamination was sporadic, and therefore did not indicate a significant plume of metal contamination affecting groundwater.

Contamination has been found in groundwater at the Industriplex site. Of particular significance to the Wells G & H Remedial Investigation is the occurrence of the volatile organic compounds such as benzene, toluene, phenol, acetone, and methyl ethyl ketone (MEK). Benzene was found in wells OW-12 and OW-17 (see Figure 2-2 for locations) at 491 and 747 ppb; toluene in well OW-12 (177 ppb); phenol in wells OW-12 and OW-17 (236-453 ppb); and acetone and MEK in well OW-16 at 2,110 and 276 ppb respectively. No volatile organic compounds were detected at wells OW-19, OW-19A, OW-20, and OW-20A which are installed downgradient from the contaminant plume. Roux Associates concluded that the volatile organic plume was limited to an area somewhere between OW-17 and OW-19, but expected it to move downgradient rapidly and reach wells OW-19 and OW-19A in 1985 or shortly thereafter.



INDUSTRIPLEX STUDY AREA IN NORTH WOBURN

FIGURE FROM PHASE II INVESTIGATION REPORT MARCH 1984. PREPARED BY ROUX ASSOCIATES FOR STAUFFER CHEMICAL COMPANY

NUS CORPORATION
A Halliburton Company

FIGURE 2-2

2.2 Site Inspections and Field Investigations Conducted by Ecology and Environment

Numerous Site Inspections (SIs) were conducted by E & E within and near the study area. The SIs conducted within the study area included Whitney Barrel, Aberjona Auto Parts, and John J. Riley Tannery, and will be discussed in this section.

Brief summaries for each facility are provided as follows:

- The Whitney Barrel Company began operations in 1949 and is currently involved in reconditioning drums, boilers, tanks, and machinery, primarily from the food industry.

  All containers (from the food industry) were cleaned onsite, originally with a caustic soda and trisodium phosphate (TSP) solution and later with TSP only. The rinse water was discharged to the MDC sewer under a RCRA permit. Non-food industry containers were cleaned offsite. Whitney Barrel Co. also dealt in scrap metal and in reducing large containers or machinery into sections and selling them (Ecology and Environment, 1980c).

  The E & E Site Inspection conducted in 1980 at the Whitney Barrel Co. noted poor housekeeping with numerous containers onsite stacked three to four containers high, and numerous pieces of scrap machinery and equipment in various stages of deterioration. Empty drums with labels for malathion, acrylic lacquer thinner, and methylene chloride were documented. Mr. John Whitney, the site owner, claimed that these drums were cleaned prior to receipt. However, a full drum of trichloroisocyanuric acid was found onsite. A chemical odor was also noted during the inspection, although no readings above background levels were noted on an Organic Vapor Analyzer (OVA) (Ecology and Environment, 1980c).

- Aberjona Auto Parts purchases wrecked autos, used autos, and auto parts for reconditioning and eventual resale. The facility has been in operation for approximately 30 years. The operation uses a degreasing chemical (trade name ZEP) which is stored on site in drums. Auto parts are sprayed with ZEP and rinsed with water. The rinse water is collected in a grease pit which empties to the MDC sewer. Spent solution in the grease pit is sometimes picked up by Murphy Waste Oil for reprocessing. The site was formerly a gas station with two underground gasoline storage tanks located on the south side of the property. These were drained when gasoline sales were terminated. An additional 500-gallon underground tank located at the southeast corner of the garage stores waste oil and transmission fluid. The contents of the tank were periodically emptied by Murphy Waste Oil for processing and eventual resale as fuel oil (Ecology and Environment, 1980a).

- The John J. Riley Company consisted of a tannery and an additional undeveloped parcel of land. The tannery is located at 228 Salem Street and consists of two buildings (a process plant and offices), two defunct chromium lagoons, and piles of unprocessed hides located behind the process building. The chromium lagoons were located beyond the hide piles to the north of the facility and were last used in 1970 according to John J. Riley. The John J. Riley Company began operations in 1909 and was sold to Beatrice Foods, Inc. in 1978 when the John J. Riley Company became a division of Beatrice Foods. In 1983, John J. Riley again assumed ownership of the firm. In 1985, the tannery was sold to its employees which continued to operate as the John J. Riley Company. The undeveloped parcel of land was established as the Wildwood Conservation Corporation by John J. Riley at approximately the same time. Both the tannery and undeveloped parcel of land were the subject of the E & E Site Inspection (Ecology and Environment, 1980b). The undeveloped parcel of land came under further study by EPA during the time it was owned by Beatrice Foods, Inc.. The unused parcel of land will hereafter be referred to as the Wildwood Conservation Corporation site (Plate 1).

The E & E Site Inspection Report, which focused primarily on the factory and land immediately surrounding the factory, noted the following:

- Chromium and benzidine dye wastes were disposed of in the lagoons, but this practice was halted and no evidence of recent use of the lagoons was found. The lagoons were located near the factory building.

- Sludge material from process sedimentation tanks was buried next to the lagoons.

- Except for the location of the second production well (S46), John J. Riley claimed the property located northeast of his facility was not utilized. However, according to an investigation by the DEQE, referenced in the Site Inspection Report, the undeveloped property contained miscellaneous debris, empty oil tanks, and several piles of new and rusted 55-gallon drums.

- The E & E Site Inspection also noted drums and debris on the unused property in addition to numerous pesticide container caps.

- In 1970, 200 to 500 five-gallon drums of arsenic trioxide were found just north of the undeveloped parcel of land. The drums were subsequently removed shortly after they were found. Initially, E & E thought this property was owned by John J. Riley but upon further investigation found it was owned by Hemingway Trucking Company (Ecology and Environment, 1980b).

- E & E was also directed by EPA to conduct a hydrogeologic field investigation and groundwater quality evaluation of a ten square mile portion of East and North Woburn (Figure 1-1). The investigation included a seismic refraction survey (a geophysical method used to determine depth to bedrock), installation of groundwater monitoring wells, development of a bedrock surface contour map and a water table contour

map, development of geologic cross-sections, and groundwater sampling and analysis. The objective of the field investigation was to define the extent and degree of groundwater contamination in north and east Woburn. The results of the study were presented in a number of interim and draft reports. This discussion will focus on the final reports entitled: "Evaluation of the Hydrogeology and Groundwater Quality of East and North Woburn, Massachusetts, 25 June 1982, TDD No. F1-8109-02" and "Chlorinated Solvent Contamination of the Groundwater, East Central Woburn, Massachusetts, 8 March 1982, TDD No. F1-8203-01" (Ecology and Environment, 1982a and 1982b). The following discussion will emphasize those results pertinent to the NUS/FIT Remedial Investigation study area.

In 1980, E & E inventoried forty municipal, industrial and private wells in the East Central Woburn study area. E & E augmented that number with the installation of twenty-two monitoring wells in 1981. These sixty two wells were designated "S" wells. Wells installed by E & E were numbered S1 to S22. The municipal, industrial and private wells were assigned numbers S23 through S62, respectively. This numbering system has been retained in the NUS/FIT Remedial Investigation. Note that dashes have been incorporated into these and other well numbers (e.g. S-1) when presenting analytical data. E & E obtained groundwater samples from all the newly installed wells (S1 through S22). Groundwater samples were also drawn from the pre-existing wells wherever feasible.

E & E's work revealed that the major groundwater problem within the study area was contamination by chlorinated volatile organic compounds. The volatile compounds found in highest concentration were TCE; trans-1,2-DCE; 1,1,1-TCA; and TETRA. The highest concentrations (>300 ppb) of TCE and trans-1,2-DCE were detected at monitoring well S21 (West Cummings Park) and well S46 (John J. Riley's production well no. 2) located on the undeveloped parcel of land later to be known as the Wildwood Conservation Corporation site (Beatrice Foods site) (Plate 2). Well S46 also contained high levels of 1,1,1-TCA (100 to 200 ppb). High levels of TETRA (>200 ppb) were detected at Well S6, north of Wells G & H.

E & E identified potential source areas for the release of these compounds based on information concerning historic use of the compounds by industries in the area upgradient of the contaminated groundwater monitoring wells. E & E suggested that the source of TCE and trans-1,2-DCE contamination at well S21 (located alongside the 200 West Cummings Park building) was to the north or northeast. Similarly, E & E found that hydrogeologic data indicated the source of TETRA contamination at well S6, located approximately 1,700 feet north of Well H, to be to the north or northeast. Lack of sufficient hydrologic data precluded any suggestion of source direction at John J. Riley Production Well No. 2 (S46) which is located approximately 1,000 feet southwest of Well G.

2.3 Draft Remedial Action Master Plan for East Woburn Prepared by Camp, Dresser, & McKee (CDM)

The Draft Remedial Action Master Plan (RAMP) was prepared by Camp, Dresser, & McKee (CDM) under contract to the EPA. Its purpose was "to identify the type, scope and sequence of activities to identify and implement a remedial action(s) to mitigate the effects of the contaminants in East Woburn" (Camp, Dresser & McKee, 1983). This provided a draft work statement for the initiation of work and was developed from existing information including: Industriplex studies, a hydrologic study of the Mystic River watershed which includes the Aberjona River, an urban runoff program case study in the Upper Mystic Lake watershed prepared for DEQE, and E & E's hydrogeologic study of the area.

The RAMP identified volatile organic contamination of groundwater to be the primary problem in the area now delineated as the NUS/FIT study area. CDM's RAMP suggested that the Aberjona River may contribute to the contamination found in Wells G & H. The RAMP also suggested that the sewer lines could represent an additional source of contamination. However, an Infiltration/Inflow Study conducted by Whitman and Howard, Inc. in November, 1983 demonstrated that a strong gradient exists into the sewer line except at times of peak rainfall when overflowing can occur at various manholes (Whitman and Howard, 1983). This finding suggests that the sewer line would not be a likely source of groundwater contamination.

The RAMP reviewed the potential application of various pump and treat technologies to the site and proposed that a Remedial Investigation and a Community Relations Plan be prepared.

2.4 Investigations Conducted at W.R. Grace

W.R. Grace's (Cryovac Division) facility, located in the northeastern portion of the study area (Figure 2-1), is a manufacturer of food wrapping equipment. Solvents such as trichloroethene (TCE) are used at the facility as degreasing agents.

In response to an EPA Administrative Order, GeoEnvironmental Consultants (GeoEnvironmental) under contract to W.R. Grace's attorneys submitted a proposal to EPA and DEQE consisting of three phases: Phase I - geophysical surveys; Phase II - installation of groundwater monitoring wells and groundwater sampling; and Phase III - controlled excavation, sampling and removal of material from a resulting pit area east of the Cryovac facility where disposal of paint sludges occurred (GeoEnvironmental, 1983).

Geophysical work conducted in Phase I consisted of magnetometry and resistivity surveys conducted by International Exploration, Inc. in April, 1983. A magnetometry survey was conducted to locate areas of stronger magnetic readings (anomalies) than the general background readings. These stronger readings can be indicative of buried ferrous metals (i.e., drums). Some such anomalies were detected on the facility property. One area in particular showed strong anomalous readings. This data was used to determine the area for the subsequent excavation.

In June, 1983, six drums were unearthed in the area of these anomalous magnetic readings; two contained a small amount of liquid, two contained dried paint residue, and two were empty. Aqueous samples were collected by GeoEnvironmental from two of the drums, and soil and water samples were collected from the bottom of the excavation pit. Split samples were collected by

NUS/FIT. Table 2-2 summarizes analytical results for samples collected by GeoEnvironmental and split samples collected by NUS/FIT. Elevated levels of ethylbenzene (849 ppb), methylene chloride (4,510 ppb), toluene (25,900 ppb), trans-1,2-DCE (9,830 ppb), TCE (105,00 ppb), and vinyl chloride (1,080 ppb) were detected by GeoEnvironmental in one of the aqueous samples from an excavated drum. Volatile organic and extractable organic compounds were detected in the soil samples collected from the excavation area.

A resistivity profile conducted at the W.R. Grace facility property indicated depths to bedrock of 10 to 62 feet below ground surface. In the resistivity method, an electric current is introduced to the ground. Electrical properties inherent to the consolidated and unconsolidated deposits result in changes in electrical resistivity. The depth at which these changes occur are inferred to be the bedrock/overburden interface. During Phase II, the depth to bedrock estimates were significantly revised after evaluation of borehole data collected during the installation of fourteen groundwater monitoring wells by GeoEnvironmental at seven locations in June, 1983.

Fourteen groundwater monitoring wells were installed by GeoEnvironmental at seven locations in June, 1983. Each location typically consisted of one well screened in overburden (two at location No. 2) and an adjacent well screened in the first twenty feet of bedrock. Groundwater monitoring wells installed by GeoEnvironmental for W.R. Grace are denoted in this report with either a GW (onsite wells) or GO (offsite wells). W.R. Grace onsite well locations are depicted on Figure 2-3. A shallow six inch diameter monitoring/recovery well was installed at location No. 6 in the pit area. The logs for these wells are presented in Appendix B.

Twelve additional groundwater monitoring wells were installed by GeoEnvironmental in September and October, 1984 onsite and offsite. Some of these wells were installed at new locations onsite and others were additional bedrock wells installed approximately 90 feet into rock at previous well locations. The offsite well GO1 cluster consists of an overburden, shallow bedrock (twenty

TABLE 2-2
ANALYTICAL RESULTS
GEOENVIRONMENTAL
VERSUS NUS/FIT SPLIT SAMPLES
COLLECTED AT W.R. GRACE
JUNE 1983

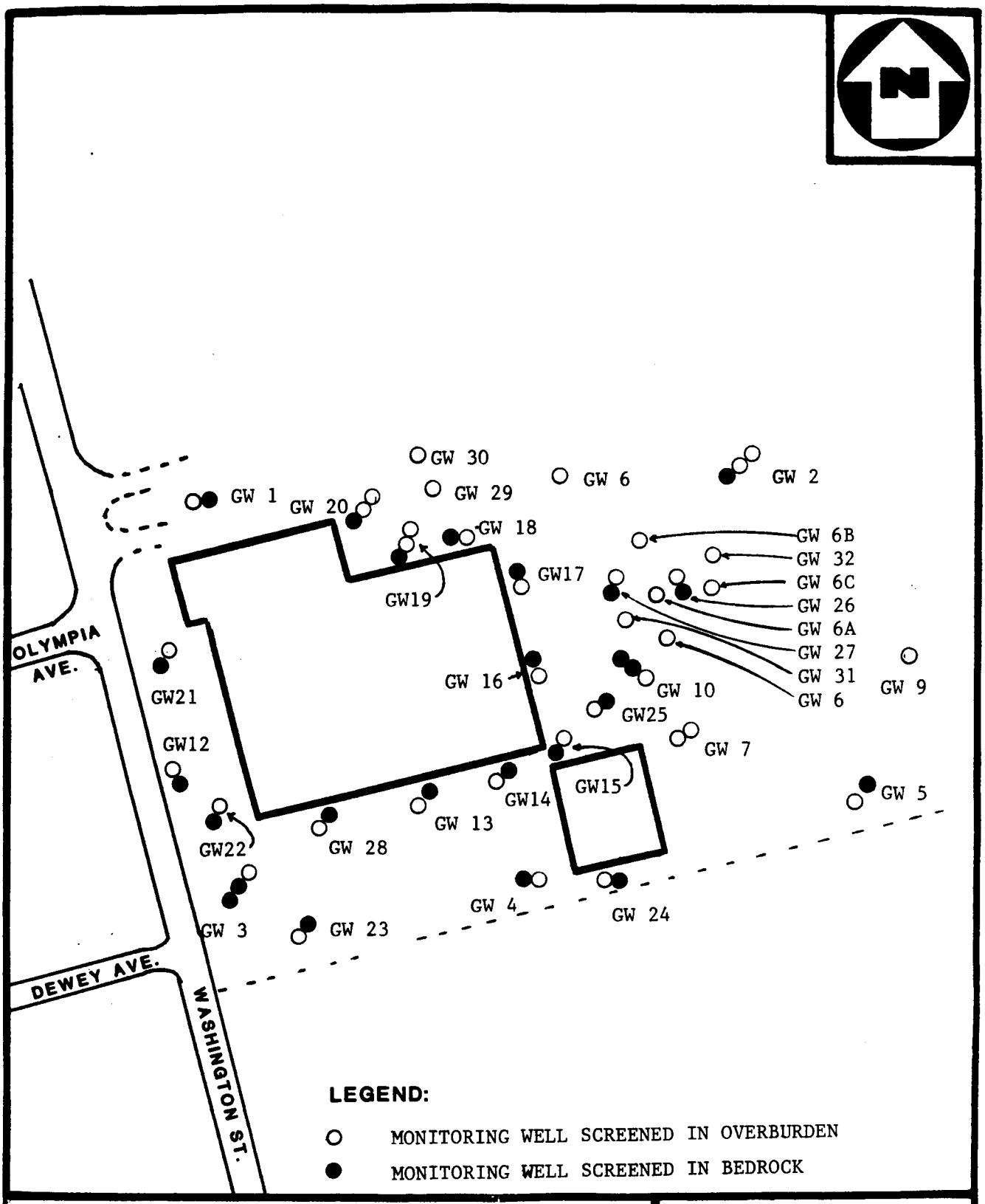
Volatile Compounds	Trench Water (ppb)		Trench Soil (ppb)		Drum #1 (ppb)		Drum #6 (ppb)	
	GEO	NUS	GEO	NUS	GEO	NUS	GEO	NUS
1,1,1-Trichloroethane	-	-	BDL	-	-	-	-	-
1,1-Dichloroethene	-	-	-	-	-	-	BDL	-
Methyl chloride	-	-	-	-	-	-	BDL	-
Tetrachloroethene	-	-	-	-	-	-	BDL	-
Ethylbenzene	81J	36J	-	-	849J	3500J	293J	1030J
Methylene chloride	11J	224J	1960J	28	4510J	4287J	123J	173J
Toluene	-	-	-	10	25900J	22200J	127J	38764J
Trans-1,2-dichloroethene	BDL	-	-	-	9830J	8230J	360J	272J
Trichloroethene	BDL	-	-	-	105000J	170200J	126J	152J
Trichlorofluoromethane	24J	-	BDL	-	-	-	BDL	-
Vinyl Chloride	BDL	-	-	-	1080J	859J	BDL	-
Chloroform	-	-	-	BDL	-	48J	-	-
Acetone	NA	-	NA	-	NA	83197J	NA	1399J
2-Hexanone	NA	26	NA	-	NA	352200J	NA	152
4-ethyl-2 pentanone	NA	22	NA	-	NA	260400J	NA	1070J
O-xylene	NA	148	NA	-	NA	6790J	NA	3460J
2-butanone	NA	-	NA	-	NA	5820J	NA	-
Carbon disulfide	NA	-	NA	-	NA	289J	NA	-
Styrene	NA	-	NA	-	NA	-	NA	134J
Acid Compounds								
Benzoic acid	NA	-	NA	-	NA	1000J	NA	BDL
2,4-Dimethylphenol	*	-	*	-	*	-	*	27J
Phenol	*	-	*	-	*	-	*	BDL
2-Methylphenol	NA	-	NA	-	NA	-	NA	56J
4-Methylphenol	NA	-	NA	-	NA	-	NA	26J
Base/Neutral Compounds								
Isophorone	*	-	*	-	-	NA	*	-
Naphthalene	*	100J	*	-	NA	170J	*	63J
2-Methylnaphthalene	NA	142J	NA	-	NA	-	NA	-
di-n-butyl phthalate	*	581J	*	224	*	498J	*	-
Bis(2-ethylhexyl)phthalate	*	-	*	-	*	-	*	BDL
Benzyl alcohol	NA	-	NA	-	NA	200J	NA	-
Diethyl phthalate	*	-	*	-	*	-	*	-
Pesticide Compounds	*	-	*	-	*	-	*	-

TABLE 2-2
ANALYTICAL RESULTS
GEOENVIRONMENTAL
VERSUS NUS/FIT SPLIT SAMPLES
COLLECTED AT W.R. GRACE
PAGE TWO

Metals, Cyanide, Phenols	Trench Water (ppb)		Trench Soil (ppb)		Drum #1 (ppb)		Drum #6 (ppb)	
	GEO	NUS	GEO	NUS	GEO	NUS	GEO	NUS
Arsenic	*	10	*	15	NA	16	NA	16
Chromium	*	-	*	10	NA	-	NA	-
Copper	*	-	*	20	NA	-	NA	-
Nickel	*	-	*	11	NA	-	NA	130
Zinc	*	57	*	64	NA	12900	NA	369000
Aluminum	NA	5940	NA	4980	NA	11700	NA	11400
Barium	NA	-	NA	23	NA	120	NA	230
Beryllium	*	-	*	0.3	*	-	*	6
Cobalt	NA	-	NA	4.7	NA	160	NA	360
Iron	NA	7570	NA	9290	NA	21700	NA	23000
Manganese	NA	530	NA	110	NA	430	NA	4170
Boron	NA	-	NA	-	NA	-	NA	-
Vanadium	NA	-	NA	17	NA	-	NA	-
Silver	*	-	*	-	*	-	*	-
Antimony	*	-	*	-	*	-	*	-
Selenium	*	-	*	-	*	-	*	-
Thallium	*	-	*	-	*	-	*	-
Mercury	*	0.2	*	-	*	-	*	1.5
Tin	NA	-	NA	-	NA	52	NA	-
Cadmium	*	-	*	-	*	1.2	*	14
Lead	*	9	*	4.3	*	180	*	710
Cyanide, Total	*	NA	*	NA	NA	NA	NA	NA
Phenols, Total	*	NA	*	NA	NA	NA	NA	NA

GEO - Data from GeoEnvironmental's Interim Report, August 1983.
\- - Not detected
BDL - Below detection limit (trace amounts)
NA - Not analyzed for
J - Quantitation is approximate due to quality control review (data validation)
* - Value is rejected due to quality control review

Note: NUS/FIT samples were analyzed for all compounds on the Hazardous Substance List (see Appendix D for a complete list of compounds). Those compounds not listed were not detected.



WELL LOCATIONS

W.R. GRACE SITE

WOBURN, MA

NUS CORPORATION

A Halliburton Company

FIGURE 2-3

feet into rock), and deeper bedrock well (50 feet into rock). In the fall of 1985, 37 additional wells were installed at 20 new locations on the property. Additional test pit excavation was conducted which will be discussed in Part II of the Remedial Investigation (source area characterization). Well logs for W.R. Grace wells are presented in Appendix B.

Numerous rounds of groundwater sampling for volatile organic contaminants were conducted by GeoEnvironmental between June, 1983 and December, 1985. The results are presented in Appendix C (Tables 1 and 2).

Based on GeoEnvironmental's analytical results, little or no volatile organic contamination was detected at well locations GW1, GW2, GW5 and GW9. (Note that well numbers are denoted as GW-1, GW-2, etc. in presentation of analytical data). Samples collected from the remaining locations contained various levels of volatile organic contaminants: chloroform, methylene chloride, TETRA, trans-1,2-DCE, TCE, trichlorofluoromethane and vinyl chloride. These data will be further discussed in Chapter 5.0.

2.5 Investigations Conducted at Wildwood Conservation Corporation

Woodward-Clyde Consultants (WCC) was retained by the attorneys for Beatrice Foods, Inc. (Lowenstein, Sandler, Brochin, Kohl, Fisher, Boylan & Meanor) to conduct a hydrogeologic investigation of the Wildwood Conservation Corporation in response to an EPA administrative order pursuant to RCRA Section 3013. The property is located east of the John J. Riley Tannery operations on an undeveloped triangular piece of land encompassing approximately sixteen acres. Beatrice Foods, Inc. owned the property for only a brief period after purchasing it from John J. Riley in 1978. The land was subsequently sold back to John J. Riley and has recently been established as the Wildwood Conservation Corporation. The John J. Riley production well No. 1, an overburden well screened in the Aberjona aquifer, is located west of the Boston & Maine railroad tracks on the tannery property (Figure 2-1). During the E & E Field Investigation, TCE; trans-1,2-DCE; 1,1,1-TCA; and TETRA were detected in Well No. S46 (John J. Riley production well

no. 2), an overburden well located on the undeveloped 16 acre parcel east of the Boston and Maine railroad tracks. These findings prompted EPA to issue an administrative order pursuant to RCRA Section 3013 to Beatrice Foods, Inc. site owners at the time, to study the potential sources for the groundwater contamination found in Well S46.

The WCC investigations were conducted in two phases and included the following:

- Acquisition and review of historical aerial photography of John J. Riley property
- A soil boring program to determine the presence or absence of soil contamination
- Installation of groundwater monitoring wells and subsequent groundwater sampling and analysis
- Performance of an aquifer test

The objectives of WCC's investigations were to determine background water quality, to identify the probable source of contaminated groundwater at the Beatrice Foods site, and to determine whether past uncontrolled dumping at the Beatrice Foods site property contributed to the degradation of groundwater quality in the Aberjona River Valley (Woodward-Clyde, 1984a and 1984b).

Seven groundwater monitoring wells were installed by WCC in September, 1983, and four additional wells were installed in July, 1984. In this report, groundwater monitoring wells installed by Woodward-Clyde Consultants for Beatrice Foods, Inc. are denoted as BW (Beatrice well overburden) and BSW (Beatrice shallow overburden well), or BSSW (Beatrice well located at or near the water table) (Figure 2-4). The wells were screened at various depths in the forty feet of overburden. The well logs for these wells are presented in Appendix B. Nine soil borings were advanced in Phase I. Soil samples collected from these borings as

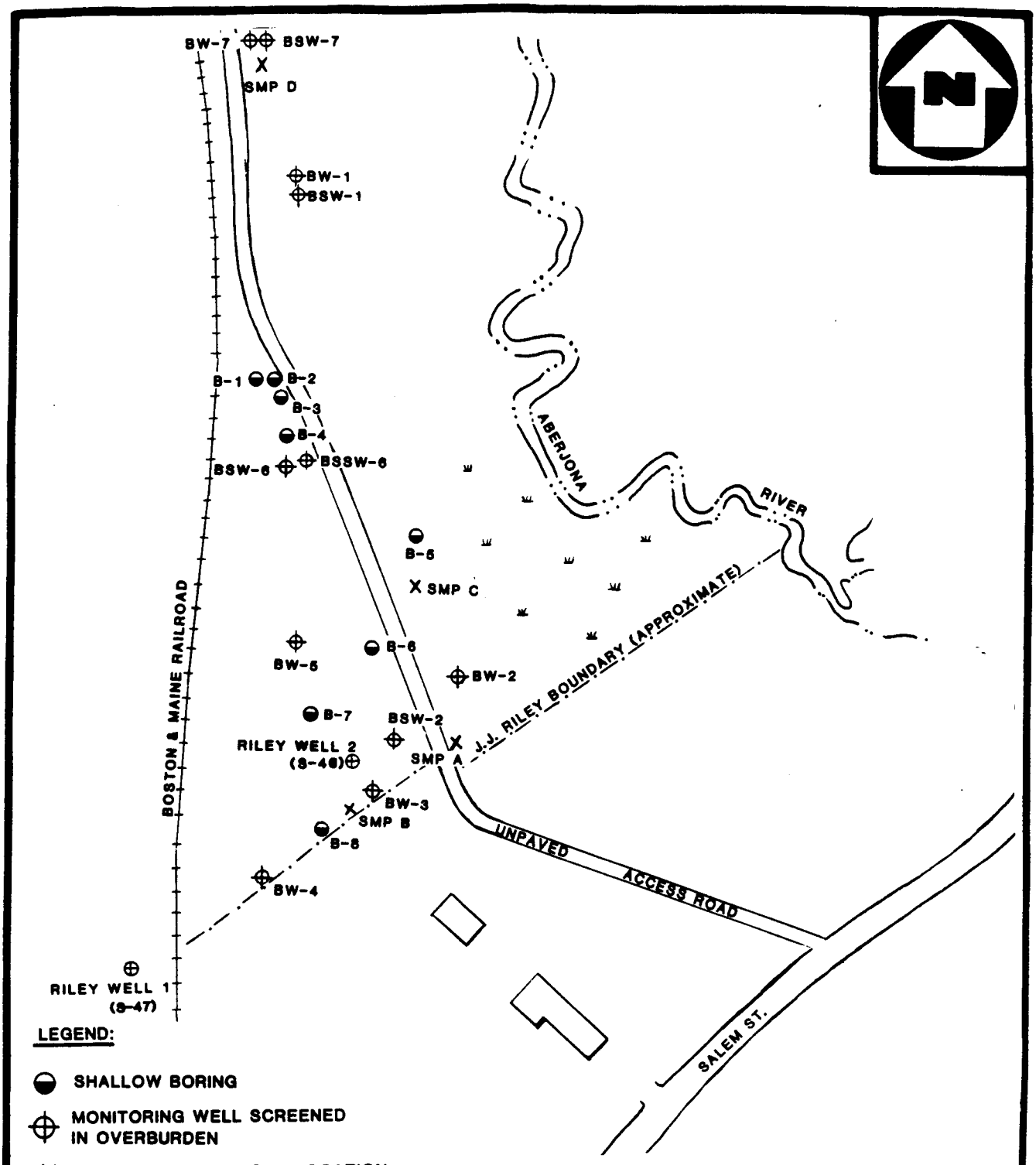


FIGURE TAKEN FROM PHASE II GROUNDWATER INVESTIGATION, J. J. RILEY SITE, WOBURN, MA NOVEMBER 2, 1984 PREPARED BY WOODWARD-CLYDE CONSULTANTS FOR LOWENSTEIN, SANDLER, BROCHIN, KOHL, FISHER, BOYLAR AND MEANOR.

SCALE 125 0 125 250 FEET

WOODWARD-CLYDE WELL AND SAMPLING LOCATIONS WILDWOOD CONSERVATION CORP. WOBURN, MA

NUS CORPORATION
A Halliburton Company

FIGURE 2-4

well as surface and subsurface soil samples collected during Phase II were analyzed for 1,1,1-TCA, trans-1,2-DCE, methylene chloride, TETRA, and TCE. Groundwater samples were also analyzed for these selected volatile organic compounds.

Figure 2-4 depicts the locations of WCC's groundwater monitoring wells, test borings and surface soil samples. Table 2-3 summarizes Phase I soil boring analytical data and Table 2-4 summarizes Phase II sampling data. The data demonstrate that surface and subsurface volatile contamination of soils exists on site. The highest concentration of contamination was 46,000 ppb of 1,1,1-TCA for surface soils (less than 6" deep) and 4,900 ppb of TCE for surface soils.

Groundwater contamination by volatile organic compounds is evidenced at most of WCC's wells, with the highest concentrations at wells BSSW6 and BSW6. All volatile organic samples were analyzed by Measurement Sciences Corporation according to EPA Method 601. The analytical results were used in comparison with NUS/FIT data analyzed by an EPA contract laboratory, to develop a reliable data base for the writing of this report.

WCC conducted a fifteen hour aquifer test by pumping the John J. Riley Production Well No. 2 (S46) at a rate between 570 to 770 gpm in July, 1984. S46 is a 24 inch diameter industrial well screened from 41 feet to 51 feet below ground surface in a sand and gravel stratum of the Aberjona aquifer. A cone of depression was reported to extend eastward to well BW2, northward to well BW6, westward to well BW4, and southward to well BW3. WCC concluded that the groundwater beneath the Wildwood Conservation Corporation site is captured by the production well. They further suggested that the Aberjona River and the adjacent swamp are recharge boundaries and that a cone of depression from the Riley production well does not extend under the Aberjona River system (Woodward-Clyde Consultants, 1984b).

From a review of historic aerial photography (1966 to 1983), WCC suggested that the Beatrice Foods site had been used for storage of large tanks and perhaps drums

TABLE 2-3
PHASE I ANALYTICAL DATA FROM
SOIL BORING PROGRAM CONDUCTED
BY WOODWARD-CLYDE CONSULTANTS
AT THE WILDWOOD CONSERVATION CORPORATION SITE

Sample ID: Soil Sample #1 at B-7 #5 B-6
#2 B-8 #6 B-3
#3 B-4 #7 BSW-6
#4 B-5 #8 Surface Sample BW-3

ANALYTICAL PARAMETERS	#1	#2	#3	#4	#5	#6	#7	#8
				(ppb)				
Methylene Chloride	<10	<10	<10	<10	<10	<10	<10	<100
1,2-Dichloroethane	<10	<10	<10	<10	<10	<10	<10	<100
1,1,1-Trichloroethane	<5	<5	<5	<5	<5	<5	<5	<50
Trichloroethene	<5	<5	2100	<5	<5	<5	150	4900
Tetrachloroethene	<5	<5	20	<5	<5	<5	6	<50

Note: 1. Table taken Geohydrology and Groundwater Contamination, J.J. Riley Site, Woburn, Massachusetts, 31, January 1984 prepared by Woodward-Clyde Consultants for Lowenstein, Sandler, Brochin, Kohl, Fisher, Boylan & Meanor.

2. Woodward-Clyde refers to the Wildwood Conservation Corporation site (EPA site name) as the J.J. Riley Site (former owner).

TABLE 2-4
PHASE II ANALYTICAL DATA FROM GROUNDWATER AND SOIL SAMPLING CONDUCTED BY WOODWARD-CLYDE CONSULTANTS AT THE WILDWOOD CONSERVATION CORPORATION SITE

Sample	Date	Tetrachloro-ethene	Methylene-chloride	Trichloro-ethene	1,1,1-Tri-chloroethane	Trans-1,2-dichloroethene	Total analyzed volatile
Water (ppb)							
BSW-1	7/16	5.9	ND	270	3.5	ND	279.4
	7/30	1.6	ND	460	1.4	ND	463
BW-1	7/16	ND	ND	ND	trace	ND	trace
	7/30	ND	ND	ND	ND	ND	ND
BSW-2	7/16	ND	ND	1.0	ND	ND	1.0
	7/30	ND	ND	5.9	ND	ND	5.9
BW-2	7/30	ND	ND	300	ND	ND	300
BW-3	7/16	2.7	ND	15	33	23	73.7
	7/30	6.5	ND	53	41	30	130.5
BW-4	7/30	ND	ND	ND	ND	ND	ND
BW-5	7/16	ND	ND	190	33	ND	193.3
	7/30	ND	ND	340	1.0	ND	340.0
BSW-6	7/30	67	ND	1,900	2,500	2,500	6,967
BSSW-6	7/30	31	68	230,000	7,200	5,100	242,399
BSW-7	7/30	92	ND	650	ND	130	872
BW-7	7/30	ND	ND	120	ND	ND	120
Soils (ppb)							
SMP-A	7/25	36,000	580	18,000	46,000	21,000	121,580
SMP-B	7/27	ND	ND	36	ND	ND	36
SMP-C	7/27	ND	ND	ND	ND	ND	ND
SMP-D	7/27	ND	ND	ND	ND	ND	ND
Subsurface Soils (ppb)							
BSW-6 (5-7')	7/16	1.5	ND	170	ND	ND	171
BSW-7 (8-10')	7/25	ND	ND	ND	ND	ND	ND
BSW-7 (8-10')	7/25	ND	ND	ND	ND	ND	ND

Notes: 1. Table taken from Phase II Groundwater Investigation, J.J. Riley site, Woburn, Massachusetts, 2 November 1984 prepared by Woodward-Clyde Consultants for Lowenstein, Sandler, Brochin, Kohl, Fisher, Boylan and Meanor.

2. Woodward-Clyde refers to the Wildwood Conservation Corporation site (EPA site name) as the J.J. Riley Site (former owner).

3. ND - Not Detected

by the two companies located south of the property: Whitney Barrel Company and Murphy Waste Oil. The existing unpaved access road was evident in past aerial photographs as were additional trails leading from both the Whitney Barrel and Murphy Waste Oil properties. Greater use of these trails was apparent from 1966 to 1969 than in 1978 to 1983 (Woodward-Clyde, 1984a).

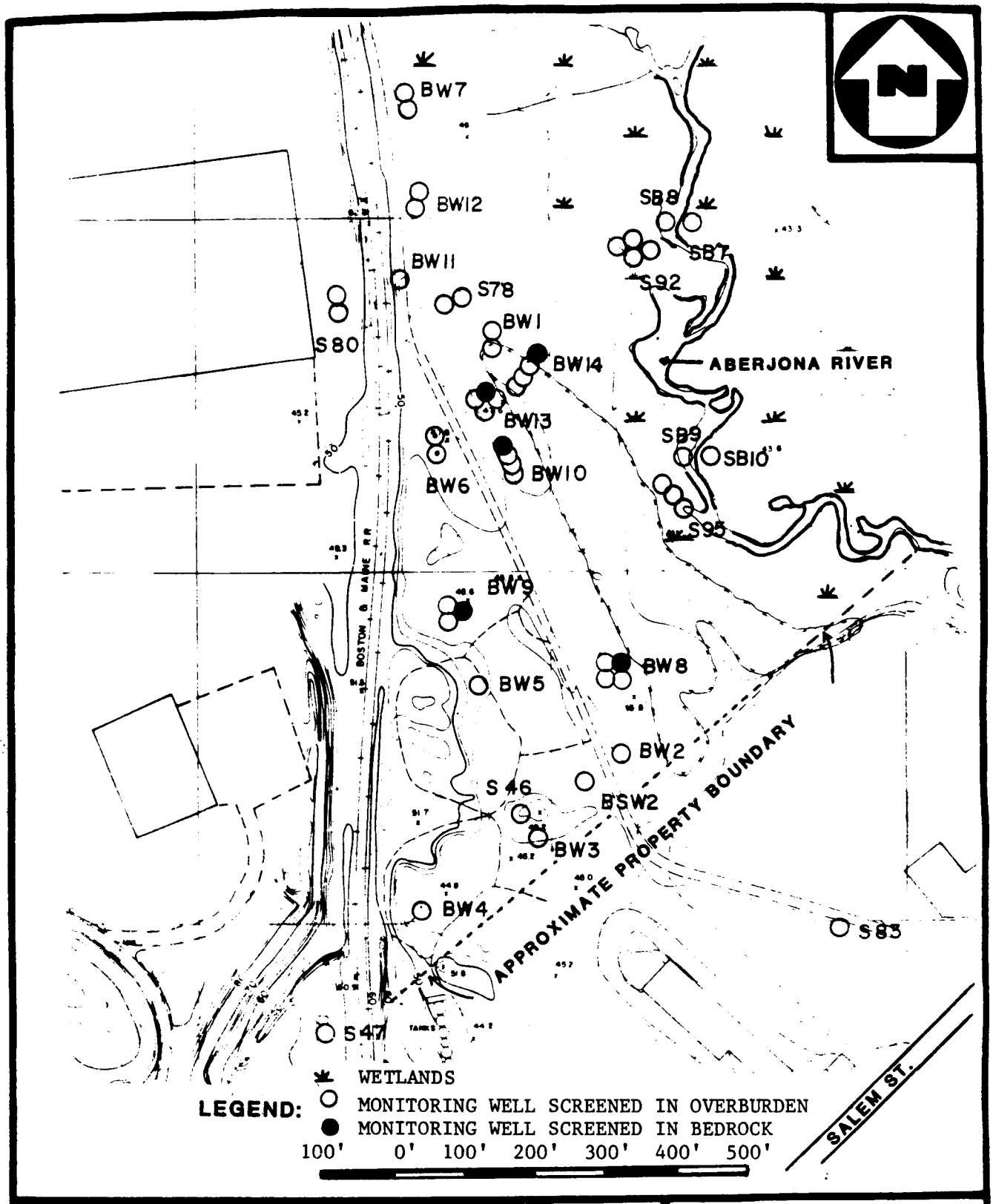
WCC concluded that groundwater contamination at the Beatrice Foods site was primarily due to onsite sources. WCC also suggested that additional offsite sources located north or west of the property may have also contributed groundwater contamination, however, they provided no evidence for this theory.

In the fall of 1985, additional groundwater monitoring wells were installed at eight locations (BW7 through BW14) by Weston Geophysical of Westboro, Massachusetts for Schlichtmann, Conway and Crowley (attorneys for the plaintiffs in the civil law suit against W.R. Grace and Beatrice Foods). Figure 2-5 depicts new well locations in relation to those wells installed by WCC. Each well location consists of two to four wells. The well logs to these wells are presented in Appendix B. Groundwater sampling was conducted of all wells by WCC in November, 1985. The samples were analyzed by ERCO Laboratories. The results are presented in Appendix C (Tables 3 and 4).

A number of volatile organic compounds were detected in these samples. The most prevalent and widespread contaminants were TCE, trans-1,2-DCE, 1,1,1-TCA, and 1,1-dichloroethane. High concentrations of contamination were detected at wells BSW6 (100,000 ppb TCE), BSSW6 (430,000 ppb TCE and 10,000 ppb 1,1,1-TCA), BSW9 (12,000 ppb TCE), BW13 (54,000 ppb TCE), and BW14 (54,000 TCE). These results will be discussed further in Chapter 5.0.

2.6 Investigations Conducted at UniFirst Corporation

Environmental Research and Technology (ERT) was contracted by UniFirst Corporation (formerly Interstate Uniform Corporation) to conduct an investigation in response to an administrative order issued by EPA in September, 1983. The



WELL LOCATIONS

WILDWOOD CONSERVATION CORP.

WOBURN, MA

NUS CORPORATION

A Halliburton Company

FIGURE 2-5

purpose of the investigation was to describe the historical development of the UniFirst site and to determine the potential of the UniFirst site as a source of tetrachloroethene (TETRA) contamination to well S6 located just west of the facility (ERT, 1984). UniFirst Corporation is a uniform service company that utilizes TETRA in its dry cleaning operation.

The consent order between EPA and UniFirst stipulated that UniFirst would determine whether a source of TETRA groundwater contamination existed upgradient of its facility. If levels of TETRA greater than 50 ppb were detected upgradient of the UniFirst site, no further investigation would be required by EPA. If levels less than 50 ppb were detected upgradient, UniFirst would be required by EPA to submit a plan for further investigation.

ERT installed seven groundwater monitoring wells at three locations upgradient of the UniFirst facility and well S6 between the Fall of 1984 and Spring 1985 (Figure 2-6). The well logs for these wells are presented in Appendix B. Volatile organic compounds were not detected by ERT or NUS/FIT in any of these wells (Table 2-5).

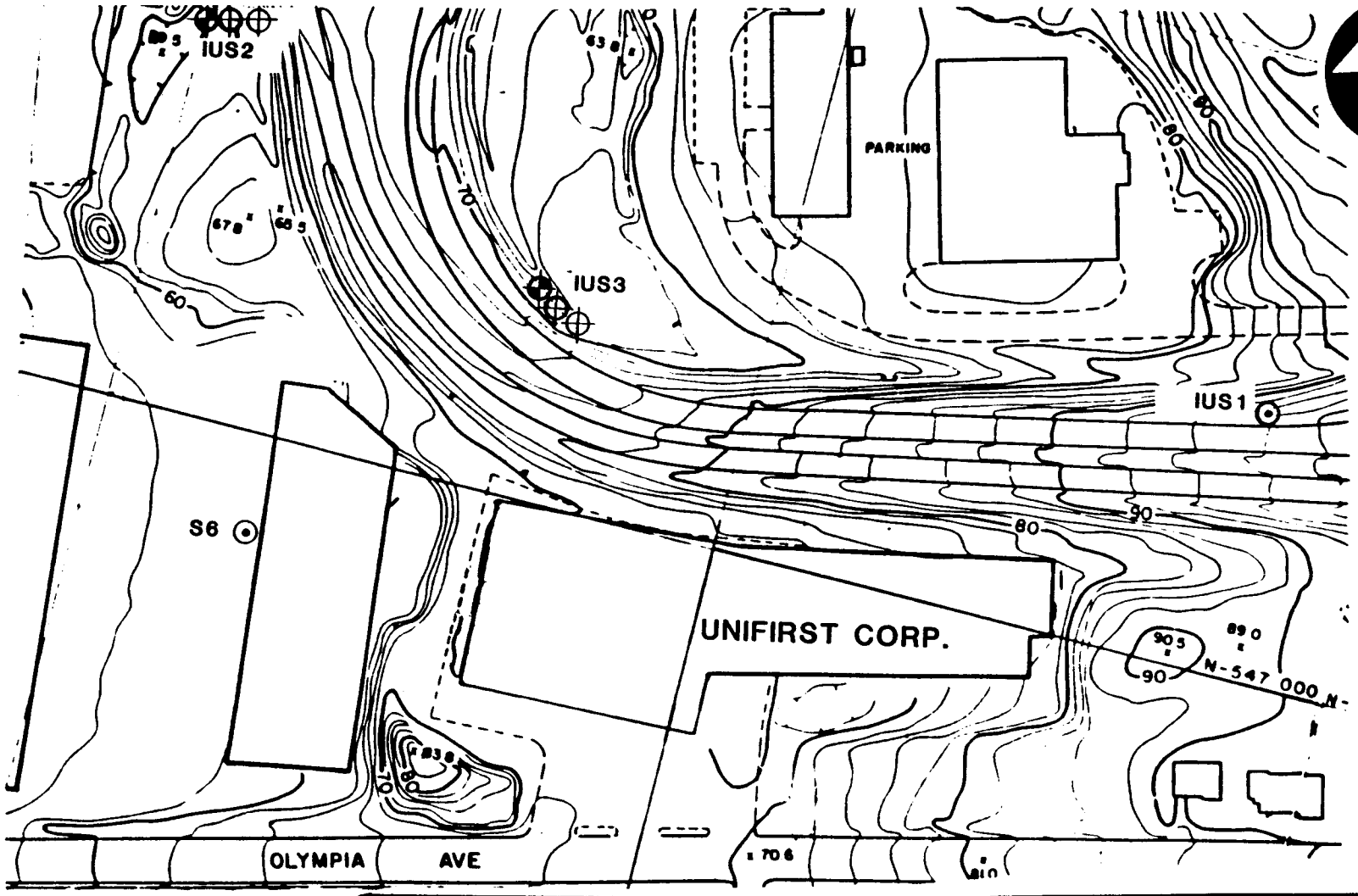
ERT described UniFirst's use and storage of TETRA as follows:

- five to six 55-gallon drums per year were used during 1966 to 1968 for their dry cleaning operation

- TETRA was stored in a 5,000 gallon above ground tank from 1977 to 1982 for transfer to tank trucks for distribution to other facilities.

- UniFirst officials reported only one significant spill in 1979 which was contained and cleaned up. UniFirst officials also contend that any spilled liquid would have ultimately been discharged to the municipal sewer.

- Waste water was discharged to the municipal sewer and still bottom waste (five gallons of diatomaceous earth filter medium per year containing 20%



LEGEND:

- BEDROCK WELL
- SHALLOW WELL
- WELL SCREENED IN OVERBURDEN AND BEDROCK

NUS CORPORATION

WELL LOCATIONS
UNIFIRST SITE
WOBURN, MA

FIGURE 2-6

TABLE 2-5
NUS/FIT VOLATILE ORGANIC ANALYTICAL RESULTS (PPB)
OF GROUNDWATER SAMPLES
MAY 1984

Sample Location		IUS-1D*	IUS-2S	IUS-2M	IUS-2D	IUS-3S	IUS-3M	IUS-3D
Sample Number			76856	76857	76854-55	76858	76861	76860
Traffic Report Number			A2752	A2753	A2750-51	A2754	1A2757	A2756
Volatile Compounds	CRDL							
Chloromethane	10	-	-	-	-	-	-	-
Bromomethane	10	-	-	-	-	-	-	-
Vinyl Chloride	10	-	-	-	-	-	-	-
Chloroethane	10	-	-	-	-	-	-	-
Methylene Chloride	5	-	-	-	-	-	-	-
Acetone	10	-	-	-	-	-	-	-
Carbon Disulfide	5	-	-	-	-	-	-	-
1,1-Dichloroethene	5	-	-	-	-	-	-	-
1,1-Dichloroethane	5	-	-	-	-	-	-	-
trans-1,2-Dichloroethene	5	-	-	-	-	-	-	-
Chloroform	5	-	-	-	-	-	-	-
1,2-Dichloroethane	5	-	-	-	-	-	-	-
2-Butanone	10	-	-	-	-	-	-	-
1,1,1-Trichloroethane	5	-	-	-	-	-	-	-
Carbon Tetrachloride	5	-	-	-	-	-	-	-
Vinyl Acetate	10	-	-	-	-	-	-	-
Bromodichloromethane	5	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	5	-	-	-	-	-	-	-
1,2-Dichloropropane	5	-	-	-	-	-	-	-
trans-1,3-Dichloropropane	5	-	-	-	-	-	-	-
Trichloroethene	5	-	-	-	-	-	-	-
Dibromochloromethane	5	-	-	-	-	-	-	-
1,1,2-Trichloroethane	5	-	-	-	-	-	-	-
Benzene	5	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	5	-	-	-	-	-	-	-
2-Chloroethylvinylether	10	-	-	-	-	-	-	-
Bromoform	5	-	-	-	-	-	-	-
2-Hexanone	10	-	-	-	-	-	-	-
4-Methyl-2-Pentanone	10	-	-	-	-	-	-	-
Tetrachloroethene	5	-	-	-	-	-	-	-
Toluene	5	-	-	-	-	-	-	-
Chlorobenzene	5	-	-	-	-	-	-	-
Ethylbenzene	5	-	-	-	-	-	-	-
Styrene	5	-	-	-	-	-	-	-
Total Xylenes	5	-	-	-	-	-	-	-

\- - Indicates the compound was not detected
CRDL - Contract Required Detection Limit
* - Analyzed by NUS/FIT screening techniques utilizing a Photovac 10A10 Gas Chromatograph

TETRA by weight) was stored in drums and transported to a municipal landfill for disposal, or disposed of in a dumpster which was removed by a commercial refuse hauler.

- No onsite disposal of waste was reported.

ERT concluded that the "potential is very low that the UniFirst site is the source of tetrachloroethene contamination in groundwater". ERT proposed that the contamination found at well S6 originates in bedrock and that other sources of contamination may exist in addition to or instead of UniFirst due to the presence of tetrachloroethene groundwater contamination in locations other than S6. ERT proposed that no further work be conducted at the site. Whether the contamination at well S6 originated in bedrock is undetermined, as the well is screened in both overburden and bedrock.

2.7 Juniper Development Group Investigation

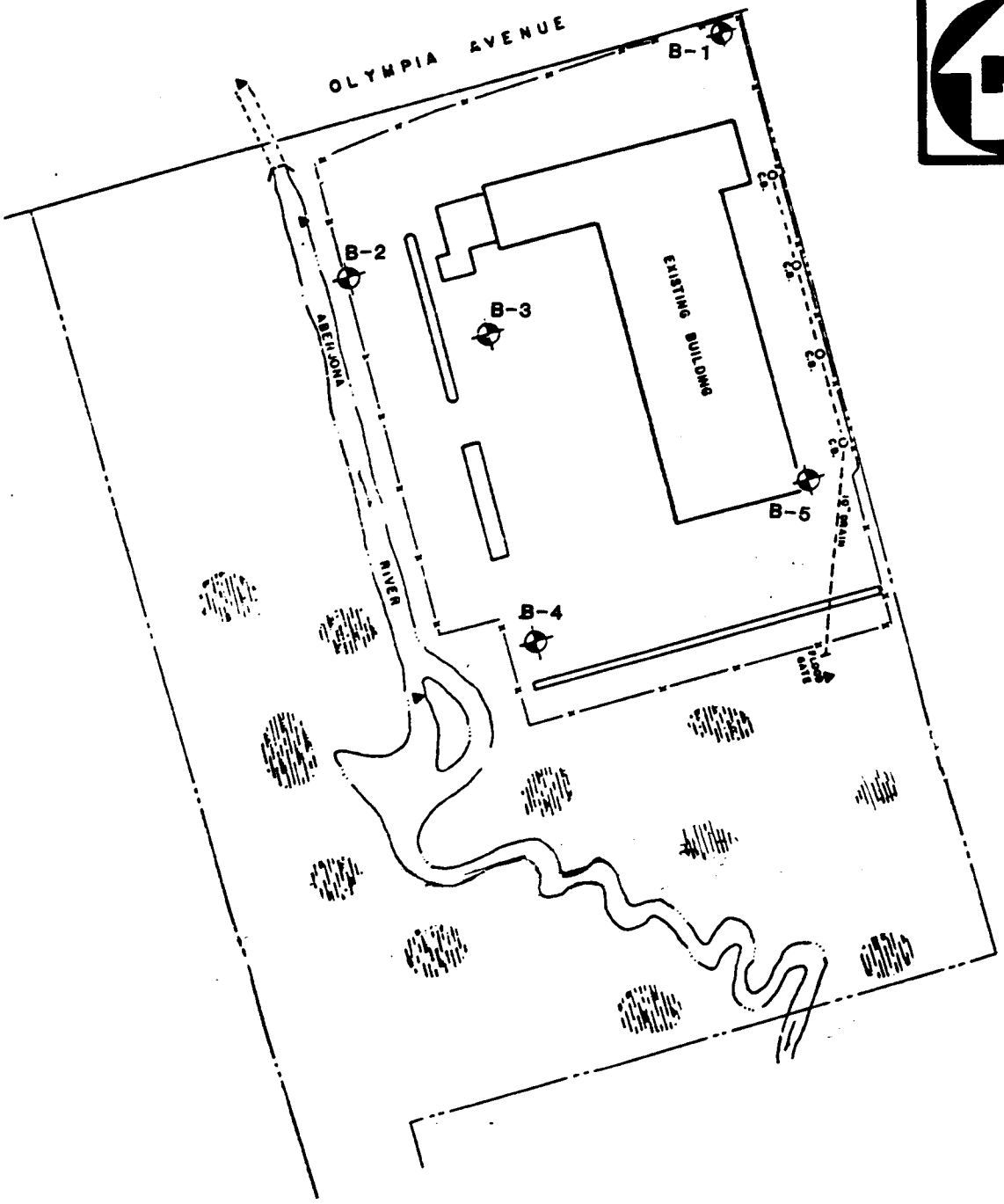
An environmental assessment of 60 Olympia Avenue, Woburn, Massachusetts, pursuant to Massachusetts General Laws Chapter 21E was conducted by Goldberg-Zoino and Associates, Inc. (GZA) (Newton Upper Falls, Massachusetts) in February, 1985 for Juniper Development Group (Winchester, Massachusetts). The area investigated consisted of approximately 21 acres owned by the Juniper Development Group and includes an eight acre parcel (60 Olympia Avenue) utilized as a truck terminal (Figure 2-1). The remaining acreage consists of wetlands along the Aberjona River south and west of the trucking terminal. The site has been used in the past for transportation and trucking operations. An underground storage tank found to contain water at the time of site acquisition was removed in July, 1984 by Juniper Development Group and replaced with two new underground tanks for the storage of diesel fuel. A past owner of the site, Hemingway Transport Company, reported to the DEQE in November, 1982 that 17 drums containing "oily type semi-solid waste" had been deposited on their property. GZA noted that no record of their removal was found (GZA, 1985).

GZA installed five overburden groundwater monitoring wells on the trucking terminal property along the western and southern boundaries, and in the northeast corner (Figure 2-7). Groundwater samples were collected from the monitoring wells and analyzed for volatile organic compounds. GZA reported that benzene (170 ppb); toluene (540 ppb); ethylbenzene (150 ppb); xylenes (750 ppb); tetrachloroethene (trace levels); 1,1,1-trichloroethane (trace levels); and trichloroethene (trace levels) were detected in groundwater from the site. GZA suggested that the aromatic volatile organic compounds detected (benzene, toluene, xylenes and ethylbenzene) were constituents of gasoline and may be present because of prior site activity. The wells these constituents were found in were located downgradient from the removed leaking underground tank (GZA, 1985).

On September 17, 1985, EPA conducted additional sampling on Juniper Development Group property southwest of the trucking terminal in between the Aberjona River and the railroad tracks (Figure 2-1). Approximately ten rusted drums and a small pile of pesticide label caps were found at this location by EPA. Soil samples adjacent to the drums and samples of drums' contents were collected and analyzed for volatile and extractable organic compounds. High levels of chlordane (5.1%) and polychlorinated biphenyls (PCBs) (3.1%) were detected in one soil sample while chlorinated volatile organic compounds (TCE and TETRA) were detected in all samples. A yellow waxy material, collected from one of the drums, was determined to be a petroleum-based grease (Granz, 1986). These drums and surrounding soil were removed by the present owner under an EPA Administrative Order in December, 1985.

2.8 EPA/USGS Aquifer Test

In the fall of 1985, EPA, through a cooperative agreement with the USGS, designed and implemented an aquifer test of Wells G & H which included installation of groundwater monitoring wells in the center of the Aberjona River Valley. These wells were installed by the US Army Corps of Engineers (COE) and are denoted as S87-S97 on Plate 1. Groundwater samples were collected from these and other



LEGEND:

MONITORING WELL SCREENED IN BEDROCK

0' 60' 120' 240'

FIGURE TAKEN FROM ENVIRONMENTAL SITE ASSESSMENT, 60 OLYMPIA AVENUE, WOBURN, MA. PREPARED BY GOLDBERG-ZOINO & ASSOCIATES, INC. FOR JUNIPER DEVELOPMENT GROUP

JUNIPER DEVELOPMENT GROUP SITE
WOBURN, MA

NUS CORPORATION
A Halliburton Company

FIGURE 2-7

wells in the study area for volatile organic compound analysis in May and November, 1985 by GeoEnvironmental and Woodward-Clyde Consultants. EPA collected split samples of GeoEnvironmental's November sampling round for Contract Laboratory Program (CLP) volatile organic compound analysis. All of these results are presented in Appendix C (Tables 5 and 6). Those samples analyzed by ETC were collected by GeoEnvironmental; those analyzed by ERCO were collected by Woodard-Clyde, while those analyzed by Compuchem were collected by EPA. The samples collected by EPA were analyzed through the CLP. The CLP data was validated according to EPA protocols, however, a more limited quality control review was conducted on the non-CLP data. In addition, this report does not address the integrity of the sampling points nor whether proper sampling plans, procedures or quality control were employed by other parties in collection of these samples.

A number of volatile organic compounds were detected including: TCE; TETRA; 1,1,1-TCA; and trans-1,2-DCE. These results will be further discussed relative to distribution of volatile organic compounds in Chapter 5.0.