ENGINEERING DIVISION

YWC

SCOPE OF STUDY
TORRINGTON LANDFILL
ENVIRONMENTAL ASSESSMENT
AND
HYDROGEOLOGIC EVALUATION

Prepared In Response To:

Connecticut Department of Environmental Protection
Administrative Order No. HM-287

On Behalf Of:

City of Torrington
City Hall
140 Main Street
Torrington, Connecticut 06790

June 1986
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YWC, INC. Project No. 6180 - 03

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1.0 INTRODUCTION

The purpose of this document is to outline the scope of study developed by York Wastewater Consultants, Inc. (YWC, Inc.) to satisfy Directive 1, Paragraph A, of the pending Connecticut Department of Environmental Protection Administrative Order No. HM-287 issued to the City of Torrington, Connecticut dated November 4, 1985. It has been revised to address comments received from the Connecticut Department of Environmental Protection (correspondence dated January 7, 1988).

Directive 1 requires that the City of Torrington upgrade the existing RCRA groundwater monitoring program at the Torrington Landfill to meet the requirements of 22a-44a(c)-28 of the Connecticut DEP Hazardous Waste Management Regulations. Section 22a-44a(c)-28 requires a groundwater monitoring program at hazardous waste disposal facilities as per regulations set forth in U.S. Environmental Protection Agency - 40, Code of Federal Regulations (CFR), Part 265, Sub-Part F, Sections 265.90 to 265.94.

To fulfill the requirements presented in Sections 265.90 to 265.92, the City of Torrington retained YWC, Inc. to prepare and implement a groundwater monitoring program as part of the Part B Application for their industrial sludge disposal area. This existing RCRA groundwater monitoring program was documented in the Part B Application which was submitted to the Connecticut DEP in July 1984.

40 CFR, Section 265.93, requires that the owners or operators of a facility accepting materials classified as hazardous waste (in the case of the City of Torrington, metal hydroxide sludge) prepare an outline for a groundwater quality assessment program which describes a more comprehensive groundwater monitoring program (than that described in Sections 265.91 and 265.92). The assessment program must be capable of determining:

1) Whether hazardous waste or hazardous waste constituents have entered the groundwater.

2) The rate and extent of migration of any detected plume.

3) The concentrations of hazardous waste constituents in the groundwater.

The Plan of Study presented herein outlines the Groundwater Quality Assessment Program prepared for the Torrington Landfill site by YWC, Inc. to meet the requirements set forth in the referenced State and Federal Regulations, as well as additional items discussed during meetings held with DEP, YWC, Inc, and City of Torrington representatives.

Specifically, this Scope of Study addresses:

- Study Area Site Description;
- Regional Geology/Hydrogeology Background;
- Location of Nearby Private Water Supply Wells;
- Existing Site Groundwater Monitoring Wells;
- Existing RCRA Detection Groundwater Sampling Program (as modified by the Connecticut DEP);
- Proposed Locations and Depths of Additional Groundwater Monitoring Wells;
- Procedures for Abandonment of Existing Vandalized Monitoring Wells;
- Proposed Analytical Parameters for Site Groundwater Quality Assessment Program;
- Proposed Upgraded RCRA Detection Groundwater Monitoring Program;
- Groundwater Sampling Techniques;
- Analytical Protocols;
- Laboratory Quality Assurance/Quality Control (QA/QC) Program;
- Schedule of Implementation.

Much of the background discussion contained herein is updated information which was previously prepared and originally presented in the referenced Part B Application. Elaboration has been provided where necessary.

2.0 BACKGROUND REVIEW

This section provides general background information on the site-specific and regional study areas.

2.1 Facility Description

The City of Torrington has operated a metal hydroxide sludge landfill on it's existing solid waste (refuse) landfill since approximately 1973. The location of this landfill site is shown in Figure 2-1. The overall landfill site encompasses approximately 60 acres, of which approximately 2.6 acres are utilized for metal hydroxide sludge disposal. The refuse landfill is bounded to the north by Peck Brook and private land owned by the Connecticut Resource Recovery Authority, presently being used as a solid waste transfer facility; to the south by high voltage transmission lines (which mark the Town line between Litchfield and Torrington), and private property owned by Mr. A. Iffland; to the east by the Metro-North Railway and commercial properties; and to the west by an asphalt drainage swale and a ridge of bedrock which rises above the landfill's upper-most grade. It should be noted that the contours shown in the landfill area (on Figure 2-1) are based on the 1969 (photo-revised) U.S. Geological Survey (U.S.G.S.) Quadrangle Map. Actual contours of the present landfill surface may vary from those suggested by the U.S.G.S. map. A site plan is presented in Figure 2-2.

The hydroxide sludge portion of the landfill was operated to dispose of sludges generated by industry located in the City of Torrington. These sludges were byproducts of the treatment of rinse waters used in metal finishing operations. All sludges that have been landfilled have been generated by Torrington industries only.

The capacity of the metal hydroxide sludge disposal portion of the landfill has been reached. The landfill is currently accepting no further sludge for disposal.

The sludges are considered a hazardous waste (F006) due to the categorical classification of wastewater treatment sludges from electroplating operations. As such, some of

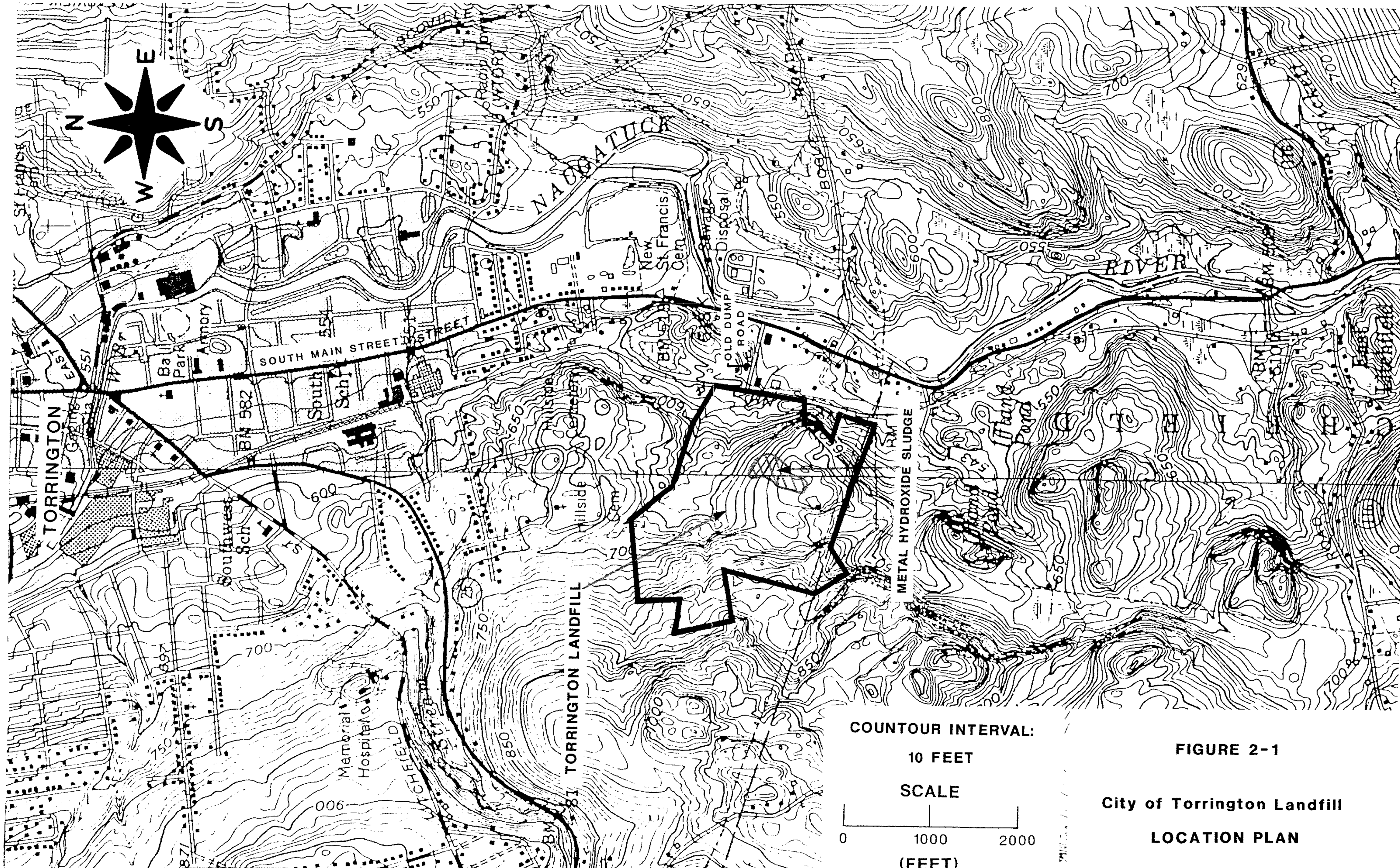


FIGURE 2-1

City of Torrington Landfill

LOCATION PLAN

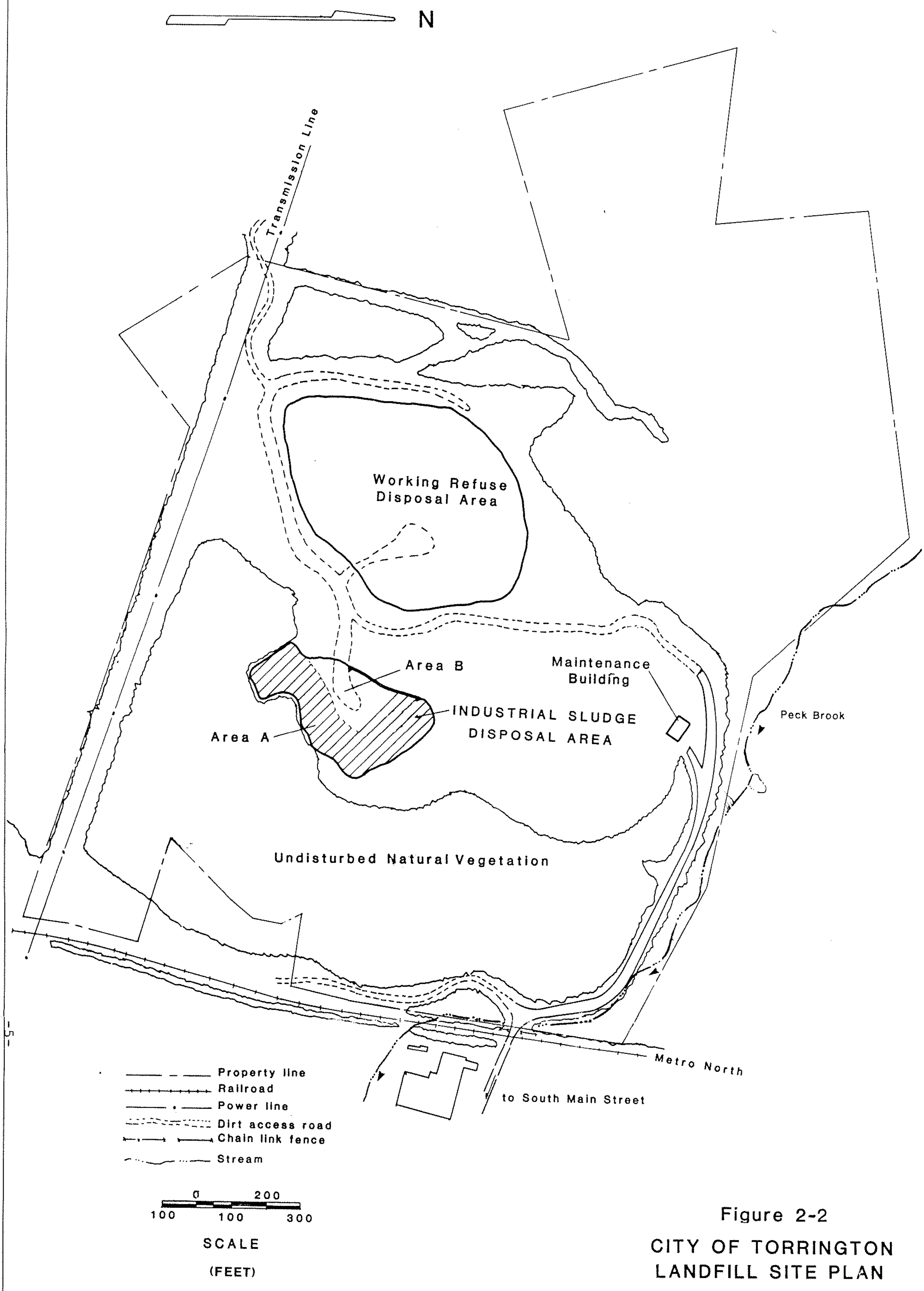


Figure 2-2

CITY OF TORRINGTON
LANDFILL SITE PLAN

YWC, Inc. July, 1984

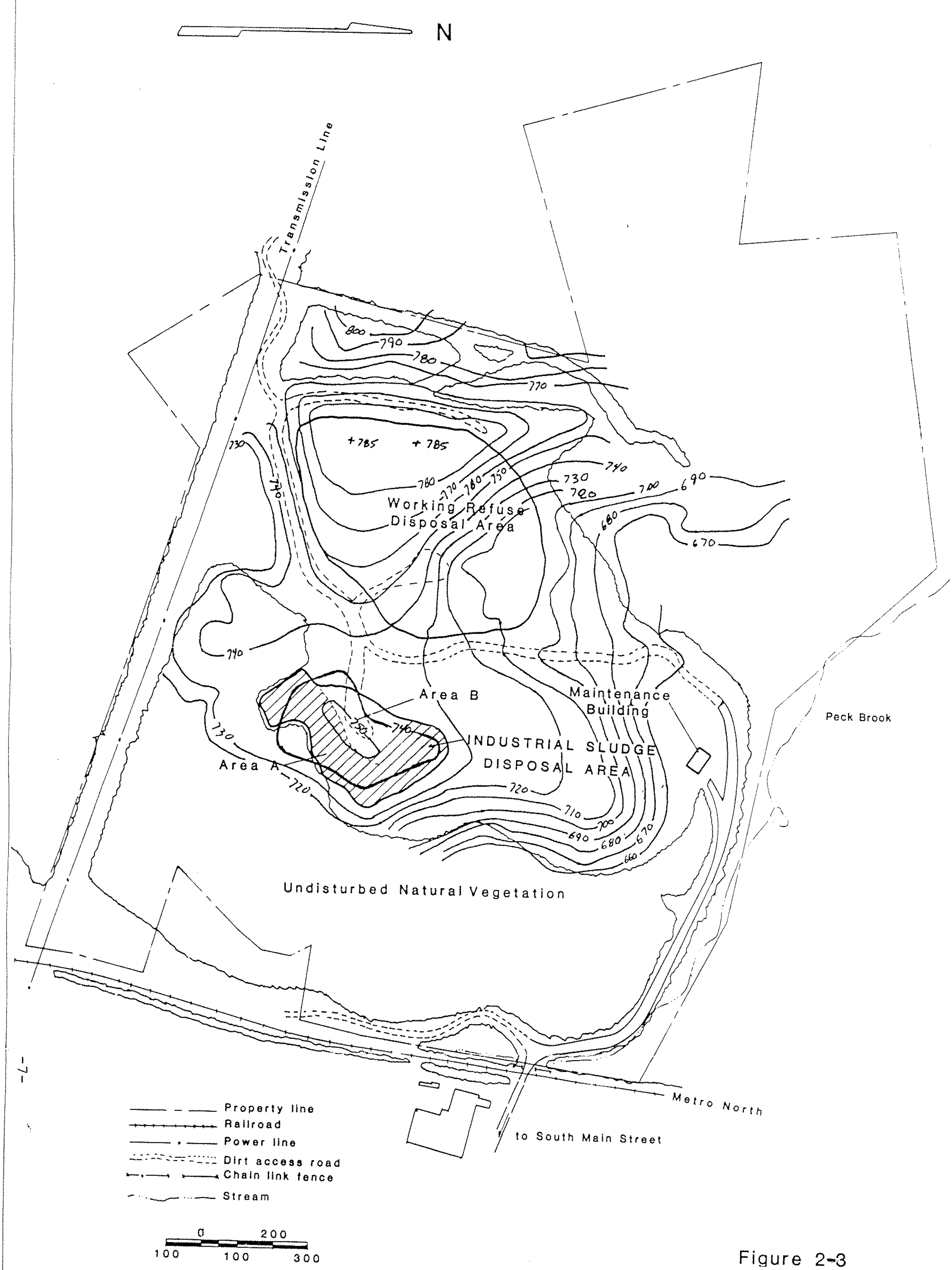
the sludges may also exceed the maximum allowable concentrations for certain metals included in the EP toxicity test.

It should be noted that much of the sludge that was deposited in the metal hydroxide section of the landfill has been there since 1973. Approximately two-thirds of the sludge that is there was landfilled before RCRA regulations were promulgated in 1980. Currently, metal hydroxide sludge is generated by four industries in the City (Colonial Bronze, Torrington Company, Union Tubular, and Turner & Seymour). Prior to the closing of the sludge landfill, sludges were dewatered either by the generators or at the Torrington Metal Hydroxide Sludge Drying Beds, and transported to the landfill by the company or by private haulers.

Figure 2-3 is a topographic map prepared to a scale of approximately 1":275'. The map covers an area 2,000 feet x 2,200 feet, centered on the facility location. Contour lines are shown at 10 foot intervals to indicate relative elevation as they were designed for final closure. Figure 2-4 is a zoning map of the City of Torrington showing the landfill to be located in an industrial zone.

2.2 Existing RCRA Groundwater and Surface Water Sampling Program

This section provides a general background review of the existing RCRA groundwater and surface water sampling program at the Torrington Landfill, and a discussion of the analytical results obtained thus far. The review is presented herein to acquaint the reviewer with information upon which the site assessment Plan of Study (outlined in Section 4.0) is based. The groundwater and surface water monitoring program that was implemented by the City of Torrington was specified by the Connecticut Department of Environmental Protection. The monitoring plan was devised to include parameters that would be applicable to the landfill site as both a refuse and metal hydroxide sludge disposal area.

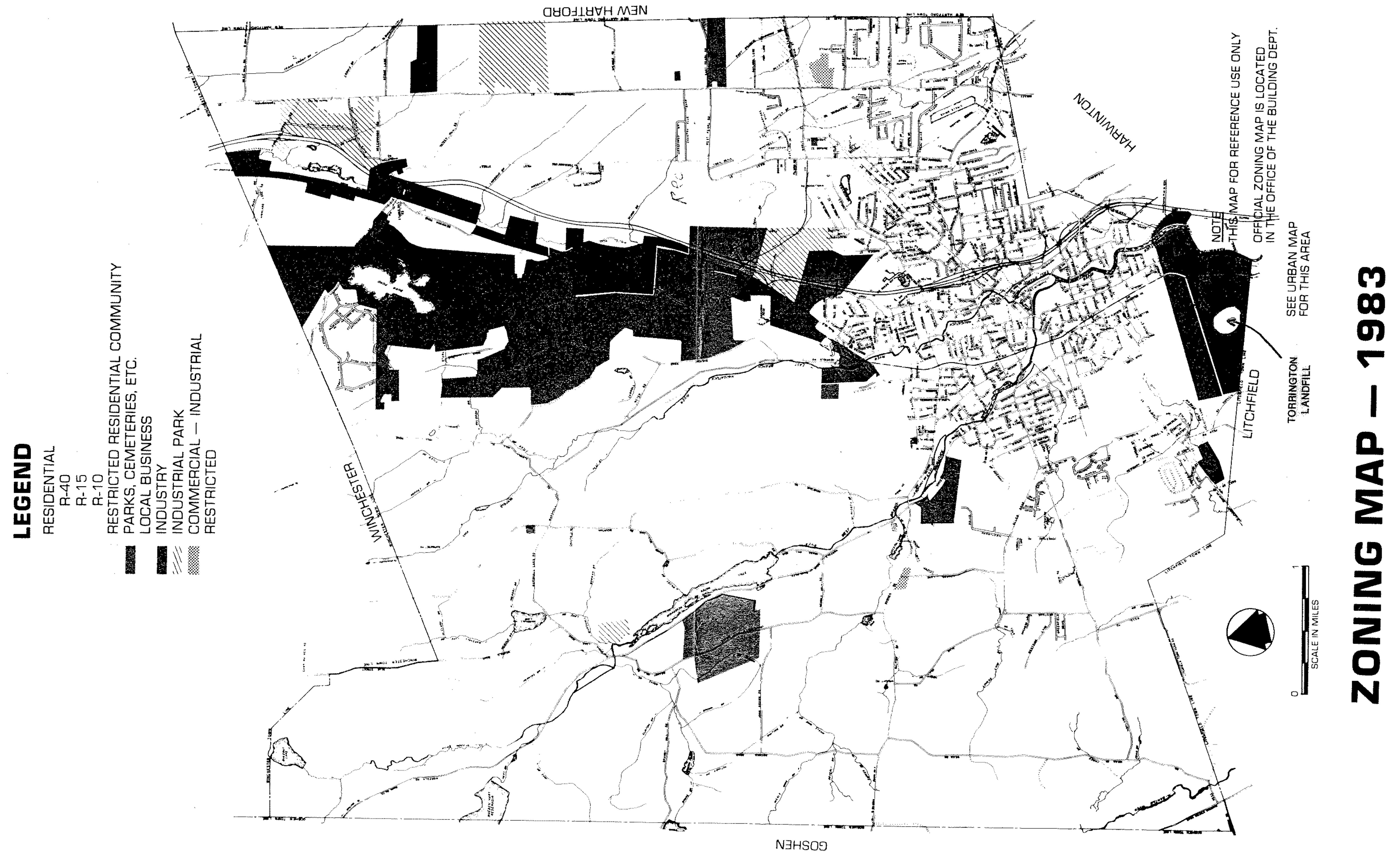


SCALE
(FEET)

CONTOUR INTERVAL
10 FEET

Figure 2-3
CITY OF TORRINGTON
LANDFILL SITE PLAN
AND TOPOGRAPHY

YWC, Inc. July, 1984



CITY OF TORRINGTON CONN.

FIGURE 2-4

a) **Summary of Groundwater Monitoring and Supply Wells Utilized for Groundwater Sampling**

There are no public water supply wells near the Torrington Landfill site. A total of ten private commercial and residential water supply wells exist in the vicinity down gradient from the Torrington Landfill, nine of which are utilized as part of the existing (DEP modified) RCRA groundwater sampling program. Table 2-1 lists the locations of these wells. Most of the sampled wells were installed between 1940 and 1960. Well boring logs and depth details are therefore not available for all but one of these wells (PW-7). The completion report for this well indicates the total depth of the well to be 365 feet. The strata encountered during drilling included 10 feet of sand overburden and 355 feet of schist bedrock. The well yield was listed as one-half gallon per minute. Additional information collected from the current owners of the other supply wells indicates that at least half of the private water supply wells sampled are probably tapping the bedrock aquifer for a portion of water supplies withdrawn, although its contribution to total well recharge volumes is questionable.

The sometimes objectionable taste and odor of water withdrawn from some of these wells is such that most well owners use it only for washing and restroom facility purposes. Table 2-2 lists the principal private wells sampled during the RCRA program.

A total of nine monitoring wells have been installed around the perimeters of the landfill at various times. The specifications of these existing monitoring wells are presented in Table 2-3. The locations of all site monitoring wells, as well as area private water supply wells sampled during the monitoring program, are presented in Figure 2-5. With the exception of one upgradient well (No. 9), all monitoring wells sampled during the RCRA groundwater monitoring program are located in areas down gradient from the working disposal areas (but within the landfill property boundaries).

TABLE 2-1
PRIVATE WATER SUPPLY WELLS IN
THE VICINITY OF TORRINGTON LANDFILL

Well Description	Date of Installation	Approximate Depth	Individual or Company	Street or Address	Town
PW-1	1941	*	LeManquais Co., Inc.	South Main Street	Torrington
PW-2	*	*	United Construction and Engineers	1500 South Main Street	Torrington
PW-3	1940's	80'	Jamesion Manufacturing	2496 South Main Street	Torrington
PW-4	*	*	Mrs. Claudia Spiegelhalter	South Main Street	Litchfield
PW-5	*	*	Agway, Inc.	South Main Street	Torrington
PW-6	*	*	J&M Sales, Inc.	South Main Street	Torrington
PW-7	1976	365'	Albrada Refuse, Inc.	Iffland Pond Road	Litchfield
PW-8	1950's	Shallow	Torrington Scrap, Inc.	1002 South Main Street	Torrington
PW-9	*	150'	Ed's Auto Body	1109 South Main Street	Torrington
PW-10	*	80'	Blue Seal Feeds	Iffland Pond Road	Litchfield

*Information not available.

TABLE 2-2
TORRINGTON GROUNDWATER USE
PRIVATE WELLS DOWNGRADIENT OF LANDFILL

Company Name	Well #	Drinking Supply	Well Water Use
Lemanguais Company	PW-1	Well Water	All Uses
United Construction & Engineers	PW-2	Well Water	All Uses
Jamesion Manufacturing	PW-3	Bottled Water	Sanitary & Equipment Washing
Agway, Inc.	PW-5	Bottled Water Except Coffee	Sanitary & Equipment Washing
J&M Sales	PW-6	Bottled Water	Sanitary & Equipment Washing
Albreada Refuse, Inc.	PW-7	Bottled Water	Sanitary & Equipment Washing
Torrington Scrap, Inc.	PW-8	Bottled Water	Sanitary & Equipment Washing
Ed's Auto Body	PW-9	Bottled Water	Sanitary & Equipment Washing
Blue Seal Feeds	PW-10	Bottled Water	Sanitary & Equipment Washing

NOTE:

The well owned by Mrs. Claudia Spiegelhalter, PW-4, on South Main Street in Litchfield was not sampled due to her refusal to allow access.

TABLE 2-3
TORRINGTON LANDFILL
GROUNDWATER MONITORING WELL SPECIFICATIONS

Well No.	Strata Being Sampled	Installation Date	Status	Elevation of Grade	PVC Stick-Up Above Grade	Elevation Top of PVC	Well Depth Below Grade	Screen Interval Below Grade	Screen Interval Elevation
1	Outwash	April 1982	Vandalized Dry	543.29'	*	*	9.21'	*	*
1A	Outwash	February 1984	In Use	543.20'	1.12'	544.33'	18.87'	18.87'- 8.87'	524.33'-534.33'
2	Outwash	November 1981	In Use	548.31'	1.16'	549.09'	11.05'	11.05'- 6.05'	537.26'-542.26'
3	Outwash	April 1982	In Use	547.52'	1.07'	548.59'	14.83'	14.83'- 4.83'	532.69'-542.69'
4	Bedrock	April 1982	In Use	547.77'	1.09'	548.86'	12.91'	25.00'-12.91'**	522.77'-534.86'
5	Outwash	November 1981	Vandalized Dry	533.74'	0.58'	534.32'	15.125'	*	*
5A	Outwash	February 1984	In Use	534.43'	0.60'	535.03'	19.50'	19.50'- 9.50'	504.93'-514.93'
6	Till	November 1981	Vandalized Dry	528.98'	1.43'	530.41'	10.00'	10.00'- 5.00'	513.98'-518.98'
7	Till	November 1981	In Use	631.09'	1.04'	632.13'	15.75'	15.75'-10.75'	615.34'-620.34'
8	Till	November 1981	Vandalized Dry	712.43'	0.54'	712.97'	14.92'	*	*
8A	Bedrock	February 1984	In Use	703.32'	1.00'	704.32'	26.50'	**	**
9	Bedrock	February 1984	In Use	758.05'	1.48'	759.53'	16.00'	**	**

* Information not available.
**Bedrock - Open hole (no screen).

TORRINGTON LANDFILL

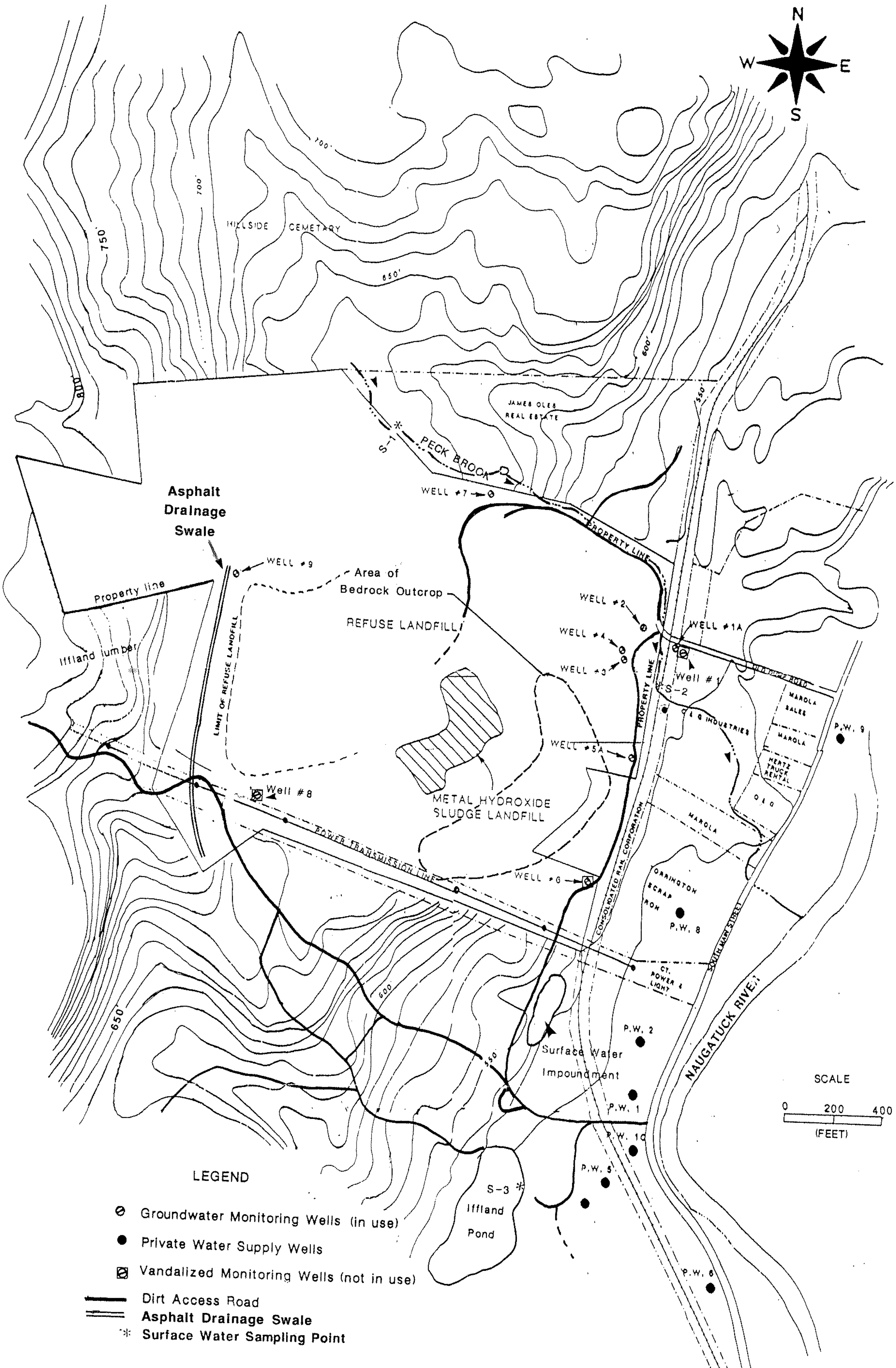


FIGURE 2-5

LOCATION OF GROUND WATER AND SURFACE WATER SAMPLING POINTS

Well Nos. 1, 5, 6, and 8 were vandalized some time in the past and are no longer usable. Well Nos. 1, 5, and 8 were replaced by Well Nos. 1A, 5A, and 8A, respectively. Well No. 6 was not replaced due to its location directly below bedrock outcrop, which forms a localized groundwater divide on the landfill's southwestern boundary.

The boring logs compiled during installation of site monitoring wells are presented in Appendix A. Monitoring well construction specification diagrams are presented in Appendix B.

b) **Surface Water Sampling Sites Included in the Existing RCRA Sampling Program**

Peck Brook and Iffland Pond are the closest water bodies to the landfill. Peck Brook runs along the northern and northeastern property boundaries. Iffland Pond is approximately 1/4 mile south of the landfill's southern boundary. A total of three surface water sampling points are currently included in the existing RCRA sampling program. The locations of these sampling points are shown in Figure 2-5.

Sampling site S-1 is located near the northwest landfill boundary at a point on Peck Brook which is upgradient of the landfill. Water samples are collected from this upgradient point to obtain background surface water quality information.

Sampling site S-2 is located on the east-northeast boundary (just south of the front access gate) at a point on Peck Brook down gradient of the landfill. Samples have been collected here to determine the impact of landfill leachate on Peck Brook down gradient from the site.

Sampling site S-3 (located at the northeastern end of Iffland Pond) has been sampled to investigate possible impacts on surface water bodies from any southerly components of surface run-off or groundwater flow from the landfill.

c) Analytical Parameters and Results

A wide variety of compounds were included for analysis, including typical refuse leachate parameters (alkalinity, dissolved solids, suspended solids, nitrogen, chemical oxygen demand, biochemical oxygen demand, iron, manganese, chloride) and metals based upon the list included in the EP toxicity test (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc). The specific analytical parameters utilized for surface water and groundwater sample analyses were as specified in the DEP "Amendment to Solid Waste Permit No. 143-1L". The document is presented in its entirety in Appendix C and includes an outline of the required analytical parameters, sampling intervals, and reporting dates.

The DEP plan specified monitoring well No. 8 as the upgradient well (with respect to the metal hydroxide sludge disposal area). While well No. 8 (and now well No. 8A due to vandalization of well No. 8), is upgradient of the hydroxide sludge area, it is also directly down gradient from the working refuse disposal area. The quality of groundwater in the vicinity of well Nos. 8 and 8A was typically the poorest of all the wells that were sampled.

Monitoring well No. 9 should give the best indication of background water quality data, as is indicated by groundwater sampling results. Analytical results obtained thus far from the landfill groundwater and surface water monitoring program are presented in Appendix D. Appendix D also includes a summary of groundwater elevations measured during each sampling round.

Groundwater quality information for the Torrington Landfill area was reviewed in order to qualitatively assess any leachate contamination originating from the landfill or neighboring businesses. Available chemical data was studied in an attempt to identify any trends in detected contaminant constituents over time, which might be used as indicator parameters for definition of a leachate plume. The information reviewed included the analytical results of routine public water supply wells sampling performed by the Connecticut DEP in 1983, and the analytical results obtained thus far for the existing RCRA surface water and groundwater sampling program for the landfill site (Appendix D).

In addition, an environmental audit was performed at the DEP offices in Hartford, Connecticut to investigate other possible contaminant sources originating from the landfill's closest commercial neighbors.

A major problem encountered when trying to compare the analytical data from various sources was the variability in the minimum detection limits reported by different analytical laboratories for many chemical parameters (in particular, heavy metals). In some cases, the minimum detection limits reported were slightly higher than drinking water standards outlined by the Connecticut DEP.

In general, the most elevated concentrations of chemical parameters historically associated with refuse leachate (conductivity, TDS, alkalinity, BOD, COD, ammonia, iron, manganese) were found in on-site groundwater monitoring well Nos. 8A and 7, with monitoring well Nos. 3 and 4 exhibiting slightly lower concentrations. The elevated levels in well Nos. 8A and 7 are to be expected since these wells are essentially located in or slightly down gradient of refuse disposal areas. The elevated levels in well Nos. 3 and 4 provide evidence that this is one of the major routes of leachate migration off the landfill site. Further study (proposed herein) will be necessary to ascertain other migration routes off-site.

Barium, iron, and manganese were the only metals detected at levels above drinking water standards in the on-site monitoring wells. Well No. 8A has displayed the highest concentrations of barium, although the levels detected are only slightly above drinking water standards. Since well No. 8A is upgradient of the metal hydroxide sludge portion of the landfill, it is assumed that the barium detected originates within the upgradient refuse disposal area and not the industrial metal hydroxide sludge disposal area.

Well Nos. 7, 8, and 8A generally displayed the highest concentrations of iron. Manganese levels in all wells were highly variable from one sampling round to the next.

Very low levels of volatile organics were detected in all monitoring wells with the exception of background well No. 9, with chloroethane being the most common volatile constituent. Evaluation of the volatile organic concentrations detected is difficult since the DEP and EPA have not established maximum concentration guidelines for most of the parameters identified. The concentrations of detected parameters for which guidelines do exist were below or near State and Federal limits.

Analytical data for the surface water samples analyzed indicate that the refuse portion of the landfill is having some adverse impact on surface water quality down gradient, although not severe. Iron and manganese appear to be the only metals contribution to surface water from the landfill.

The refuse leachate indicator parameters utilized during the sampling program have not been detected in the private water supply wells down gradient at concentrations greater than those naturally occurring in the region, with possible exception of iron and manganese. Analytical data indicates that elevated levels of these metals are seasonal and probably naturally occurring. The consistently higher than normal levels of iron detected at PW-8 are probably due to the nature of the business on the surface (scrap metal). Very low levels of volatile organics were detected in a few of the private wells during the program, again at such low levels as to pose no significant hazard.

3.0 REGIONAL AND SITE TECHNICAL DESCRIPTION

3.1 Geology

The Torrington Landfill lies within the Western Connecticut highlands, an area of crystalline metamorphic and igneous bedrock. Bedrock outcrops in the eastern portion of the landfill, consisting of quartz-plagioclase granulite with subordinate layers of mica-plagioclase-quartz schist, have been identified as belonging to the Hartland Formation. The western portion is underlain by granite, grading to granitic gneiss belonging to the Tyler Lake Granite Formation. The landfill is situated in both the Torrington and West Torrington quadrangles mapped by the United States Geological Survey. Numerous bedrock outcrops exist in both quadrangles. On-site, there are several scattered outcrops at the southern and western borders of the landfill. One significant bedrock outcrop is located at the southeast corner of the property. Bedrock in the landfill area dips toward the west-northwest, with an inclination of approximately 60°. A regional bedrock map displaying the relative location of bedrock contact lines is presented in Figure 3-1. Bedrock outcrops can be clearly seen on Figure 3-2 (surficial geology).

The topography of the Torrington area was only slightly modified by the last major geologic event in the region, the Pleistocene Glaciation. Glacial ice advances and retreats during this period caused erosion and weathering of the bedrock surface, rounding existing peaks and deepening existing valleys. Geomorphologic features associated with glaciation, i.e., outwash and till deposits, are observed throughout the study region. The dominant surficial deposit in the landfill area is till, which averages 10 to 15 feet in thickness, and much thicker under the crests of drumlins. The till consists chiefly of light gray to brown, loose, unsorted, and unstratified deposits ranging in particle size from silt to boulders.

Other surficial materials observed in the area include glacial outwash deposits and alluvial stream deposits which average 5 to 10 feet thick, increasing in thickness

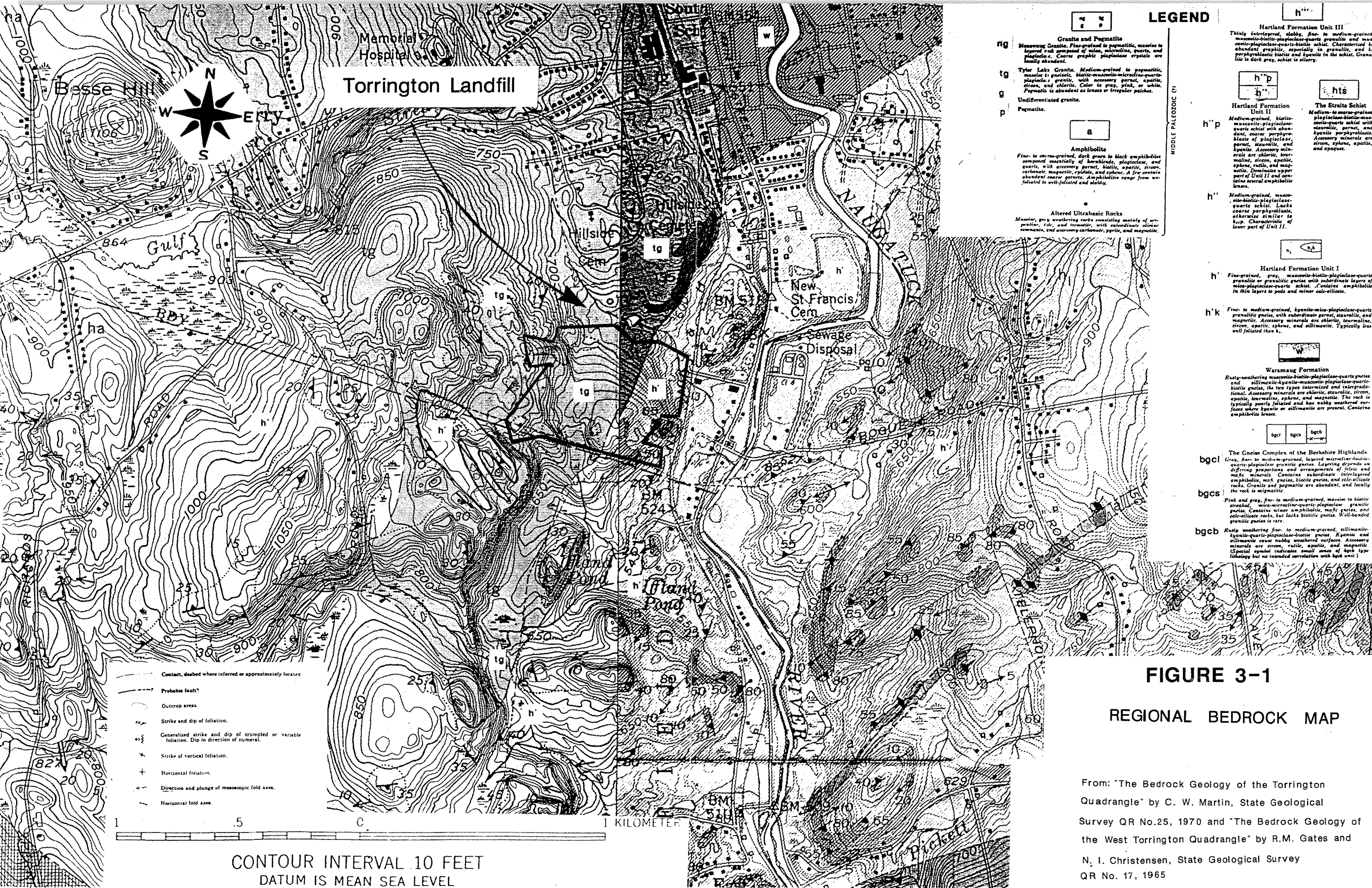


FIGURE 3-1

REGIONAL BEDROCK MAP

From: "The Bedrock Geology of the Torrington Quadrangle" by C. W. Martin, State Geological Survey QR No.25, 1970 and "The Bedrock Geology of the West Torrington Quadrangle" by R.M. Gates and N. I. Christensen, State Geological Survey QR No. 17, 1965

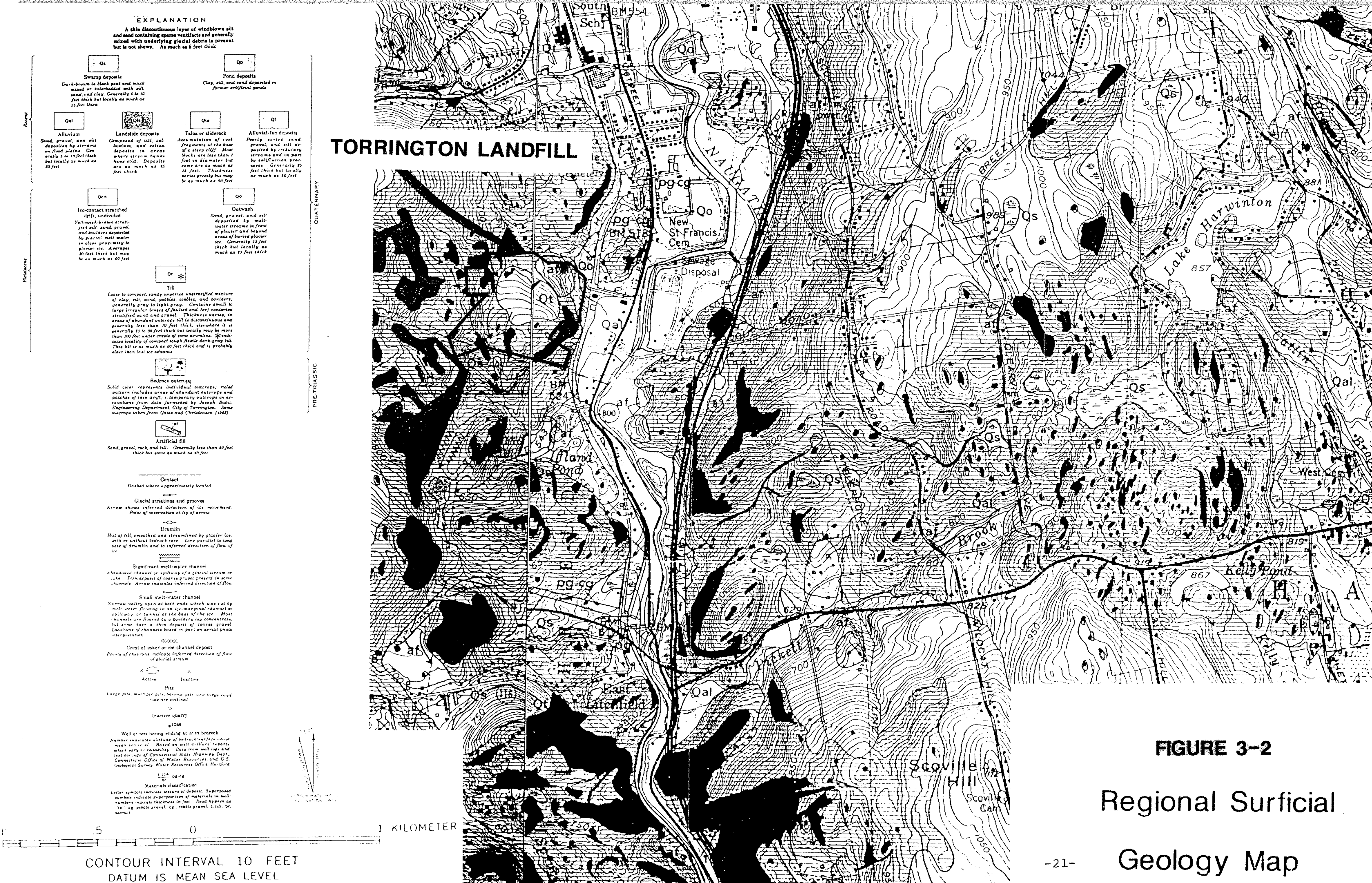


FIGURE 3-2

Regional Surficial Geology Map

near the banks of he Naugatuck River. The eastern edge of the landfill nearly coincides with the transition from till to outwash, and is near the alluvial deposits flanking the River. Alluvial deposits associated with the Naugatuck River flood plain are currently being quarried for sand and gravel in the area east and down gradient from the landfill site. A map displaying the surficial geology of the region is presented in Figure 3-2.

At the time of this writing, the thickness of the unconsolidated deposits between bedrock and artificial material at the landfill is not known. U.S.G.S. surficial geology maps indicate that the landfill site is underlain by till deposits, and is bounded at the eastern section by outwash. This information is supported by boring logs compiled during the installation of the existing site monitoring wells (see Appendix A). Boring logs for monitoring well Nos. 1A, 5A, and 6 indicate that the material on the eastern boundary of the landfill is medium to fine sand with a trace of gravel, silt, and cobbles (outwash), while logs for monitoring well Nos. 7, 8A, and 9 (upgradient on the northern, southern, and western boundaries, respectively) indicate unconsolidated deposits to be a sandy till. A cross section showing the elevation relationship between bedrock, unconsolidated materials, and waste material across the site from well No. 9 to well No. 6 is presented in Figure 3-3.

It should be noted that the cross section depicted is based upon very limited data regarding interior unconsolidated strata and fill material thicknesses. It is presented herein only to provide a general description of geologic/hydrogeologic trends across the site. A site specific surficial geology map, based upon site monitoring well boring logs and U.S.G.S. surficial geology maps, is presented in Figure 3-4.

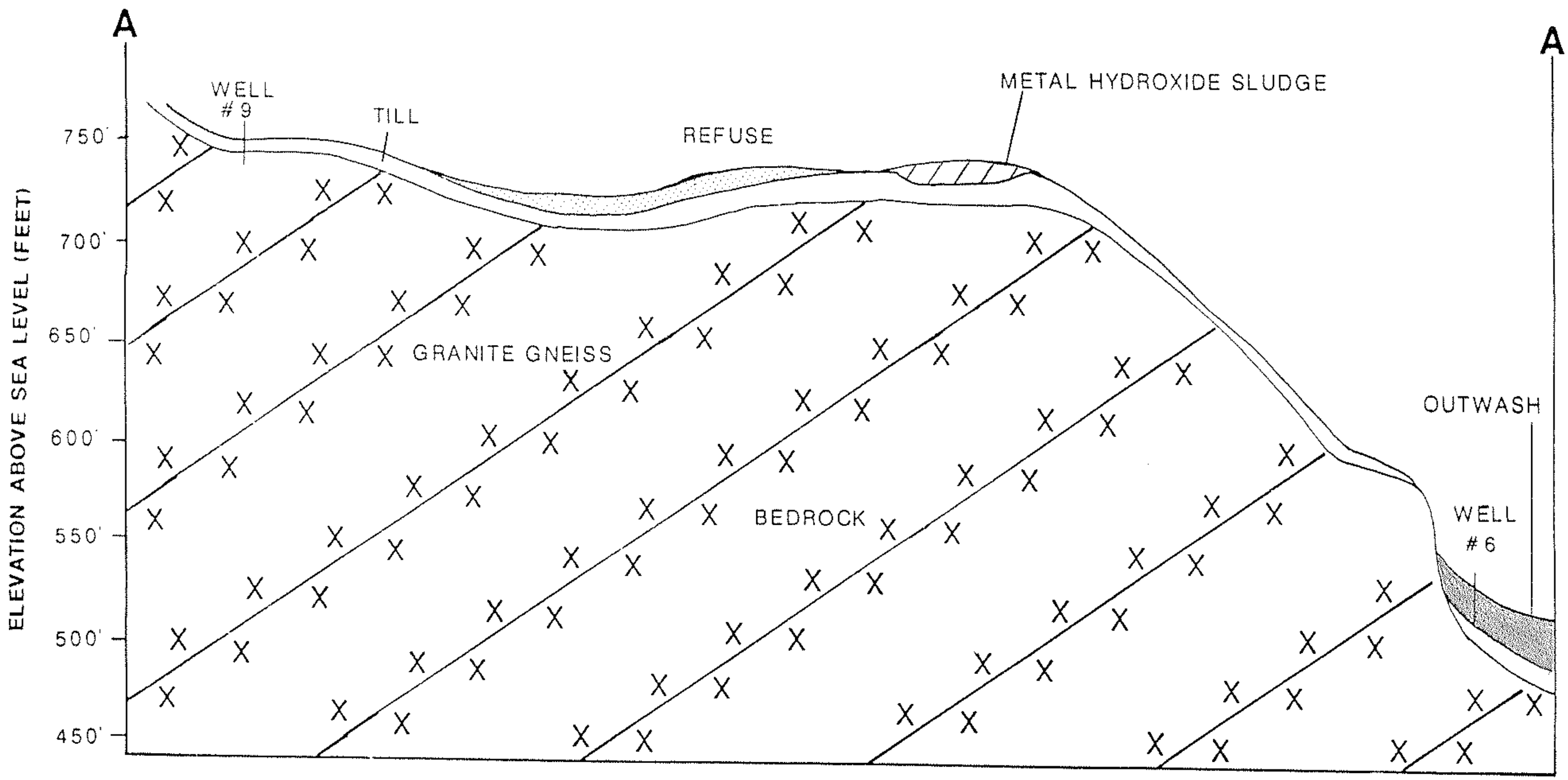
3.2 Hydrogeology

a) Surface Water

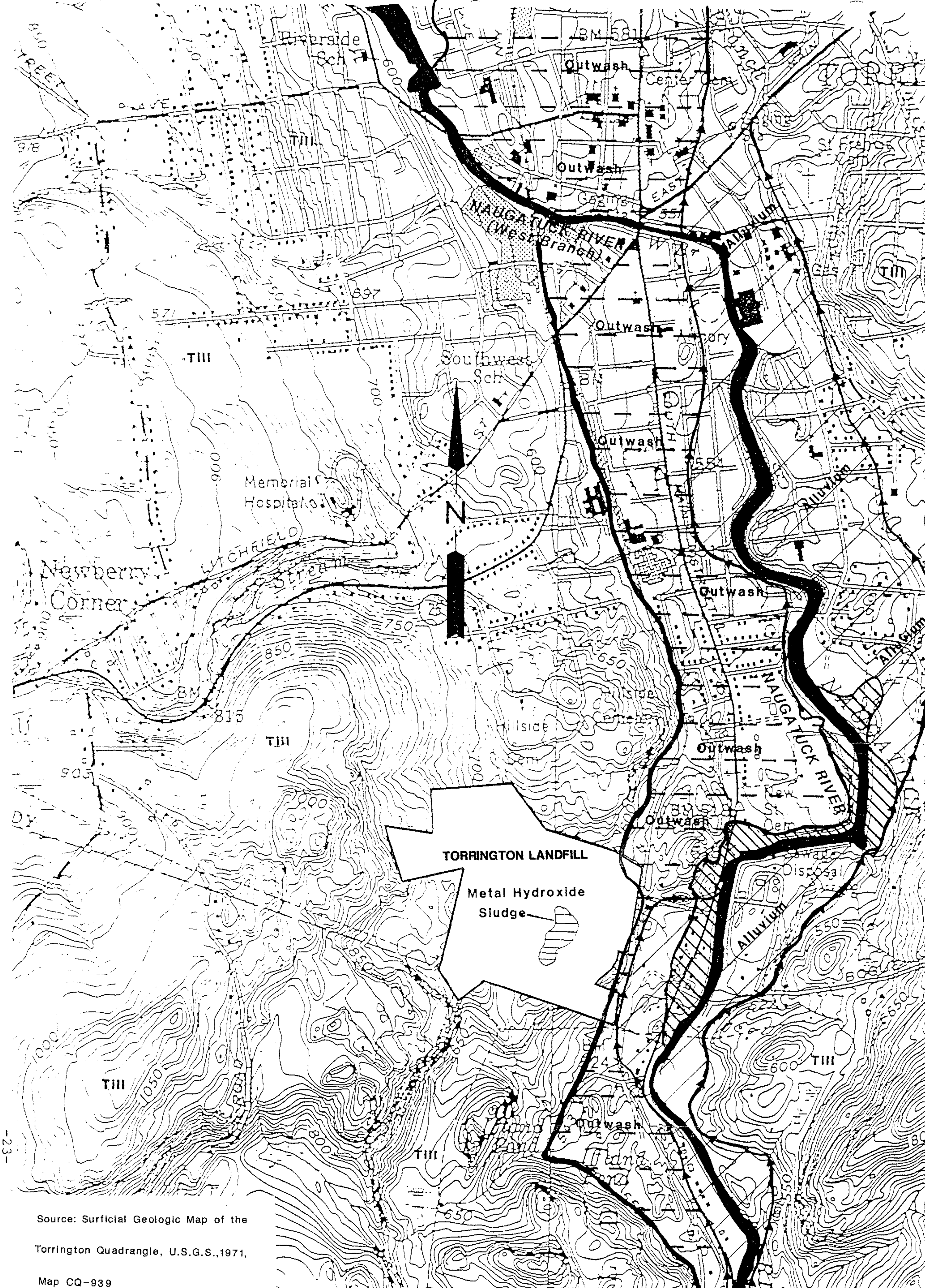
The Torrington Landfill site is located within the Naugatuck River Basin (see Figure 3-5), which is one of the 21 basins within the Naugatuck Regional

FIGURE 3-3

TORRINGTON LANDFILL
CROSS SECTION



HORIZONTAL SCALE: 1 INCH = 273 FEET
VERTICAL SCALE: 1 INCH = 80 FEET



Source: Surficial Geologic Map of the Torrington Quadrangle, U.S.G.S.,1971, Map CQ-939

CONTOUR INTERVAL

10 FEET

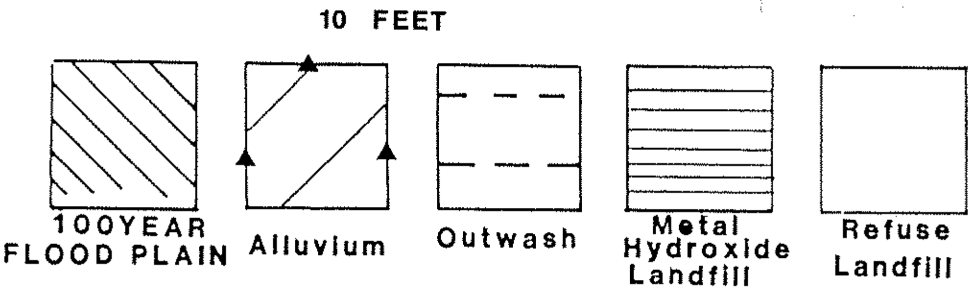


FIGURE 3-4

SITE SURFICIAL GEOLOGY MAP

SCALE

1" = 1000'

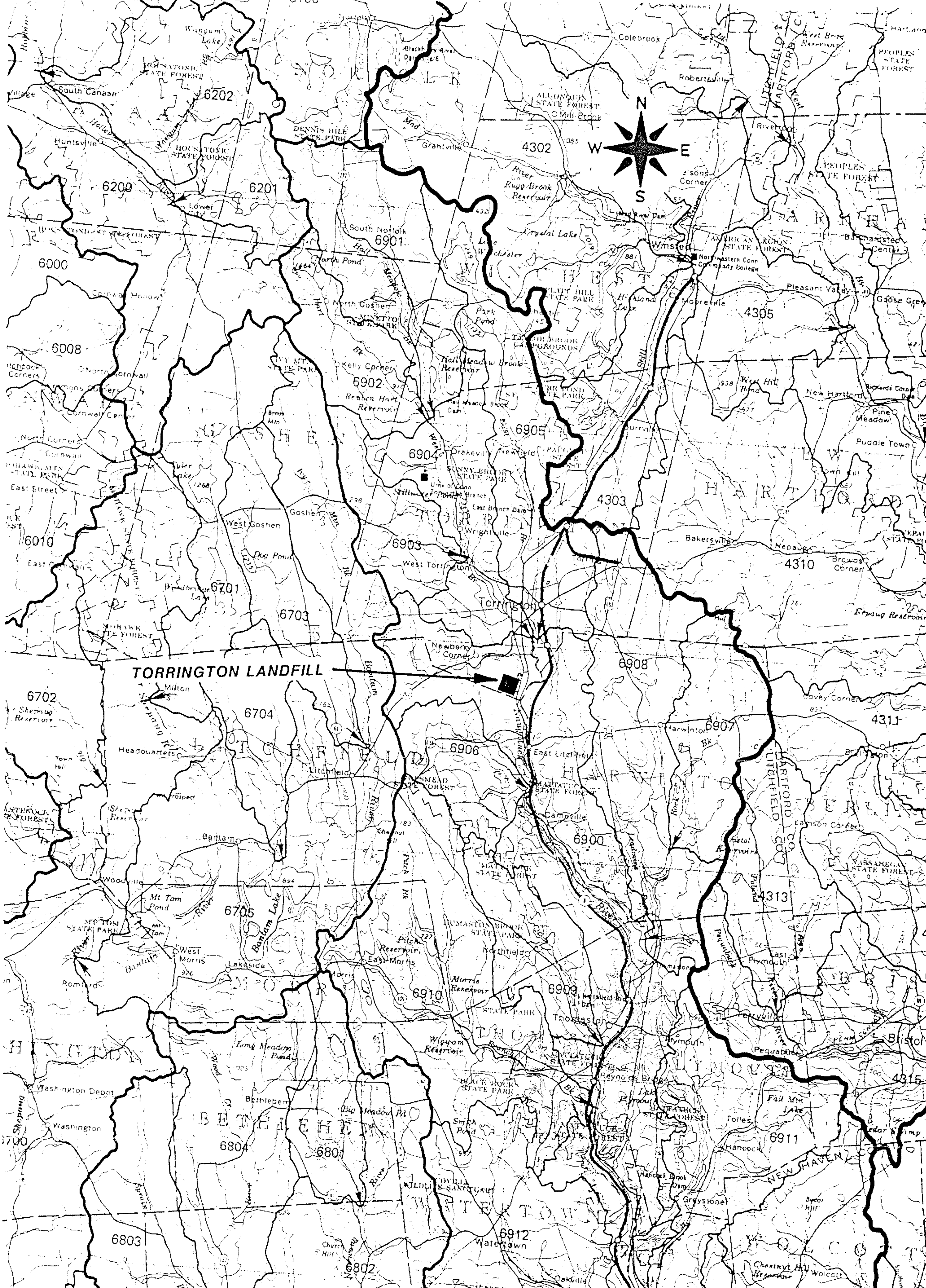


FIGURE 3-5

DRAINAGE BASIN MAP

SCALE: one inch equals two miles

DRAINAGE BASIN		AREA (sq. mi.)
69	NAUGATUCK REGIONAL BASIN	311.1
6901	Hall Meadow Brook	2.4
6902	Hart Brook	6.8
6903	Nickel Mine Brook	5.6
6904	West Branch Naugatuck River	34.0
6905	East Branch Naugatuck River	14.4
6906	Spruce Brook	5.7
6907	Rock Brook	8.7
6908	Leadmine Brook	2[illegible].8
6909	Northfield Brook	5.6
6910	Branch Brook	22.6
6911	Hancock Brook	15.4
6912	Steel Brook	1[illegible].0
6913	Beaverpond Brook	[illegible].6
6914	Mad River	25.9
6915	Fulling Mill Brook	[illegible].3
6916	Hop Brook	17.4
6917	Long Meadow Pond Brook	8.4
6918	Beacon Hill Brook	10.2
6919	Bladens River	10.8

Basin. All of the basins ultimately drain into the Naugatuck River. The Naugatuck Regional Basin covers 311.1 square miles, and is one of nine regional basins within the Housatonic Major Basin.

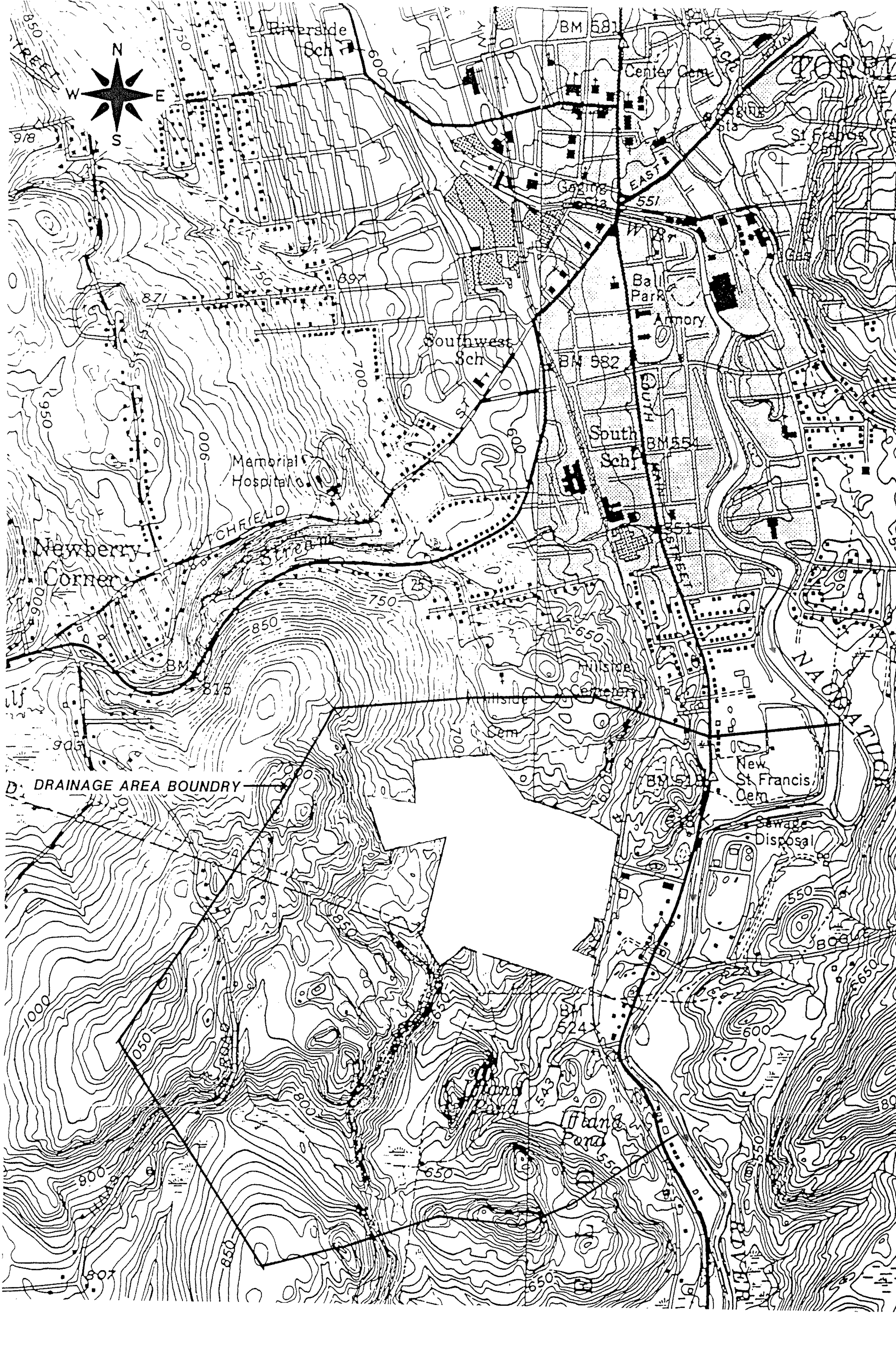
A localized drainage divide was drawn for the immediate area around the landfill (Figure 3-6). It indicates that the landfill is within 2,000 feet of the line marking the beginning of upgradient drainage areas that could drain toward the landfill. A drainage swale on the upgradient (western) boundary prevents storm water from flowing onto the landfill.

Surface water bodies within one mile of the site include:

- Peck Brook
- Naugatuck River
- Iffland Pond
- Gulf Stream
- Swamp and Wetland Areas

The surface water bodies that are down gradient are Peck Brook, Iffland Pond, and the Naugatuck River. Peck Brook is the closest surface water body, and is adjacent to the north end of the refuse landfill. Peck Brook flows in a southeasterly direction, and discharges into the Naugatuck River. Based upon analysis of water samples taken from the brook, it appears that the refuse portion of the landfill is having some impact on the brook. The metals that would be found in metal hydroxide sludges have not been found in Peck Brook. It is noted that if metals were found in the brook, it would be impossible to determine whether the metals migrated from the hydroxide sludge landfill or the refuse landfill.

The Naugatuck River is located approximately 2/10 of a mile to the east of the Torrington Landfill. The river receives all surface water drainage from three to four miles to the east and to the west. The



CONTOUR INTERVAL
10 FEET

FIGURE 3-6

LOCALIZED SURFACEWATER DRAINAGE

SCALE:
1" = 1000'

Naugatuck River flows in a southerly direction and ultimately discharges to the Housatonic River.

Iffland Pond is located to the south of the Torrington Landfill, and receives flow from at least two streams. Iffland Pond discharges to a stream which joins Peck Brook between the landfill and the Naugatuck River.

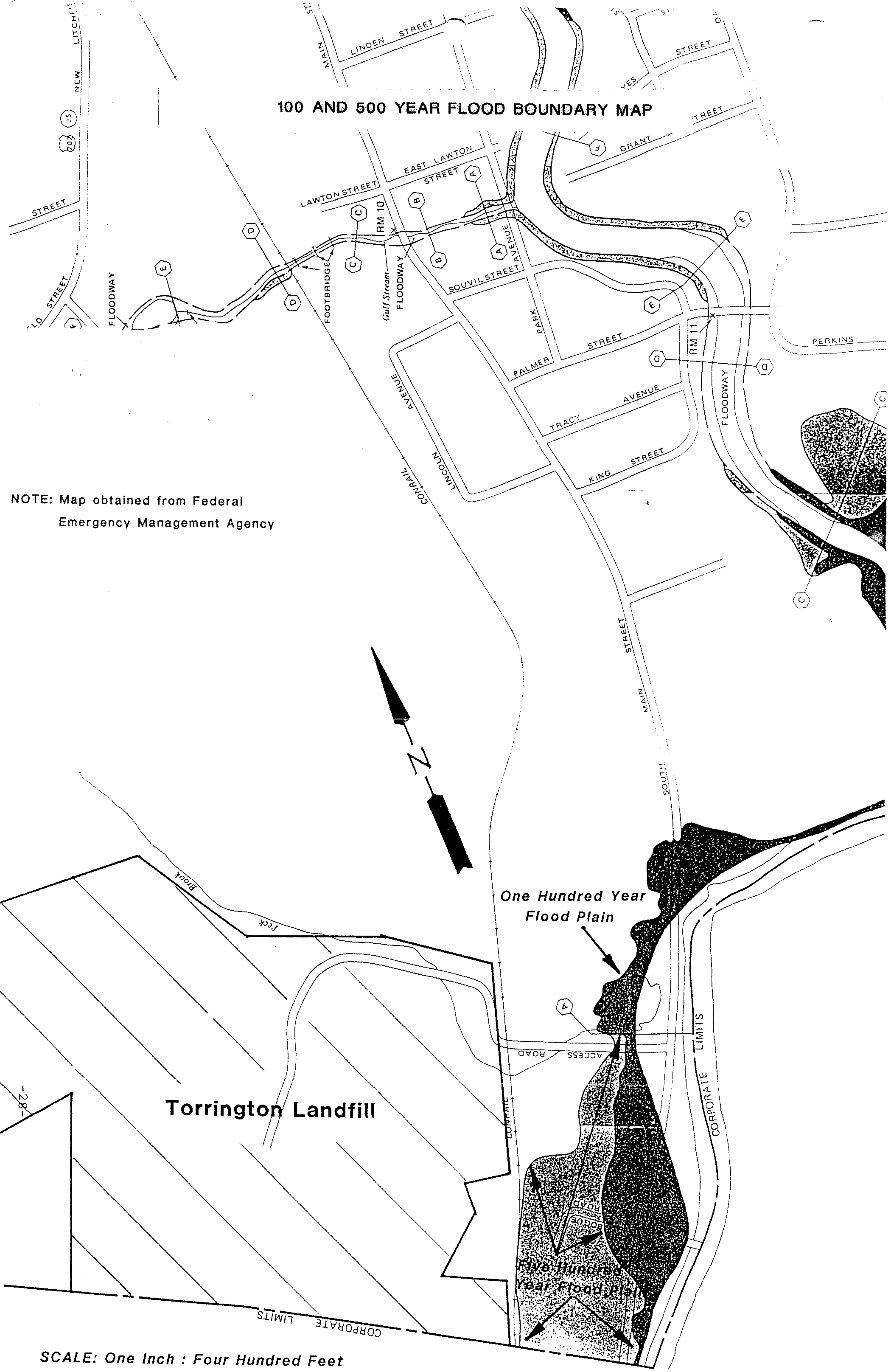
The Gulf Stream is approximately 6/10 of a mile to the northwest of the landfill. The stream flows in an easterly direction along Route 25 (until Route 25 turns north), ultimately discharging into the Naugatuck River. The stream is separated from the landfill by hills with peak elevations of 1,000 feet or more.

The 100 and 500 year flood boundaries are shown on Figure 3-7. The 100 year or 500 year flood boundaries would not reach either the refuse landfill or the metal hydroxide sludge portion of the landfill.

b) **Groundwater**

The major aquifer of the Torrington Region is contained within outwash (stratified drift) deposits consisting chiefly of layers of fine to coarse sand and gravel with traces of silt and clay. This material occurs almost exclusively as narrow belts in stream valleys and lowlands. Much of the aquifer is heterogeneous, with abrupt horizontal and vertical changes in texture, which causes difficulties in aquifer analysis. The outwash material near the banks of the Naugatuck River in the Torrington area was deposited on bedrock or till mantled bedrock in valleys and lowlands. It is bounded laterally and at its base by more impervious till and bedrock aquifer materials. The till and bedrock aquifers on the upgradient slopes provide the majority of recharge to the down gradient outwash aquifer. Since the rate of groundwater movement in these bounding aquifers is

100 AND 500 YEAR FLOOD BOUNDARY MAP



NOTE: Map obtained from Federal Emergency Management Agency

SCALE: One Inch : Four Hundred Feet

FIGURE 3-7

generally much slower than that in the outwash aquifer, well yields from the outwash aquifer may be restricted. Sustained pumping of water supply wells near the Naugatuck River may, therefore, reverse the natural groundwater discharge to the river, and induce localized recharge to the aquifer from the river.

According to U.S. Geological Survey sources, the narrow outwash aquifer being tapped by private wells down gradient of the landfill has an estimated range of transmissivity between 2,700 to 10,500 ft^2/day, indicating moderate to good yield to wells in the area. The saturated thickness of the unconsolidated material at down gradient well points ranges from 10 to 40 feet.

The second most productive aquifer of the region is the crystalline bedrock aquifer. Most of this aquifer is composed of a hard, dense, rock consisting of tightly interlocked mineral grains. Granitic gneiss and schist are the dominant bedrock types of the region. The solid part of crystalline bedrock is essentially impervious. Groundwater movement is largely in open fractures and joints which are most common in the upper few hundred feet of bedrock. Thus, the productivity of the aquifer varies widely from site-to-site due to widely differing transmissivities. It is therefore very difficult to predict well yields in the bedrock aquifer prior to drilling activities.

The thin till aquifer mantling bedrock on the landfill site consists of non-stratified, non-sorted deposits composed of rock particles ranging in size from boulders to clay. It extends under the outwash deposits in the valley and down gradient lowlands as a thin layer over bedrock.

Flood plain alluvial deposits, consisting of approximately 5 to 15 feet of silty gravel, cobbles, and boulders, line the upper surface of the outwash aquifer along the Naugatuck River.

Due to its relatively impervious nature, the till aquifer does not yield significant quantities of water to wells.

The groundwater in the saturated zone above bedrock at the landfill is shallow due to the thin layer of till covering bedrock and the relatively steep slopes involved. There is little existing information on the elevations or contours of the water table other than water level data collected from the groundwater monitoring wells on the periphery of the landfill. It is expected that the bedrock contours have a significant impact on the groundwater contours. This is evidenced by the fact that the groundwater elevations drop vertically 180 feet over a horizontal distance of 1,450 feet (from well No. 8A to well No. 6). There is a similar drop topographically, as well as in the elevations of bedrock.

A significant bedrock outcrop exists along he south-east boundary of the refuse landfill. The outcrop causes a localized groundwater divide in the till aquifer that separates the groundwater flow into two major components. One groundwater flow component is across the southern boundary of the refuse landfill. The other discharge would be across the northern and northeast boundaries of the landfill. Analytical results of samples taken from well No. 6 indicate that this groundwater divide occurs. Well No. 6 is immediately down gradient of the bedrock outcrop, and has shown relatively small impacts from the refuse landfill when compared to other monitoring wells. The conductivity of water from well No. 6 was 35 umhos/cm, while the same parameter ranged from 1,300 to 2,000 umhos/cm in the other wells down gradient of the landfill. The concentration of other parameters such as chloride, ammonia, nitrate, and hardness were one to two orders of magnitude lower at well No. 6 than other down gradient wells. A groundwater elevation contour map based on correlation of site topographic contours, aerial photo stereo pairs, and available water table elevation data is presented in Figure 3-8.

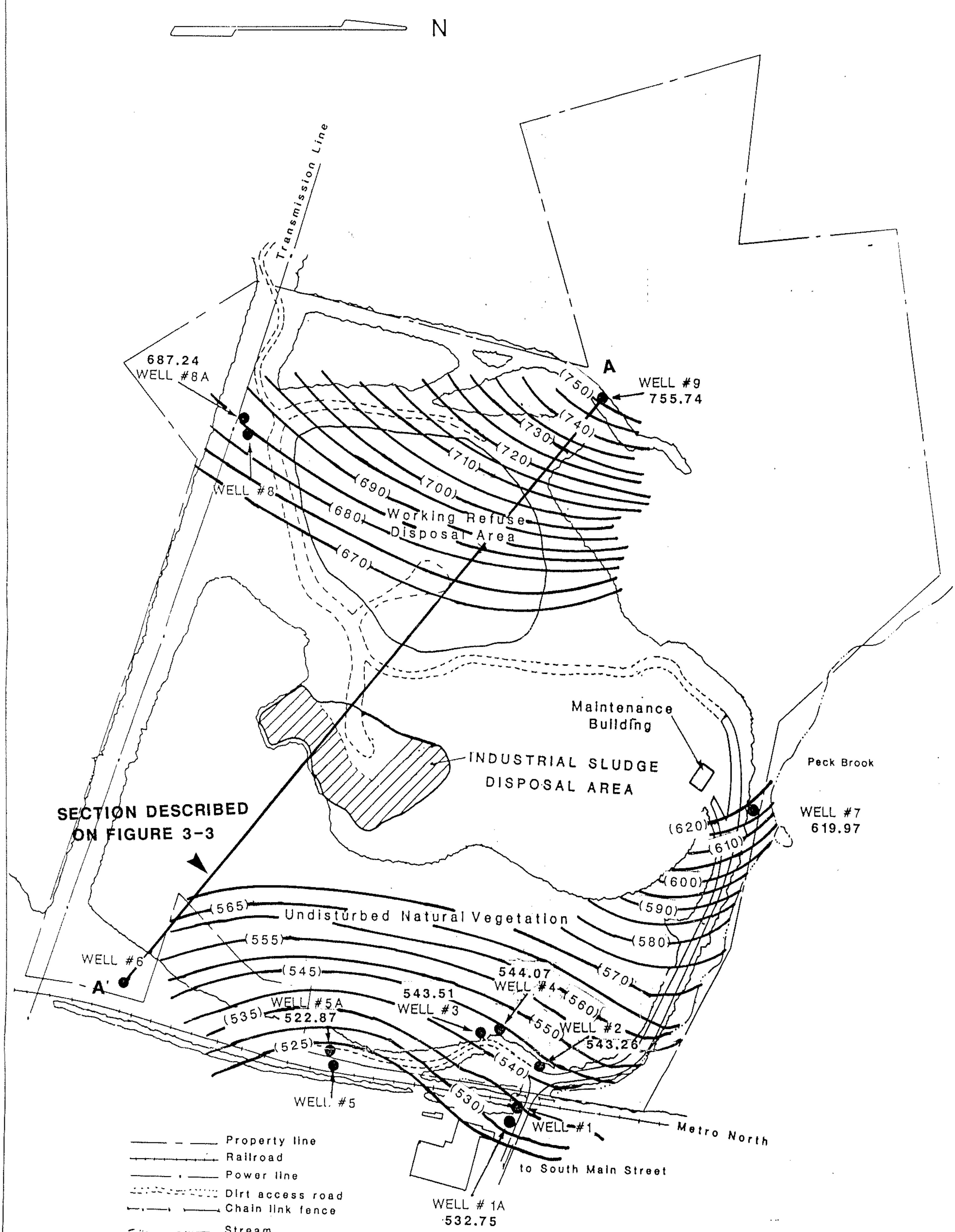


FIGURE 3-8

Torrington Landfill Site
Groundwater Level Contour Map
Fourth Quarter: October 29, 1987

Note: Contour Elevations in Feet

The available water table elevation data indicates that a radial flow pattern exists on the landfill site, with groundwater following topographic and bedrock contours, ultimately flowing in an easterly direction toward the Naugatuck River.

Using available water level data and the formula:

$$I = \frac{dh}{dL}$$

Where:

I = Hydraulic Gradient
dh = Vertical Difference in Total Head Between Points of Measurement
dL = Horizontal Distance Between Points of Total Head Measurements

The maximum hydraulic gradient across the landfill site (between monitoring well Nos. 9 and 1A) was calculated to be 0.109 ft./ft. The average groundwater flow velocity in the till aquifer underlying the landfill was approximated using Darcy's Law where:

$$V = \frac{-K}{n} \frac{dh}{dL}$$

K = Hydraulic Conductivity
n = Porosity
$\frac{dh}{dL}$ = Hydraulic Gradient
V = Average Linear Groundwater Flow Velocity

An average horizontal groundwater flow velocity of 0.0006 ft./day (0.22 feet/year) was calculated for the site using an estimated hydraulic conductivity (for the till material) of 0.001 feet/day; an estimated average porosity of 0.18; and a hydraulic gradient of 0.109 ft./ft. It should be noted that these figures are very approximate due to the limited porosity and hydraulic conductivity data available. More definitive measurements of these variables will be collected during the assessment program.

Vertical gradients cannot be estimated at this time since the existing monitoring well system does not include a well pair. It is assumed, however, that the landfill is located in a recharge area due to its location. It is expected that the heterogeneous nature and varying thickness of the till aquifer material, coupled with widely varying hydraulic gradients, cause wide variations in hydraulic conductivities, transmissivities, and flow velocities across the site. At this time, the data available is insufficient for the construction of a groundwater flow net.

The predominant source of groundwater flowing beneath the landfill site is contributed from percolation of rainwater through the landfill materials. This is due to the physical location of the landfill which is situated on the side of a hill, with a difference in elevation of approximately 300 feet between upgradient and down gradient areas.

The quantity of groundwater beneath the upgradient portion of the landfill is low because of predominantly bedrock topography with steep slopes that promote rapid run-off of precipitation.

3.3 Regional Groundwater and Surface Water Classification

The Torrington Landfill site is located within an area classified by the Connecticut DEP as GB/GA for groundwater and B/A for surface water (see Figure 3-9). Due to the presence of the landfill, a more reasonable classification for the study area would be GC/GC and C/B since leachate from the refuse landfill could potentially degrade groundwater and surface water quality down gradient, rendering it unusable for water supply uses without a substantial degree of treatment.

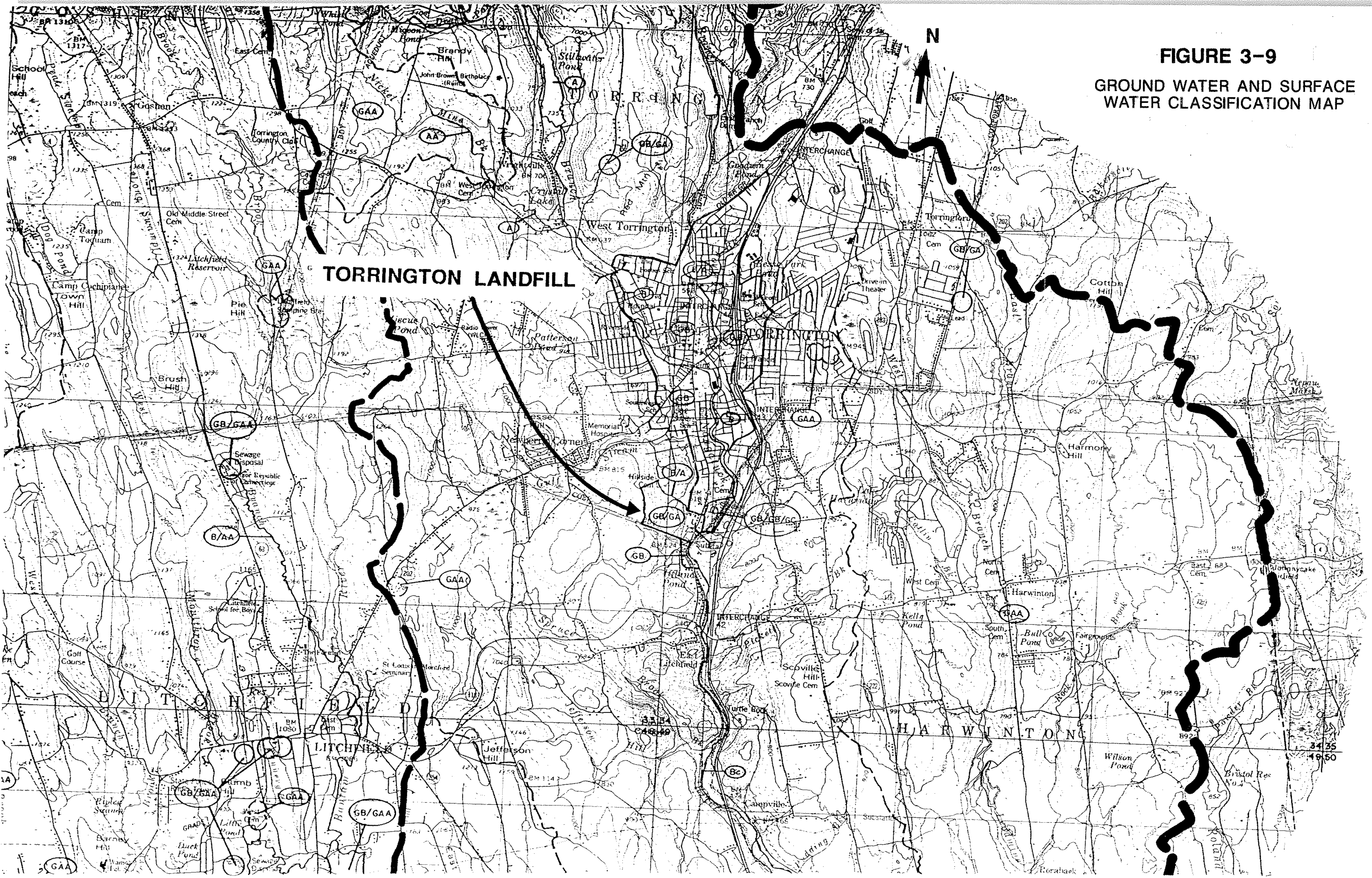


FIGURE 3-9

GROUND WATER AND SURFACE WATER CLASSIFICATION MAP

4.0 GROUNDWATER ASSESSMENT - TECHNICAL APPROACH OVERVIEW

The plan presented herein is comprehensive and has been developed to identify any groundwater contamination which may have resulted from metal hydroxide leachate from the hydroxide sludge portion of the landfill and/or leachate from a mixture of metal hydroxide sludge and sanitary refuse. As earlier stated, it will be very difficult (if not impossible) to characterize the sludge and refuse portions of the landfill as two separate entities due to the fact that the sludge disposal portion is located on top of the refuse landfill.

It should be noted that while the existing groundwater and surface water analytical data indicates that the landfill is having some adverse effect on groundwater and surface water quality in the study area, the concentrations of metals detected thus far in on-site monitoring wells has been negligible, with the exception of iron and low levels of barium. The majority of the parameters detected in elevated concentrations have been those normally associated with refuse leachate rather than metal hydroxide leachate.

YWC feels that additional on-site monitoring wells would be pointless since it is acknowledged that groundwater in the vicinity of the landfill has been impacted and contains compounds that are not naturally occurring.

YWC proposes to accomplish the Groundwater Assessment/Remedial Investigation of the Torrington Landfill using a three-phased approach.

The first phase will entail the performance of groundwater investigation tasks outlined herein, including the installation of additional monitoring wells, groundwater sampling, and laboratory analysis of collected groundwater samples for those parameters of 40 CFR 264, Appendix IX version of the 40 CFR 261, Appendix VIII list compounds which have U.S. EPA approved analytical protocols at the time of sample analysis.

Phase II will entail interpretation/evaluation of collected analytical data and client/regulatory agency correspondence to discuss findings. Supplemental investigative efforts will be implemented at this point in the project if deemed necessary.

Phase III will entail preparation of a Groundwater Assessment/ Remedial Investigation Report which includes the following:

- Documentation of field activities performed;
- Presentation of analytical data generated;
- Final data interpretation and conclusions drawn;
- "As built" specifications for monitoring wells installed;
- A discussion of additional hydrogeologic data collected;
- RIP conclusions;
- Evaluation/recommendations for remediation alternative if ultimately deemed appropriate for the site.

YWC proposes to focus the majority of Phase I investigative efforts in areas down gradient of the three on-site groundwater flow direction components. The groundwater sampling efforts and analytical parameters proposed for the off-site environmental assessment are not intended to be utilized as an addendum to the existing RCRA groundwater and surface water sampling program, but rather to better identify the site groundwater flow regime and any contaminant plume(s) which may be migrating off-site. The analytical parameters outlined herein for initial Phase I sampling activities are therefore proposed as a one time investigative effort to identify the chemical constituents of any contaminant plume(s) which may be present in groundwater down gradient from the metal hydroxide sludge/sanitary landfill. If a plume is identified in this preliminary assessment phase, the Phase II supplementary monitoring program will be adjusted to include the contaminant constituents identified during Phase I (subject to approval by DEP/EPA), and to better evaluate its rate of migration and extent. If no significant plume is detected, the monitoring program will be adjusted accordingly.

4.1 Phase I - Groundwater Monitoring Well Installations

An off-site groundwater monitoring network consisting of seven monitoring wells is proposed to determine if refuse and/or metal hydroxide leachate is currently impacting groundwater quality down gradient from the landfill.

The Phase I groundwater monitoring well installation and sampling plan has been designed to accomplish the following objectives:

- Establish a stratigraphic column for overburden and bedrock materials;
- Collect information on off-site unconsolidated aquifer materials, including grain size distribution, porosity, hydraulic conductivity, and hydraulic gradients;
- Determine approximate groundwater flow rates and flow directions off-site;
- Investigate vertical components of the off-site groundwater flow regime (i.e., recharge, discharge, or lateral flow area), and provide a vertical profile of groundwater quality down gradient from the major metal hydroxide landfill flow regime (directional) component;
- Investigate the degree of fracturing in the bedrock aquifer down gradient from the landfill;
- Determine the presence of any off-site contaminant plume(s) and identify contaminant constituents;
- Quantify off-site dilution, dispersion, and attenuation of detected parameters.

a) Location and Depth of Monitoring Wells

It is proposed that the existing landfill groundwater monitoring network be expanded to include seven additional wells. The approximate locations of proposed new monitoring wells are presented in Figure 4-1. The wells have been positioned to intercept groundwater flowing off the north, northeast, and south property boundaries. Monitoring well No. 9 will continue to supply (upgradient) background water quality data for comparison with down gradient groundwater quality data. Wells are not proposed for the area down gradient of (vandalized) monitoring well No. 6 (along the southeast boundary) since a substantial bedrock aquiclude causes a localized groundwater divide upgradient of this site. Prior to being vandalized, well No. 6 showed no contamination, which provides further evidence indicating a groundwater divide at this location.

Off-site composite overburden monitoring well Nos. OS-10, OS-11, and OS-12 will be located south of the southern landfill boundary (at the locations shown in Figure 4-1) to investigate the quality of groundwater flowing off the landfill's southern boundary, and to better define the hydrogeologic characteristics of the area. All three wells will be installed to bedrock surface.

Monitoring Well No. OS-13 will be installed near the intersection of Old Dump Road and South Main Street to quantify off-site dilution, dispersion, and attenuation of the chemical constituents detected in on-site Well Nos. 1A, 1B, 2, 3, and 4. Well No. OS-13 will be installed to bedrock surface as a composite overburden well.

Well No. 1B (deep) will be placed adjacent to existing Well No. 1A, and will be installed approximately 15 feet into bedrock, depending upon the degree of fracturing observed during rock coring activities.

The purpose of the well pair (1A, 1B (deep)) will be to:

- Investigate vertical components of the groundwater flow regime;

TORRINGTON LANDFILL

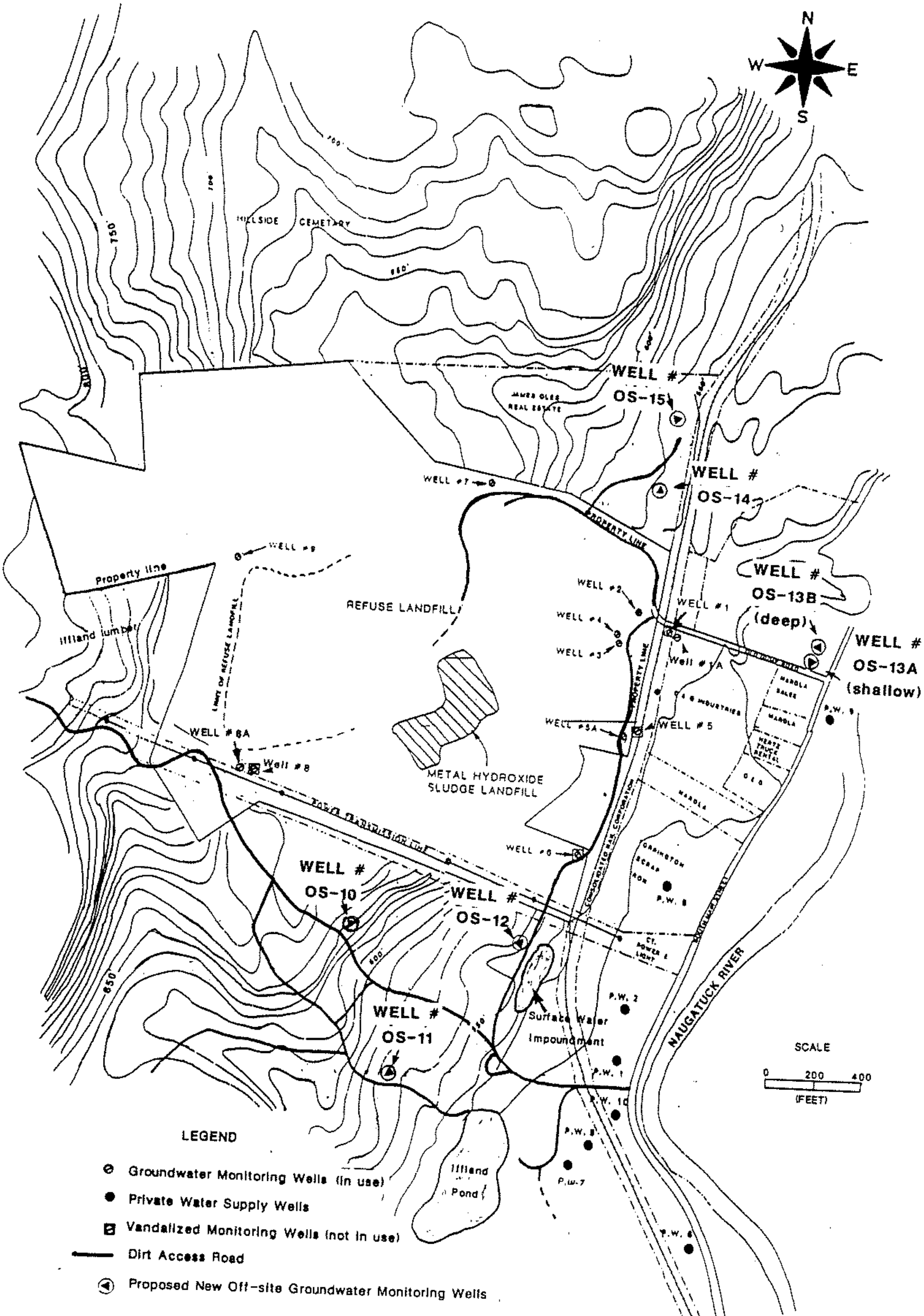


FIGURE 4-1

Location of Proposed Off-site Groundwater Monitoring Wells

- Investigate the degree of fracturing in the bedrock aquifer;

- Determine the correlation between aquifer depth (and type) and contaminant concentrations (if detected);

If a strong downward component of vertical flow is indicated by water level and sampling data collected from this well pair, then the installation of additional deep (bedrock) monitoring wells to cover the northeastern and southern landfill flow direction components may become necessary at some point in the future.

Monitoring well Nos. OS-14 and OS-15 will be located approximately 200 feet and 550 feet, respectively, from the northeastern landfill property line, and approximately 100 feet west of the Conrail railway. Both wells will be installed to bedrock surface. The purpose of composite well Nos. OS-14 and OS-15 will be to: 1) quantify off-site dilution, dispersion and attenuation of those contaminant constituents found in on-site monitoring well No. 7; 2) to further characterize the hydrogeologic characteristics of the area; and 3) to identify any off-site plume resulting from northerly components of groundwater flow off the landfill.

All groundwater monitoring wells will be installed in accordance with specifications and methodologies outlined in Section 5.0 (Field Protocols - Quality Assurance/Quality Control).

The precise location of new monitoring wells will be controlled by site accessibility and the location of sub-surface utilities. However, based upon a previous walk-through of the site by the author, it is anticipated that monitoring well installation locations will be very near those locations shown in Figure 4-1. Well installation points will be staked in the field prior to initiation of on-site well construction activities.

Upon completion of monitoring well installations, well elevations and locations will be surveyed for determination of groundwater elevations and preparation of as-built drawings. This information will also be utilized to further delineate groundwater flow regimes.

In addition to the newly installed monitoring wells, groundwater sampling and analysis of the existing private wells will also be conducted. In order to further delineate the vertical extent of contaminant plumes from the landfill, those private wells which are accessible will be sounded for depth.

4.2 Groundwater Sampling - Analytical Parameters

As per agreements voiced between YWC, the U.S. EPA, and the Connecticut DEP during the project meeting held on April 21, 1987 at the Connecticut DEP Headquarters in Hartford, Connecticut, it is anticipated that Well Nos. 9, 13, 1A, 1B (deep), 5A, and OS-12 will be sampled for the complete list of (recently proposed) 40 CFR 264 IX compounds (see Appendix E), an amended version of the 40 CFR 261 Appendix VIII list. It should be noted that, at the time of this writing, many of the compounds listed have no published, EPA approved analytical protocols. Reportedly, an approved list of protocols will be published some time in 1987. Feasibility of analysis for many of the compounds listed in proposed EPA Appendix IX is therefore somewhat contingent upon publication of approved analytical protocols for these chemical parameters. This dilemma will be further discussed with U.S. EPA and Connecticut DEP representatives prior to initiation of on-site sampling activities. The wells chosen for this extensive analytical parameter group sampling effort are located down gradient of the two major sludge landfill flow regime components. All remaining new and existing groundwater monitoring wells (Well Nos. 8A, OS-10, OS-11, 2, 3, 4, OS-14, and OS-15) will be sampled for those analytical parameters listed in 40 CFR 265.92 as per agreements made during the above referenced meeting, as well as cyanide and on 8010 - 8020 volatile organic scan.

Sampling of private wells will include:

- continuing sampling as specified in the solid waste Permit No. 143.1L;
- annual sampling and analysis for the 11 metals formerly assayed for in Wells 3, 4, 5A, and 8A;
- annual sampling and analysis for sodium, sulfate, cyanide, and the (permit-required) volatile organic scan; and
- semi-annual sampling for pH, specific conductance, and the 9 (permit-required) leachate indicator parameters.

Groundwater monitoring well sampling procedures, materials, and sample preservation techniques to be utilized during the site assessment program will be as outlined in Section 6.0. Laboratory analytical protocols (tentative) and QA/QC to be followed during laboratory analyses are presented in Section 7.0. A complete description of the YWC Laboratory QA/QC is included as Appendix F.

The analytical data obtained for all wells will be carefully compared in order to establish the location and extent of any contaminant plumes resulting from landfill leachate.

Water level elevation data collected during sampling activities will be used to prepare a groundwater elevation contour map which will be included in the first determination report (Phase III).

After the initial round of samples, quarterly groundwater monitoring will be continued as for previous (1986 - 1988) events, with the continuation of analysis as per that program (Solid Waste, Permit No. 143-1L).

5.0 FIELD PROTOCOLS - QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

This section addresses specific methodologies and protocols to be utilized for QA/QC during the on-site well installation and sampling activities at the Torrington Landfill site. The well drilling and installation methodologies sections are based upon review of available information concerning geologic/hydrogeologic and chemical characteristics at the study site. A comprehensive description of methods required for every conceivable situation which might be encountered in the field has not been attempted. Rather, the drilling and well installation methodologies presented herein are intended only as basic guidance for quality control. Exact protocols may be altered in the field based upon specific conditions encountered, but shall always be in accordance with applicable State and Federal Guidelines.

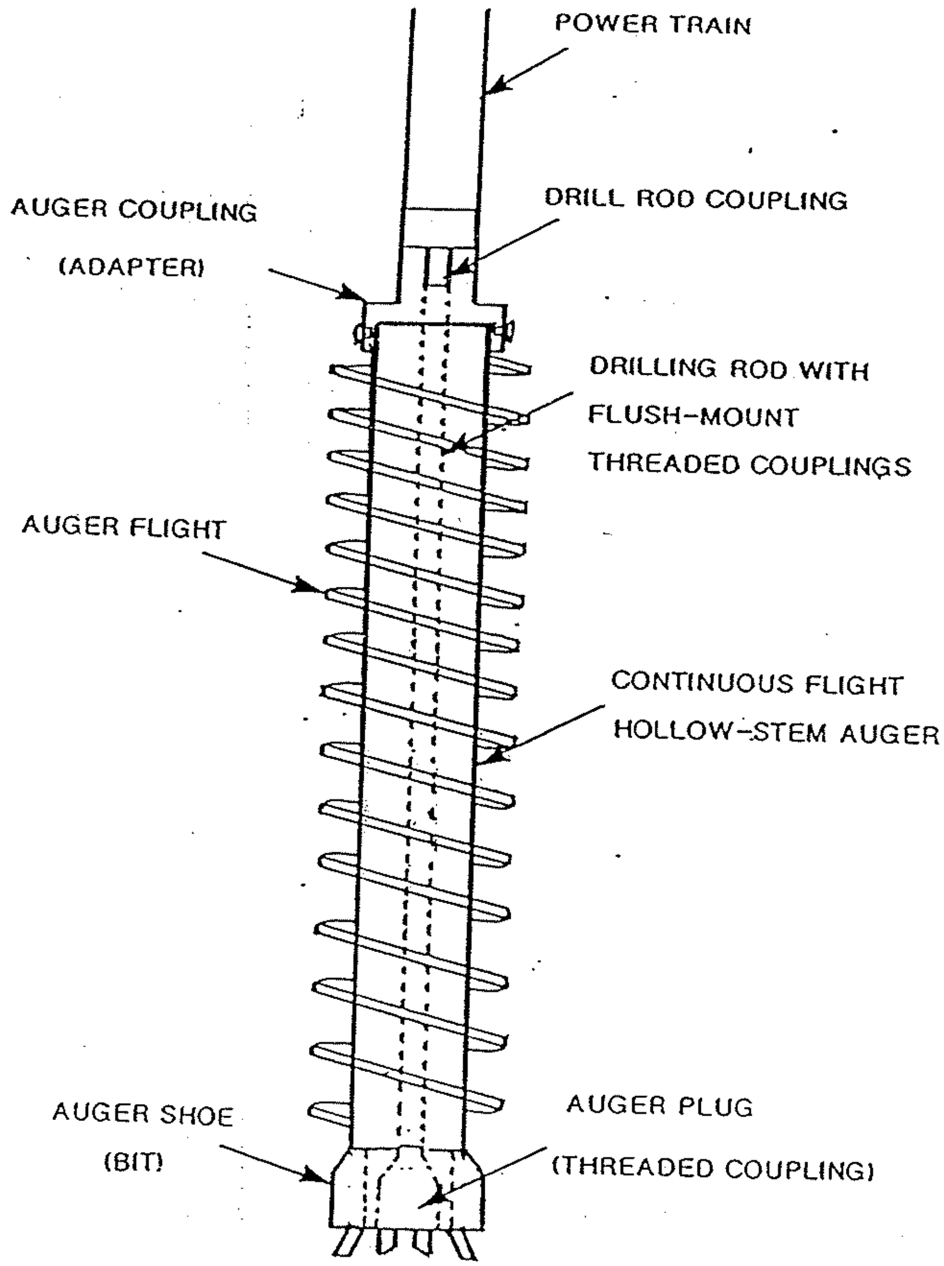
5.1 Well Drilling Methodology

Down-hole well boring equipment will be cleaned prior to initiating the first well bore hole and in between well boring locations as specified in Section 5.1b. All groundwater monitoring well bore holes will be initially advanced using the continuous flight, hollow stem auger method of rotary drilling.

To ensure that soil samples collected are representative of depth intervals being sampled, an auger plug (of appropriate diameter for the internal diameter of the hollow stem augers) will be utilized to prevent the entrance of soils into the open end of the auger string (at the auger shoe (bit)). The auger plug will be attached to the end of a string of drilling rod (via threaded coupling) of sufficient length so that the plug is positioned at the down-hole end of the auger string (flush with the auger shoe - see Figure 5-1). As the boring progresses and sections of auger are added to the auger string, equal lengths of drilling rod will be added concurrently to maintain the auger plug's position at the bottom of the auger string. The above-ground end of the drilling rod string will be attached to a threaded drill rod coupling inside the auger coupling (adapter).

FIGURE 5-1

HOLLOW-STEM AUGER DRILLING ASSEMBLY



When drilling composite wells, if auger refusal occurs (due to cobbles, boulders, or bedrock) within the first 15 feet and prior to reaching the desired total depth, the drill string will be withdrawn from the bore hole and moved to an adjacent alternate location, as directed by the YWC boring supervisor, to investigate the continuity and extent of the obstruction encountered. Where absolutely necessary for stratigraphic identification/verification, 5 feet of exploratory rock coring may be performed utilizing a standard AX core barrel to investigate the vertical extent of the encountered obstruction.

If examination of the core barrel sample and the rate of core barrel penetration indicate bedrock, drilling activities will be terminated. If unconsolidated material is encountered within 2 feet from the point at which rock coring was initiated, the core barrel will be withdrawn from the bore hole. A boulder fracturing wedge, or other appropriate drilling tool, will be inserted to the bottom of the bore hole in an attempt to fracture the obstructing boulder to such a degree that the auger string can be advanced. If this attempt proves unsuccessful, the drilling method may be converted to a combination of the tricone rotary bit, core barrel, and casing drive methods. If auger advancement is possible, boring and sampling activities shall continue until bedrock is encountered.

When rock coring becomes necessary, a coring water recirculation tub will be used to prevent coring water run-off onto the ground surface, and to minimize the volume of water required. Drilling mud will not be utilized during well installation activities at the Torrington site. All retrieved rock core samples will be examined, logged, and retained in wooden core boxes for future reference.

When installing the deep bedrock monitoring well (15 feet into bedrock), all coring will be performed utilizing a standard NX core barrel. Retrieved core samples will be carefully examined by the YWC geologist to differentiate between boulders and bedrock. If examination of core samples indicates bedrock, drilling shall be terminated approximately 15 feet into the bedrock/unconsolidated material interface. Five inch interior diameter, flush joint steel casing will be advanced to the bedrock interface to prevent bore hole collapse during well installation activities. Well installation methods for the bedrock well and composite well(s) will be as specified in Section 5.2.

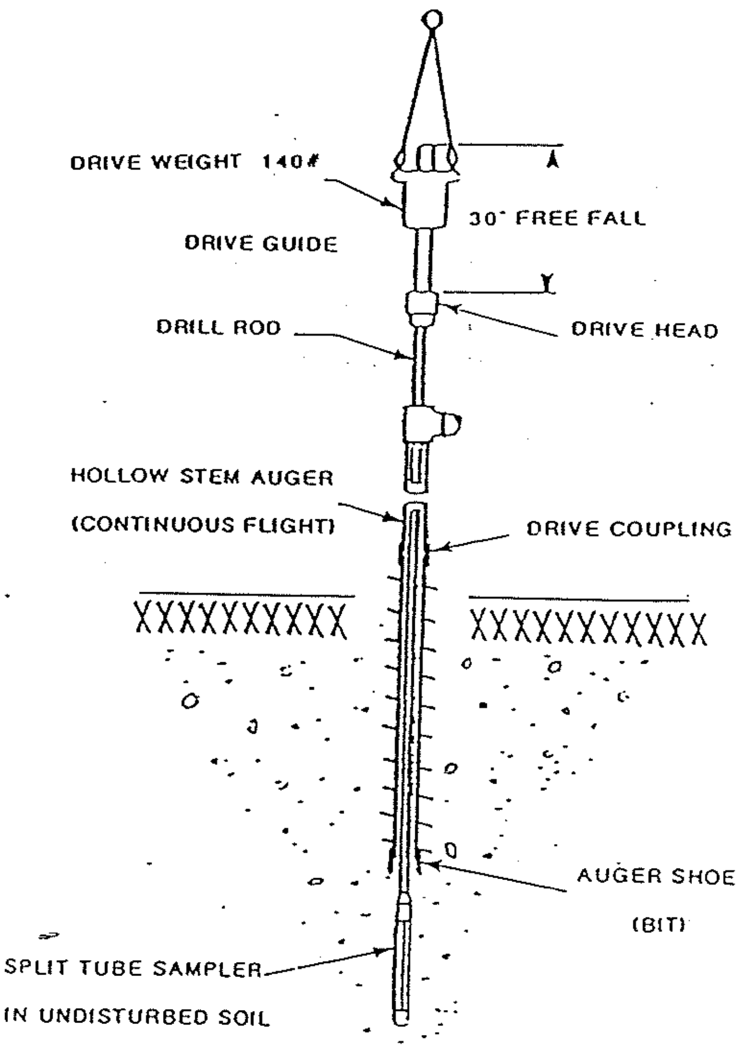
a) **Monitoring Well Bore Hole Soil Sampling**

Split tube (spoon) soil samples will be collected at 5 foot intervals during auger advancement for stratigraphic identification of formations penetrated at each well boring site. Auger advancement will be stopped at 5 foot intervals, where upon the auger plug will be removed to allow driving of the split tube sampler. Soil samples will be obtained at each 5 foot sampling interval by driving the split tube sampler 24 inches into the undisturbed material at the bottom of the well bore hole with a standard 140 pound cylindrical drive hammer (see Figure 5-2). The number of hammer drops per 6 inches of sampler advancement will be recorded in the boring supervisor's well/bore hole geologic log. Upon retrieval of the split tube sampler from the bore hole, soil samples obtained will be examined and documented in the boring supervisor's log in accordance with the Standard Geologic Logging Protocols presented in Appendix G. A representative soil sample from each split spoon sample will be placed in a glass jar for future reference and for the performance of soil sieve analyses. This will facilitate the acquisition of particle size distribution data necessary to approximate porosity and permeability values for the overburden (water table) aquifer at each well site.

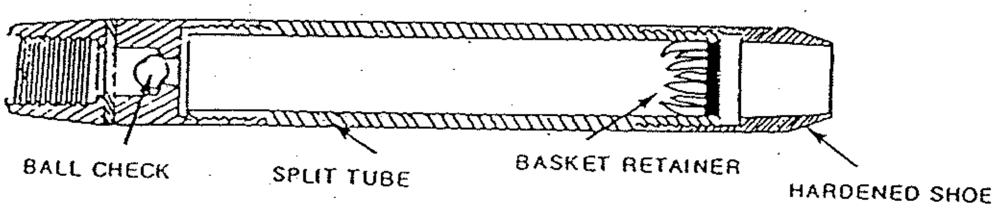
The split tube sampler will require rinsing (with approved potable water) only between sampling intervals at each well bore hole since soil samples obtained will not be analyzed in the laboratory. Split tube samplers will, however, require steam cleaning before the first well bore hole is initiated, and between well bore holes as specified below.

FIGURE 5-2

SPLIT TUBE SAMPLER DRIVE ASSEMBLY



SPLIT TUBE SAMPLER



b) **Cleaning and Lubrication of Drilling and Sampling Equipment**

To prevent the introduction of contaminants from off-site, all drilling and sampling equipment shall be thoroughly cleaned with steam/high pressure water prior to arrival at the project site. Pre-arrival cleaning shall include both the inside and outside of all portable water tanks, augers, drill casings, drill rods, split tube samplers, and recirculation tanks. All equipment shall be free of any asphaltic, bituminous, or other encrusting or coating materials.

Prior to commencement of on-site drilling activities and between individual bore holes, all hollow stem augers, drill casings, drill rods, split tube samplers, recirculation tubs, and other equipment to be utilized shall be inspected for cleanliness, and if found to be unsatisfactory, thoroughly cleaned (inside and out) with steam/high pressure water, as directed by the YWC boring supervisor. In addition, all split tube samplers shall be rinsed with approved water between soil sampling intervals.

All water utilized for coring, casing wash-out, sampling equipment cleaning, and drilling equipment must be approved by the field Project Manager prior to use on-site. It should always be assumed that the ground surface is contaminated. No down-hole drilling tools, equipment, casing, or sampling devices shall be paced on the ground (or drilling rig platform) after cleaning. New plastic sheeting shall be laid on the ground surface as a work surface to store augers, drill casing, screen, riser pipe, and fittings after cleaning. This sheeting will be discarded after each hole is drilled and replaced with new plastic sheeting for the next boring site.

Only silicone or vegetable based lubricants will be used on the threads of down-hole drilling equipment. Lubricants to be utilized will be approved by the Project Geologist or field Project Manager prior to use on-site.

c) **Composite Monitoring Well Installation Procedures**

Upon completion of each monitoring well bore hole, measurements will be performed, as necessary, to ensure that the auger (casing) drill string is not plugged with formation cuttings. Well material installation procedures will then proceed as follows:

1) Insert the appropriate length of well screen and riser pipe through the hollow portion of the auger (casing) string to the bottom of the bore hole. Clean gloves will be worn by workers while handling well screen and riser pipe to prevent possible contamination of materials by dirty gloves (hands).

2) Add 2 feet of sand pack to the annular space between the well screen and auger (casing) string at the bottom of the bore hole.

3) Verify that the sand pack has reached the desired depth with a sand tamp.

4) Withdraw a 2 foot length of the auger (casing) string from the bore hole.

5) Measure the static water level within the well screen and riser pipe.

6) Adjust the setting depth (depth interval) of the well screen, if necessary, so that approximately 2 feet of the screened interval is above the measured static water level. Add sufficient sand to maintain this positioning.

7) Add 2 feet of sand pack.

8) Verify proper sand pack placement and continuity with the sand tamp.

9) Withdraw another 2 feet of the auger (casing) string from the well bore hole.

10) Repeat Steps 6 through 10 until the screened interval is at the proper setting depth, and the sand pack is approximately 2 feet above the top of the screened interval.

11) Withdraw the auger (casing) drill string to a depth equal to that of the top of the sand pack.

12) Add 2 feet of bentonite pellets to the annular space above the sand pack, a small amount at a time, while incrementally withdrawing the auger (casing) drill string.

13) Verify the depth and continuity of the bentonite seal with the sand tamp to ensure it has reached the desired interval directly above the well screen sand filter pack.

14) Install available auger flight drill cuttings in the remaining annular space above the bentonite seal to a depth approximately 3 feet below grade. If available cuttings are insufficient to fill the remaining annular space, then bentonite or cement grout shall be substituted.

15) Cut off appropriate length of riser pipe so that the above ground portion extends 2 feet above the ground surface.

16) Install riser pipe plug (cap) (which is easily removable by hand).

17) Place 5 foot steel protective casing over riser pipe and position it so that the top of the steel protective casing is level, or slightly above the top of the well riser pipe.

18) Fill in annular space between steel protective casing and the bore hole with Portland cement/ sand mixture. Cement should be mounded around the protective casing to promote rapid water run-off and prevent puddling.

19) If available, remaining auger flight drill cuttings can be mounded on top of the cement and surroundings to provide additional protection from run-off.

A diagram of a typical completed composite monitoring well installation is presented in Figure 5-3.

d) **Bedrock Monitoring Well Installation Procedures**

Upon completion of bedrock coring activities, well materials installation procedures will proceed as follows:

1) Insert 10 feet of screen and the appropriate length of PVC riser pipe (equipped with a neoprene triseal packer positioned 1 foot from the bottom of the riser pipe) through the interior of the steel drill casing to the bottom of the core hole, taking care to ensure that the packer is seated just below the bedrock-unconsolidated material interface.

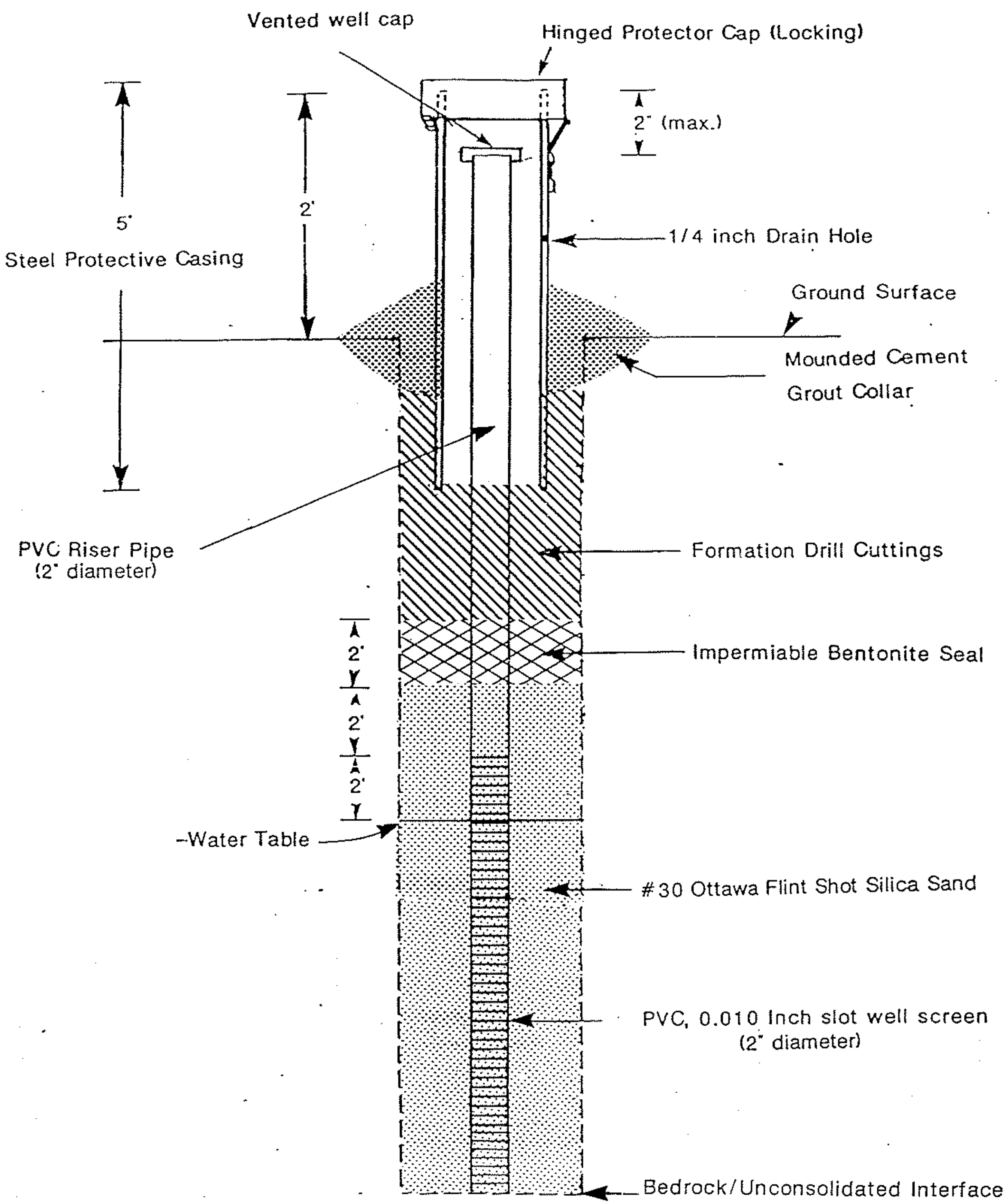
2) Slowly add 1 foot of bentonite pellets to the annular space between the well riser pipe and drill casing at the bottom of the casing (directly above the triseal packer at the bedrock interface).

3) Verify that the bentonite seal has reached the desired depth with a sand tamp.

4) Withdraw 1 foot of the steel drill casing from the bore hole.

FIGURE 5-3

COMPOSITE MONITORING WELL



(Drawing not to scale)

5) Add 1 foot of bentonite pellets (as per Step 2).

6) Repeat Steps 2 through 5 until a 3 foot bentonite seal has been placed directly above the packer.

7) Withdraw the steel drill casing to a depth equal to that of the bentonite seal.

8) Install available auger flight drill cuttings in the remaining annular space to a depth approximately 3 feet below grade while incrementally withdrawing the remaining down hole drill casing from the bore hole. If available formation drill cuttings are insufficient to fill the remaining annular space (to a level 3 feet below grade), then bentonite or cement grout may be substituted.

9) Cut off the appropriate length of riser pipe so that the above ground portion extends 2 feet above the ground surface.

10) Install a riser pipe plug (cap) which is easily removable by hand.

11) Place 5 feet of steel protective casing over riser pipe and position it so that the top of the steel protective casing is level or slightly above the top of the PVC well riser pipe.

12) Fill in the annular space between the steel protective casing and bore hole with Portland cement/sand mixture. Cement should be mounded around the protective steel casing to promote rapid water run-off and prevent puddling around the well.

The purpose of the bentonite seal is to provide an impermeable barrier to groundwater migration from the unconsolidated aquifer into the bedrock aquifer via flow through the annular space between the well riser pipe and the bore hole wall at the unconsolidated/bedrock interface. The primary function of the "triseal packer" is to prevent migration of the bentonite seal into the screened portion of the bedrock core hole, as well as to provide a secondary barrier to vertical groundwater migration. This double barrier to groundwater flow between the overburden and bedrock zones will help to ensure that groundwater samples obtained from well # 1B are representative of actual bedrock aquifer groundwater quality conditions. A construction diagram of the triseal packer bentonite seal configuration is presented in Figure 5-4.

A diagram of a typical bedrock monitoring well is presented in Figure 5-5.

e) **Monitoring Well Elevation Surveying**

Upon completion of monitoring well installation activities, the elevations of the ground surface, PVC riser pipe, and steel protective casing will be surveyed by a qualified YWC representative for inclusion into the final assessment report.

f) **Monitoring Well Construction Materials Specifications**

Monitoring well material selections have been based upon knowledge of chemical characteristics of groundwater at the Torrington site. Monitoring well construction materials will be approved by the Project Hydrogeologist prior to use on-site. Materials specifications will be as follows:

1) Monitoring Well Screens - New 2 inch diameter, commercially fabricated, ASTM approved, PVC slotted (0.010 inch slot size). All screen bottoms shall be securely fitted with a cap or plug of the same composition as the screen.

FIGURE 5 - 4

BEDROCK MONITORING WELL
PACKER - BENTONITE SEAL CONFIGURATION

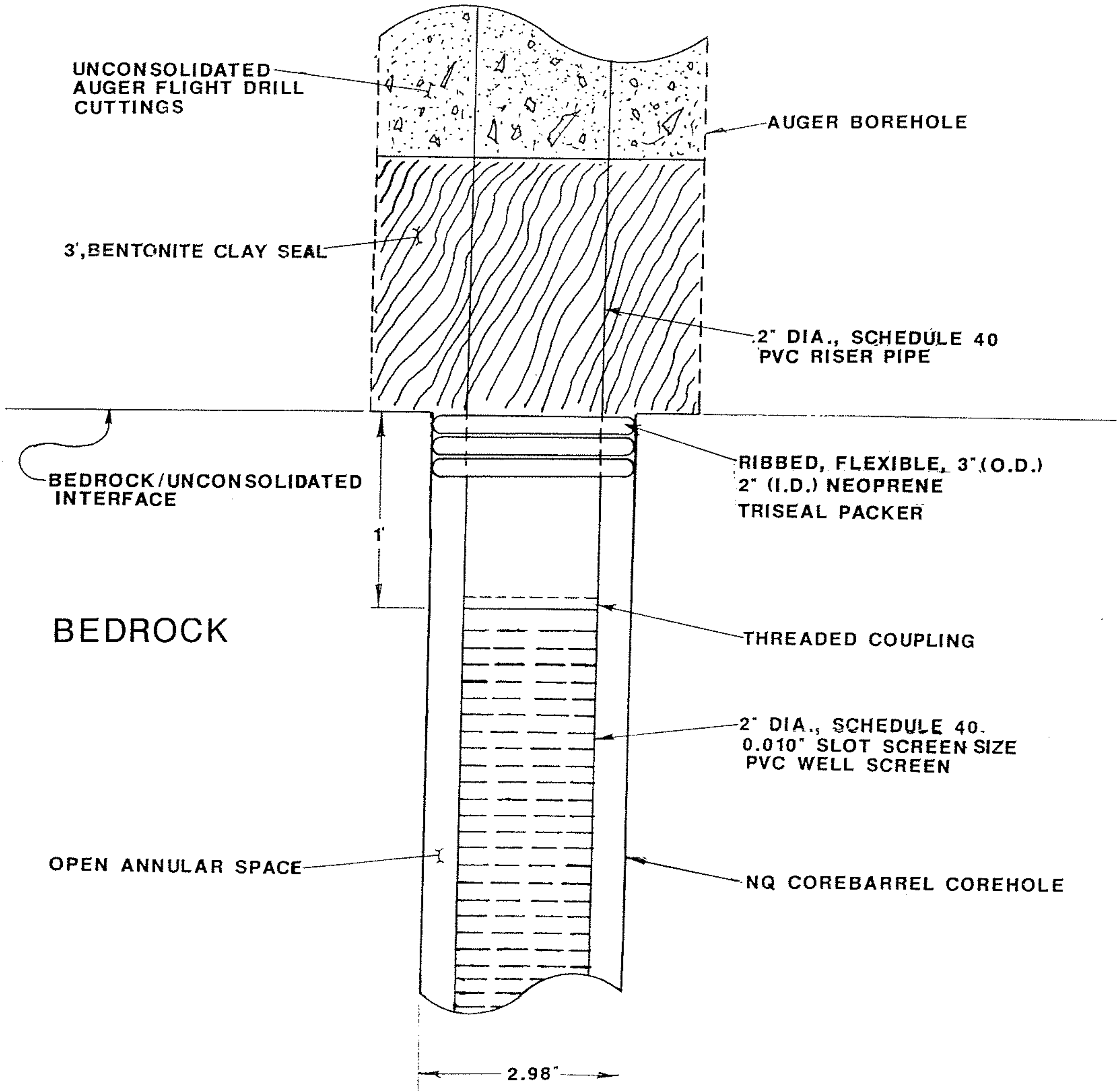
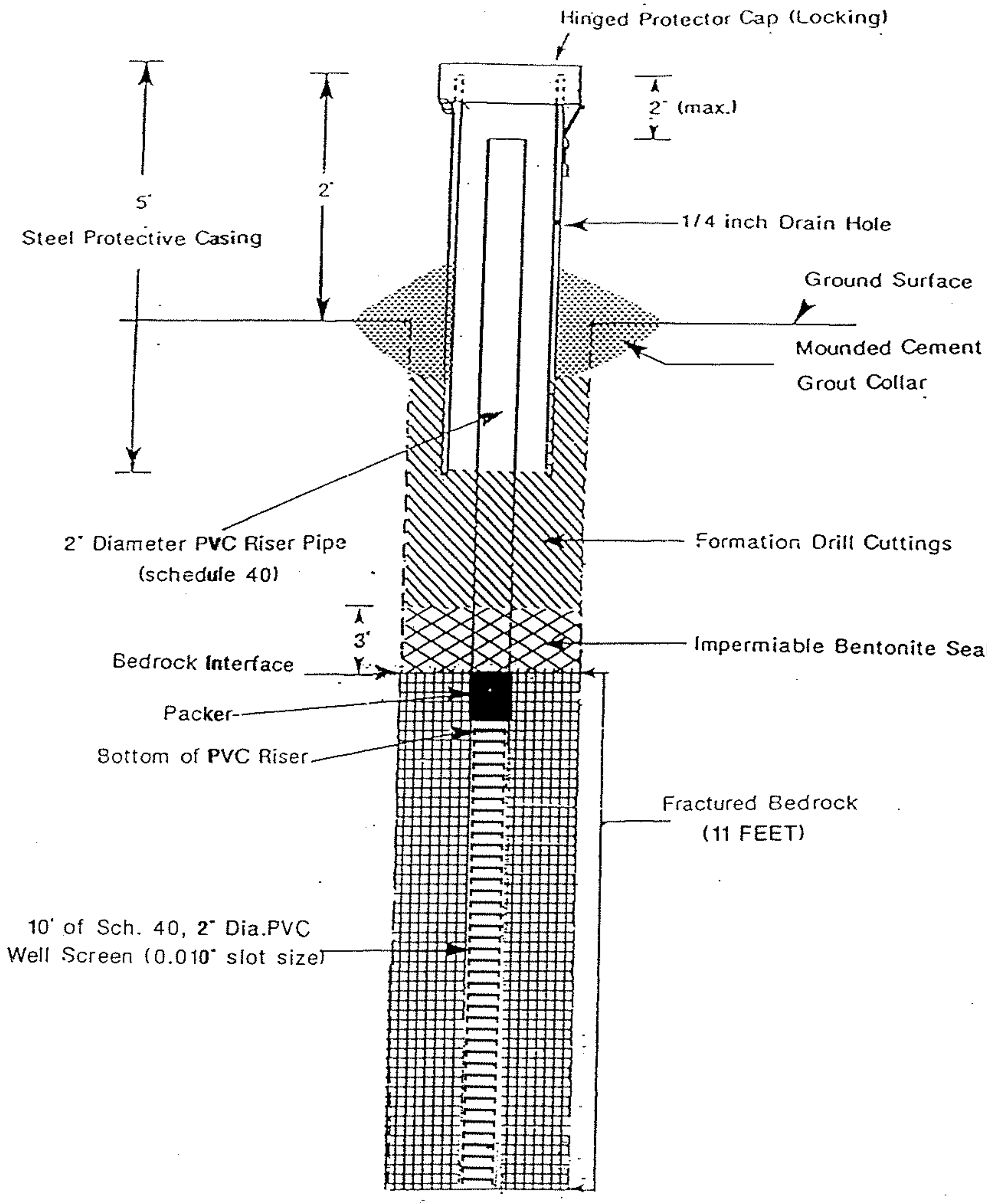


FIGURE 5-5
Bedrock Monitoring Well



(Drawing not to scale)

2) <u>Monitoring Well Riser Pipe (Casing) and Fittings</u> - Two (2) inch diameter, PVC. No fittings (coupling) shall restrict the inside diameter of the joined casing and/or screen. Joints within and between screen and riser pipe shall be threaded couplings. No cements or glues will be used on well material couplings.

3) <u>Bentonite Seals</u> - Commercially available bentonite pellets or powder, approved by the Project Hydrogeologist.

4) <u>Surface Steel Protective Casings</u> - A 5 foot minimum length of new, 5 inch diameter, iron/steel pipe, equipped with a lockable hinged cover (cap) to keep precipitation and run-off out of the casing. A 1/4 inch diameter drain port (hole) shall be drilled in the protective casing approximately 6 inches above final grade. The outside only of protective casings, hinges, and covers (caps) will be painted fluorescent orange prior to arrival on-site. The well designation shall be painted on the outside of the protective casing after installation.

5) <u>Padlocks</u> - All padlocks shall be of a quality as manufactured by Yale. All site monitoring wells will be secured with locks, opened by the same key or combination. Locks shall be installed on the protective casing cap from the date of casing installation.

6) <u>Well Screen Sand Pack</u> - No. 30 Ottawa Flint Shot Silica Sand or sand of equal quality which is chemically and texturally clean, inert, siliceous, and of appropriate size for well screen and host environment. The lithology, grain size distribution, trade name source (pit or quarry of origin), and processing method of the sand pack material shall be reviewed and approved by the Project Hydrogeologist prior to use on-site.

7) Water Sources - The sources of any water to be used in drilling, grouting, sealing, purging, well installation, or equipment washing will be approved in advance by the field Project Manager. All water will be procured, transported, and stored in a manner to avoid chemical degradation of the water once obtained.

8) Down-Hole Drilling Equipment Lubricants - Only petroleum jelly, teflon tape, silicone, lithium grease, or vegetable based lubricants will be used on the threads of down-hole drilling equipment. All lubricants will be approved by the Project Hydrogeologist prior to use on-site.

9) Surface Completion Mounded Collar - Commercially available Portland cement/sand mixture.

As part of the construction process, mounded collars will be placed on (pre-existing) Wells # 7 and 9. Inspection (and repair, if necesary) of all other collars will take place during construction.

g) Monitoring Well Development Procedures

The development of monitoring wells will be performed as soon as practical after well installation. Development will be performed with a surge block and pump and/or a bottom discharge/filling bailer, depending upon the well setting depth. Development will proceed and continue until the following conditions are met:

1) The well water is clear to the unaided eye.

2) The sediment thickness remaining within the well is less than 5% of the screen length.

3) The standard development of wells will require the removal of five times the standing water volume in the well.

Water will not be added to a well as part of the development once the seal is placed. However, if approved by the Project Manager, the well screen and riser pipe may be purged of remaining sediments with clear water from the approved source.

h) **Abandonment of Vandalized (Existing) On-Site Monitoring Wells**

As previously stated, on-site monitoring Well Nos. 1, 5, 6, and 8 were vandalized at some time in the past and are no longer usable. Vandals have pulled the PVC well screen and riser out of the ground to a point where the well screen no longer intersects the saturated zone. Thus, no water is currently contained within these wells.

According to Section 25-128-57 (Procedure of Abandonment) of the DEP Document entitled "Groundwater Monitoring Guidelines for Hazardous Waste Management Facilities", February 1983, all wells to be abandoned must be plugged to prevent the entrance of surface water and/or circulation of water between or among producing formations. It is further mandated that the wells be chlorinated prior to abandonment, and that the wells be checked from land surface to the entire depth of the well before being sealed to ensure against the presence of any obstruction which will interfere with sealing operation.

Since the aforementioned wells are not currently set within a producing (saturated) formation, chlorination, in this instance, would not be appropriate.

Since the wells in question were vandalized in such a manner that they currently extend only a few feet below ground surface, YWC proposes that the procedures utilized for their abandonment and removal be as follows:

- Each well will be checked to ensure that no groundwater is present within the well screen and riser.

- If water is found on the wells, the well screen will be withdrawn further until the bottom reaches the unsaturated zone.

- Appropriate lengths of heavy drill rod ("A" rod) will be inserted to the bottom of the well screen. This rod will be used to remove the end cap attached to the bottom of the screen, and then withdrawn.

- The PVC well screen and riser will be slowly removed from the bore hole, using a power winch, if necessary, while adding bentonite clay pellets to the bore hole through the opened end of the well screen. This procedure will be continued until the entire sub-surface portion of the well screen and riser has been removed and the bore hole is completely filled with bentonite pellets.

- Water will then be added to the bentonite pellets in the unsaturated zone, to initiate swelling.

6.0 GROUNDWATER SAMPLING - QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The following is a description of the methodologies and materials specifications to be utilized for Quality Assurance/Quality Control (QA/QC) during the YWC groundwater sampling program at the Torrington site. All methods and materials specifications presented herein have been selected based upon the site specific parameters chosen for analyses and project objectives.

6.1 Groundwater Sampling Analytical Parameters

As stated in Section 4.2, Well Nos. 9, 13, 1A, 1B (deep), 5A, and OS-12 will be sampled for the compounds listed in the July 24, 1986 issue of the Federal Register, soon to be Appendix IX of 40 CFR 264. However, until approved analytical protocols are published for the Appendix IX list (a revised version of 40 CFR 261 Appendix VIII compounds) EPA approved methodologies may not be available for some of the parameters listed. All remaining new and existing monitoring wells (Nos. 2, 3, 4, 8A, OS-10, OS-11, OS-14, and OS-15) will be sampled for those parameters listed in 40 CFR 265.92.

6.2 Sampling - Materials Specifications and Preparation/ Preservation Techniques

Groundwater sample collection materials, containers, and field preparation/preservation specifications for each analytical parameter group/constituent will be as presented in Table 6-1.

6.3 Groundwater Sample Collection Procedures

Groundwater samples will be collected as soon as possible after installation of monitoring wells, but no sooner than one week after completion of monitoring well development activities. This waiting period is necessary to ensure that the hydraulic flow regime on-site has returned to equilibrium.

TABLE 6-1
SAMPLING MATERIALS SPECIFICATIONS
FIELD PREPARATION/PRESERVATION TECHNIQUES

Parameter	Groundwater Sample Collection Materials	Sample Container Materials/Volume	Field Preparation/ Preservation Techniques
Volatiles	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	(3) 40 ml Clear Glass V.O. Vials with Teflon Cap	Unprepared. Pack On Ice/ Refrigerate
B/N/A Extractables, Pesticides, PCB	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	(3) 64 oz. Amber Glass Bottles	Unprepared. Pack On Ice/ Refrigerate
Metals	Portable Peristaltic Pump (ISCO Model 60-3004 060); Tygon (Plastic) Tubing, 90 mm Stainless Steel Filter Holder (Millipore) 0.45 Micron Filters	(2) 1 Liter Plastic Bottles	Addition of HNO_3; Pack On Ice/ Refrigerate
Dioxin	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	(2) 1 Liter Amber Glass Bottles	Addition of $Na_2S_2O_2$; Pack On Ice/ Refrigerate
Cyanide	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	1 Liter Plastic	NaOH Ascorbic Acid to pH >12; Pack On Ice/Refrigerate
Fluoride	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	500 ml Plastic	Pack On Ice/ Refrigerate
Sulfide	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	500 ml Plastic	Addition of 2 ml of Zinc Acetate; Pack On Ice/ Refrigerate

TABLE 6-1 (Continued)
SAMPLING MATERIALS SPECIFICATIONS
FIELD PREPARATION/PRESERVATION TECHNIQUES

Parameter	Groundwater Sample Collection Materials	Sample Container Materials/Volume	Field Preparation/ Preservation Techniques
Chloride	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	500 ml Plastic	Pack On Ice/ Refrigerate
Phenols	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	500 ml Glass	Addition of H_2SO_4; Pack On Ice/ Refrigerate
Sulfates	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	500 ml Plastic	Unprepared. Pack On Ice/ Refrigerate
TOC	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	120 ml Plastic	H_2SO_4; Pack On Ice/ Refrigerate
TOX	3' Long, 1-1/4" Diam., Bottom Filling, Stainless Steel Bailer; Cotton Twine (New)	1 Liter Glass	Unprepared. Pack On Ice/ Refrigerate

Upon initiation of sampling activities, the specific well sampling procedures and field documentation protocols will be as follows:

1) Complete the preliminary information portions of the Field Data Sheet (see Figure 6-1) for the well being sampled.

2) Inspect surface well components for signs of tampering. If vandalism is indicated, this will be noted on the Field Data Sheet (Item No. 7).

3) Unlock well protector and open protector cap.

4) Measure the distance from the top of the well riser pipe to the groundwater level with an electronic water level probe. Record the water level measurement on the Well Data Sheet (Item No. 9).

5) Measure the distance from the top of the well riser pipe to bottom of the well with the water level probe. Record the depth measurement on the Well Data Sheet (Item No. 10).

6) Subtract Item No. 9 from Item No. 10. Record the height of the standing water column in the well (Item No. 11).

7) Calculate the volume of the standing water column using the formula:

$$V = 0.041 (h) (D^2)$$

Where: h = Height of Standing Water Column in Well
D = Diameter of Well Screen and Riser Pipe
V = Volume of Water Column in Well

The prescribed purging volume for the well will be three times the volume of water column in the well (V).

FIGURE 6-1
GROUNDWATER MONITORING FIELD DATA SHEET
(TO BE COMPLETED FOR EACH MONITORING WELL)

1. Date of Sample Collection:
2. Project Name:
3. Project Location:
4. Name of Person Performing Sampling:
5. Monitoring Well Designation (Number):
6. Upgradient or Down Gradient Well:
7. Appearance of Well Surface Components:
8. Weather Conditions:
9. Distance from Top of Well Riser Pipe to Groundwater:
10. Total Depth of Well from Top of Riser Pipe:
11. Height of Standing Water Column in Well:
12. Diameter of Well Screen and Riser Pipe:
13. Method of Well Purging:
14. Volume of Water Purged (Evacuated):
15. Method(s) of Sample Collection:
16. Material Type of Sampler(s):
17. Are Samples Filtered:
18. Sample Description(s):

Well Sample Number		Sample Container Types & Sizes	Preservative(s)	Analytical Parameters
________	A	________	________	________
	B	________	________	________
	C	________	________	________
	D	________	________	________

19. Appearance of Samples from this Well:

20. Field Measurements:

    pH ________
    Temperature ________
    Conductivity ________

21. Comments:

8) Evacuate the prescribed purging (water) volume from the well within the peristaltic pump. All well purging water will be discharged into a graduated five gallon bucket for measurement. (If well recharge rates are such that the required purging volume cannot be evacuated within one-half hour, the well will be pumped dry once and allowed to recharge, where upon sampling will commence).

9) The conductivity, temperature, and pH meter probes will be inserted into the five gallon bucket immediately after a sufficient volume of water has been discharged therein to allow measurement of these parameters. Conductivity, pH, and temperature readings will be recorded in Item No. 20 of the Data Sheet.

10) Upon completion of well purging, record the actual volume of water purged (Item No. 14).

11) After the well has been purged and the pH, temperature, and conductivity has been recorded, collection of the groundwater samples to be analyzed for metals will proceed as follows:

    a) Insert a new, unused 0.45 micron filter paper and a new, unused (coarse) pre-filter paper into the stainless steel filter holder. The pre-filter will be on the input side of the filter holder.

    b) Connect the peristaltic pump discharge tube to the input part of the filter holder.

    c) Fill the 1 liter plastic sample bottle (prepared with HNO_3) by pumping the well while holding the filter holder discharge port over the bottle opening. Turn off pump. Screw on bottle cap.

    d) Remove the peristaltic pump suction tubing from the well. Place the unused pump tubing, purge water, and filter papers into garbage bags for disposal.

12) All samples collected for the remaining individual parameters and parameter groups (volatiles, base/neutral/acid extractables, pesticides, PCB, dioxin, and miscellaneous inorganics) will be obtained by lowering a dedicated (bottom filling), laboratory decontaminated, stainless steel bailer into the well via new cotton twine. Samples will be transferred from the bailer to respective sample containers.

13) All sample containers will be labeled and the field chain-of-custody documented in accordance with procedures outlined in Sub-Section 6.3b. Sample identification information will then be recorded in Item No. 18 of the Field Data Sheet.

14) All sample bottles will be prepared by the analytical laboratory with the appropriate preservatives prior to arrival on-site.

All groundwater samples will be packed in coolers (packed with ice) immediately after labeling and documentation. All collected samples will be transported to the YWC Analytical Laboratory in Monroe, Connecticut on the date of collection.

a) Cleaning of Non-Disposable Sampling Equipment

All non-disposable sampling equipment to include electronic water level and temperature/conductivity meter probes, pyrex beakers, five gallon buckets, and stainless steel filter holders, will be thoroughly cleaned between sampling locations to prevent cross-contamination of samples. Stainless steel bailers utilized will be decontaminated in the YWC Laboratory after use.

Sampling equipment cleaning procedures will be as follows:

Pyrex Beakers and Electronic Water Level Meter Probes - Wash with dish washing detergent. Rinse well with distilled water.

Stainless Steel Filter Holders (Metals Sampling)

1) Rinse with nitric acid.
2) Rinse with distilled water.
3) Repeat Steps 1 and 2.

Conductivity/Temperature Probe

1) Soak for five minutes in solution made up of 10 parts distilled water, 10 parts isopropyl alcohol, and 1 part HCl.

2) Rinse well with distilled water.

Five Gallon Plastic Buckets

Wash with mild water and detergent mixture. Rinse with approved water.

All peristaltic pump tubing, tubing connectors, and filter papers will be replaced with new, unused materials between sampling locations to prevent cross contamination of samples and/or monitoring wells.

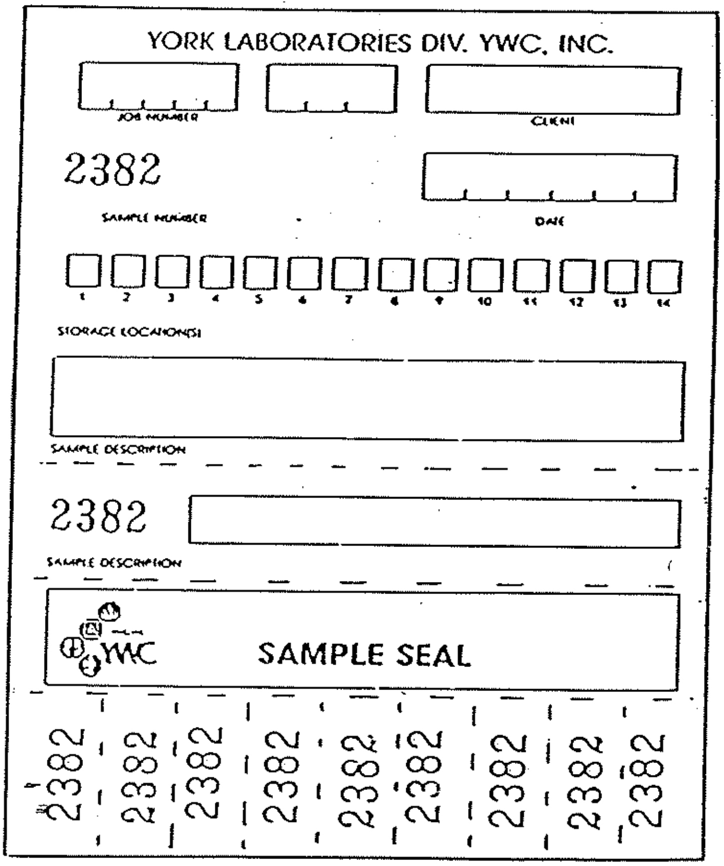
b) **Sample Identification and Documentation**

Immediately after placing the groundwater sample into its appropriate container(s), all sample containers shall be labeled and documented according to the sample identification and logging procedures outlined below:

1) Fill out standard YWC adhesive sample label (see Figure 6-2). The sample identification shall indicate the monitoring well number. In addition, all sample labels shall include the YWC engineering job number, project name (client), and date of sample collection.

FIGURE 6-2

ADHESIVE SAMPLE LABEL



2) Affix the large portion of the adhesive label to one of the large sample containers. Affix one of the small adhesive sample identification numbers to each of the remaining samples collected from that monitoring well.

3) Affix an adhesive sample seal sticker across each sample container cap.

4) Affix the center sample identification strip to the field "Chain-Of-Custody Record" Form (see Figure 6-3), along with the associated sample identification number sticker. The "Chain-Of-Custody Record" Form shall also include the project name (client), name of the person logging the sample, YWC engineering job number, and the date of sample collection.

If sample custody is transferred prior to reaching the laboratory, the "Chain-Of-Custody Chronicle" will so indicate at each transfer.

c) **<u>Sample Packaging and Shipping</u>**

All groundwater samples will be packed in plastic ice chests (coolers) in a manner as to prevent sample bottle breakage during shipment. This will entail the wrapping of each individual sample container in foam rubber or other packing material, and placing them in a tightly packed formation at the bottom of the ice chest. Ice will then be packed on top of the sample bottles and covered with sufficient additional packaging material as necessary so that no void space remains.

Sample coolers will be transported to the YWC Laboratory by van on the day of sample collection. A laboratory sample custodian will be in

YORK LABORA
YWC

FIGURE 6-3

CHAIN OF CUSTODY RECORD

CLIENT ____________________

JOB No. ____________________

SAMPLE IDENTIFICATION

Sample No.	Sample Description	Condition	Comments

CHAIN OF CUSTODY CHRONICLE:

COLLECTED BY:

1 NAME: ____________ DATE: ____________
SIGNATURE: ____________ SEALS PLACED ON CONTAINERS? ☐ YES ☐ NO

CUSTODY TRANSFERRED TO:

2 NAME: ____________ DATE: ____________ TIME: ____________
SIGNATURE: ____________ ARE SEALS INTACT ? ☐ YES ☐ NO ☐ N/A

CUSTODY TRANSFERRED TO:

3 NAME: ____________ DATE: ____________ TIME: ____________
SIGNATURE: ____________ ARE SEALS INTACT ? ☐ YES ☐ NO ☐ N/A

RECEIVED IN LABORATORY BY:

4 NAME: ____________ DATE: ____________ TIME: ____________
SIGNATURE: ____________ ARE SEALS INTACT ? ☐ YES ☐ NO ☐ N/A

WERE ANY SAMPLES SPLIT WITH ANOTHER PARTY ? ☐ YES ☐ NO
IF YES, IDENTIFY ____________

charge of proper log-in and storage of samples. Laboratory log-in and chain-of-custody documentation procedures will be as discussed in Section 7.0.

7.0 LABORATORY PROTOCOLS - QA/QC

In this section, laboratory protocols regarding sample log-in, sample security, chain-of-custody, preservation, and storage are presented along with a discussion of the QA/QC samples to be analyzed as part of this assessment program. In addition to the information presented in this section, Appendix F contains the QA/QC portion of the YWC Laboratory SOP which provides a broader reference for YWC Laboratory internal QA/QC practices.

7.1 In-House Sample Log-In Procedures

Upon arrival of samples at YWC, the Sample Custodian will fill out a Laboratory Service Request Form (LSR) for those samples received (see Figure 7-1). The client name, client project number, and YWC job number are entered into the heading section. The LSR is also signed and dated by the person responsible for log-in. The "Special Instruction" Section can be used to list such items as additional analysis, sample matrix (soil, water, etc.), bottle types, or specific storage location.

The LSR has been designed to list the various analytical parameters in a manner that facilitates log-in on the company computer. The information on the LSR is then stored on the computer. Upon receipt of the initial sample shipment, a permanent job file will be created using the YWC job number assigned to the Torrington Landfill Assessment. It will contain the LSR, chain-of-custody sheet, results of analysis as they become available, as well as other information pertinent to that particular job.

All samples will be placed into refrigerators capable of maintaining a 4°C storage temperature. Volatiles samples are stored in segregated refrigerators to minimize cross-contamination. Maximum holding times for individual parameters and parameter groups are presented in Table 7-1.

PREPARED BY: ____________

LABORATORY SERVICES REQUEST

CLIENT: ____________
CLIENT PROJ ID: ____________
YORK JOB #: ____________

SAMPLE SEQ #(S): ____________

SPECIAL INSTRUCT:

TEST	DESCRIPT	SVC GRP
☐ ACIDITY	ACIDITY BY POTENTIOMETRIC TITRATION	WC
☐ AG	SILVER BY AA/ICP	AS
☐ AL	ALUMINUM BY AA/ICP	AS
☐ ALKALIN	ALKALINITY BY TITRATION OR pH METER	WC
☐ ALKALIN-P	PHENOPHTHALEIN ALKALINITY	WC
☐ AMMONIA	NESSLERIZATION METHOD w/PRELIM DISTILLATION	WC
☐ APC	TOTAL AEROBIC PLATE COUNT	MB
☐ AS	ARSENIC BY AA/ICP	AS
☐ AS-EP	EPTOX ARSENIC BY FLAME	AS
☐ AU	GOLD BY AA/ICP	AS
☐ B	BORON BY AA/ICP	AS
☐ BA	BARIUM BY AA/ICP	AS
☐ BE	BERYLLIUM BY AA/ICP	AS
☐ BNA-HSL	MS ANALYSIS FOR HSL BASE NEUTRALS & ACIDS	MS
☐ BNA-MISC	MS ANALYSIS FOR MISCELLANEOUS BNA COMPOUNDS	MS
☐ BNA-PP	MS ANALYSIS FOR PP BASE NEUTRALS & ACIDS	MS
☐ BOD20	BIOLOGICAL OXYGEN DEMAND - 20 DAY	MB
☐ BOD5	BIOLOGICAL OXYGEN DEMAND - 5 DAY	MB
☐ BROMIDE	BROMIDE BY LINEAR REGRESSION	WC
☐ BTU	BTU	SC
☐ BULK SED	BULK SEDIMENT ANALYSIS - GRAIN SIZE	WC
☐ CA	CALCIUM BY AA/ICP	AS
☐ CD	CADMIUM BY AA/ICP	AS
☐ CHLORIDE	MERCURIC NITRATE METHOD	WC
☐ CL-RES	RESIDUAL CHLORINE	WC
☐ CLRPHYL A	CHLOROPHYLL-A ANALYSIS	MB
☐ CO	COBALT BY AA/ICP	AS
☐ COD	CHEMICAL OXYGEN DEMAND - DICHROMATE REFLUX	WC
☐ COLIF-F	FECAL COLIFORMS BY MEMBRANE FILTER METHOD	MB
☐ COLIF-S	STREPT COLIFORMS	MB
☐ COLIF-T	TOTAL COLIFORMS BY MEMBRANE FILTER METHOD	MB
☐ COLOR	VISUAL COMPARISON METHOD	WC
☐ CONDUCT	CONDUCTIVITY	WC
☐ CORROS	CORROSIVITY BY PH METER	WC
☐ CR	CHROMIUM BY AA/ICP	AS
☐ CR-HEX	HEXAVALENT CHROMIUM BY COLORIMETRY	WC
☐ CU	COPPER BY AA/ICP	AS
☐ CYAN-A	AMENABLE CYANIDES AFTER DISTILL - COLORIMETRIC	WC
☐ CYAN-EPTOX	CYANIDE BY E P TOXICITY	WC
☐ CYAN-T	TOTAL CYANIDE AFTER DISTILL - COLORIMETRIC	WC
☐ CYANATE	CYANATE IN WATER	WC
☐ DENSITY	DENSITY	SC
☐ DIOXIN	DIOXIN	SC
☐ DO	DISSOLVED OXYGEN	MB
☐ ELEC R	ELECTRICAL RESISTANCE	WC
☐ FE	IRON BY AA/ICP	AS
☐ FFAC	FREE FATTY ACID CONTENT	WC
☐ FL PT	FLASH POINT	WC
☐ FLUORIDE	SPADNS METHOD WITH PRELIMINARY DISTILLATION	WC
☐ FORMALD	FORMALDEHYDE	WC

TEST	DESCRIPT	SVC GRP
☐ FULL EPTOX	FULL E P TOXICITY ANALYSIS	SC
☐ FULL PP	FULL PRIORITY POLLUTANT ANALYSIS	SC
☐ FULL-HSL	FULL HAZARDOUS SUBSTANCE LIST ANALYSIS	SC
☐ HARDNESS	HARDNESS	WC
☐ HC-FP	HYDROCARBON FINGER PRINTING	SC
☐ HC-G	GRAV. DETERMINATION OF PETROL HYDROCARBONS	WC
☐ HC-IR	IR DETERMINATION OF PETROLEUM HYDROCARBONS	IR
☐ HC-SCAN	HYDROCARBON SCAN	GC
☐ HERB	GC-ECD ANALYSIS FOR TOTAL HERBICIDES	GC
☐ HERB-EPTOX	GC-ECD ANALYSIS FOR E P TOX HERBICIDES	GC
☐ HG	MERCURY BY AA/ICP	AS
☐ HG-EP	EPTOX MERCURY BY AA/ICP	AS
☐ IGNIT	IGNITABILITY	WC
☐ IODIDE	LEUCO CRYSTAL VIOLET METHOD	WC
☐ K	POTASSIUM BY AA/ICP	AS
☐ LI	LITHIUM BY AA/ICP	AS
☐ MBAS	ANIONIC SURFACTANTS AS MBAS	WC
☐ MG	MAGNESIUM BY AA/ICP	AS
☐ MN	MANGANESE BY AA/ICP	AS
☐ MTL-EPDW	AG AS BA CD CR HG PB SE (DRINKING WATER LDL)	SC
☐ MTL-EPTOX	AG AS-EP BA CD CR HG-EP PB SE-EP	SC
☐ MTL-HSL1	AG AL AS BA BE CA CD CO CR CU FE HG K MG MN NA NI	SC
☐ MTL-HSL2	PB SB SE TL V ZN	SC
☐ MTL-NIPDWR	AG AS BA CD CR HG PB SE	SC
☐ MTL-PP	AG AS BE CD CR CU HG NI PB SB SE TL ZN	SC
☐ MTL-RCRA	AG AS BA CD CR HG PB SE	SC
☐ NA	SODIUM BY AA/ICP	AS
☐ NI	NICKEL BY AA/ICP	AS
☐ NITRATE	BRUCINE METHOD	WC
☐ NITRITE	SPECTROPHOTOMETRIC DETERMINATION	WC
☐ NOX	TOTAL OXIDES OF NITROGEN	WC
☐ OIG-G	GRAV. DETERMINATION OF OIL AND GREASE	WC
☐ OIG-IR	IR DETERMINATION OF OIL & GREASE	IR
☐ ODOR	THRESHOLD ODOR NUMBERS	WC
☐ OIL-FP	OIL FINGERPRINTING BY FLUORESCENCE SPECTROSCOPY	SC
☐ OIL-WTR	PERCENT OIL AND/OR PERCENT WATER	WC
☐ ORG-HSL	ORGANICS ONLY HAZARDOUS SUBSTANCE LIST ANALYSIS	SC
☐ ORG-PP	ORGANICS ONLY PRIORITY POLLUTANT ANALYSIS	SC
☐ PB	LEAD BY AA/ICP	AS
☐ PCB	GC-ECD ANALYSIS FOR PCB's	GC
☐ PD	PALADIUM BY AA/ICP	AS
☐ PEST-EPTOX	GC-ECD ANALYSIS FOR E P TOX PESTICIDES	GC
☐ PEST-HSL	GC-ECD ANALYSIS OF HSL PESTICIDES	GC
☐ PEST-MISC	GC ECD ANALYSIS OF MISCELLANEOUS PESTICIDES	GC
☐ PEST-PP	GC-ECD ANALYSIS OF PP PESTICIDES	GC
☐ PH	HYDROGEN ION ACTIVETY	WC
☐ PHENOLS	DISTILL THEN EXTRACT WITH CHLOROFORM	WC
☐ PHOS	ASCORBIC ACID METHOD AFTER PERSULFATE DIGESTION	WC
☐ PHOS-O	ORTHO-PHOSPHATE BY LINEAR REGRESSION	WC
☐ PT	PLATINUM BY AA/ICP	AS

TEST	DESCRIPT	SVC GRP
☐ REACT	REACTIVETY	WC
☐ S	SULFUR	WC
☐ SB	ANTIMONY BY AA/ICP	AS
☐ SE	SELENIUM BY AA/ICP	AS
☐ SE-EP	EPTOX SELENIUM BY FLAME	AS
☐ SET-SOL	SETTLEABLE SOLIDS VIA IMHOFF CONE	WC
☐ SILICA	SILICA BY LINEAR REGRESSION	WC
☐ SN	TIN BY AA/ICP	AS
☐ SP GRAV	SPECIFIC GRAVITY	WC
☐ SPC	STANDARD PLATE COUNT	MB
☐ SULFATE	GRAV DETERMINATION WITH IGNITION OF RESIDUE	WC
☐ SULFIDE	IODOMETRIC METHOD WITH TITRATION	WC
☐ SULFITE	IODOMETRIC METHOD	WC
☐ SVI	SLUDGE VOLUME INDEX	WC
☐ SWL	STATIC WATER LEVEL	WC
☐ TDS	TOTAL DISSOLVED SOLIDS @ 180°C	WC
☐ TI	TITANIUM BY AA/ICP	AS
☐ TKN	TOTAL KJELDAHL NITROGEN - MACRO METHOD	WC
☐ TL	THALLIUM BY AA/ICP	AS
☐ TOC	TOTAL ORGANIC CARBON	SC
☐ TOC4	TOTAL ORGANIC CARBON - QUADRUPLICATE	SC
☐ TOX	TOTAL ORGANIC HALIDES	SC
☐ TOX4	TOTAL ORGANIC HALIDES - QUADRUPLICATE	SC
☐ TS	TOTAL SOLIDS DRIED @ 103-105°C	WC
☐ TS-AQ	TOTAL SOLIDS FOR AQUEOUS SAMPLES	WC
☐ TSS	TOTAL SUSPENDED SOLIDS @ 103-105°C	WC
☐ TURBID	TURBIDITY BY TURBIDITY METER	WC
☐ V	VANADIUM BY AA/ICP	AS
☐ VOL ACID	VOLATILE ACIDS	WC
☐ VOL CONT	VOLATILE CONTENT	WC
☐ VOL-BTX	MS ANALYSIS OF BENZENE, TOLUENE, XYLENE	MS
☐ VOL-DHS	VOLATILES - DEPT OF HEALTH SERVICES	SC
☐ VOL-HSL	MS ANALYSIS FOR HSL VOLATILES	MS
☐ VOL-MISC	MS ANALYSIS FOR MISCELLANEOUS VOLATILES	MS
☐ VOL-PP	MS ANALYSIS FOR PP VOLATILES	MS
☐ VS-LIQ	FIXED & VOLATILE SOLIDS @ 550°C - LIQUID SMPL	WC
☐ VS-SOL	FIXED & VOLATILE SOLIDS @ 550°C - SOLID SMPL	WC
☐ WT-RES	WEIGHT RESIDUE - PARTICULATE MATTER IN AIR	WC
☐ ZN	ZINC BY AA/ICP	AS

FIGURE 7-1

TABLE 7-1
SAMPLE HOLDING TIMES*

Parameter	Holding Times
Color	24 Hours
Conductance	24 Hours
Hardness	6 Months
Odor	24 Hours
pH	6 Hours
Total Dissolved Solids	7 Days
Turbidity	7 Days
Metals	6 Months
Alkalinity	24 Hours
Chloride	7 Days
Cyanide	24 Hours
Fluoride	7 Days
Ammonia-Nitrogen	24 Hours
Nitrate-Nitrogen	24 Hours
Nitrite-Nitrogen	48 Hours
Total Phosphorus	24 Hours
Sulfate	7 Days
Surfactants	24 Hours
Formaldehyde	24 Hours
Asbestos	N/A
Coliform, Total	4 Hours
Coliform, Fecal	4 Hours
Methane, Butane, Methanol	7 Days
Volatile Organics by EPA 624	7 Days
B/N/A Organics by EPA 625	7 Days
Pesticides/PCB's Dioxin	7 Days

*In accordance with EPA Methods for Chemical Analysis of Water and Wastes, March 1979, EPA-600 4-79-020.

7.2 Sample Security and Chain-Of-Custody

The Sample Custodian is in charge of the sample security. All samples are stored in a controlled access area (sample receiving room). This room is a secure area which is kept locked before and after business hours. The area is kept under close control by the Sample Custodian during business hours. Individual storage units (refrigerators, cabinets, etc.) are kept under lock during non-business hours as well.

An in-house chain-of-custody sheet is used to track samples after their arrival at York Laboratories (see Figure 7-2). It is initiated by the Sample Custodian. All subsequent transfers to and from storage are recorded on the chain-of-custody sheet by the analyst.

7.3 Laboratory QA/QC

The following sections describe the QA/QC program to be implemented as part of the Torrington Landfill sampling program.

a) Blanks, Spikes, and Duplicate Samples - Analytical QA/QC

As a means of evaluating the reliability of the sampling program, three types of special samples are used by the YWC Laboratory. These are listed below along with a brief description of their purposes.

Sample Type	Purpose
Trip Blank (Volatiles)	Evaluates the effect, if any, of shipping and handling on sample integrity.
Field Blanks	Tests effectiveness of field decontamination procedures.
Duplicates and Spikes (Per Protocols)	Evaluates repeatability of laboratory results, homogeneity of samples, inherent matrix effects on analyte recovery and reproducibility.

YORK LABORATORIES DIVISION

YWC

SAMPLE CONTROL RECORD

Laboratory Custody Chronicle

Date: __________
Sample Custodian Signature __________
Document Control # __________
Case Number __________
Airbill Number __________

1. Custody Seal — present/absent; intact/not intact
2. Chain-of-Custody — present/absent
3. Sample Tags — present/absent; listed/not listed on chain-of-custody
4. SMO Forms — present/absent

LABORATORY SAMPLE NUMBER	REMOVED BY	DATE AND TIME REMOVED	REASON	DATE AND TIME RETURNED

REMARKS

FIGURE 7-2

The following QA/QC samples will be analyzed for the Torrington sampling program.

Trip Blanks - One trip blank for volatiles will be required for each load of samples that arrive at York Laboratories from the Torrington site. The trip blank is a pre-filled, 40 milliliter, teflon capped vial that will travel with the sample bottles to and from the Torrington site.

Field Blanks - To collect field blanks, water provided by the laboratories will be poured over sampling equipment after decontamination and collected into a set of bottles designated for this purpose. Enough water will be collected to fill bottles for each parameter or bottle type. To test decontamination procedures during water sampling, field blank water will be poured over the stainless steel bailers used to collect well water samples.

Matrix Spike and Matrix Spike Duplicates - Matrix spikes, matrix spike duplicates, and duplicates will be analyzed as required by U.S. EPA-CLP protocols, IFB WA 85-J176/J177/J178, July 1985 Revisions for Organics, and SOW-785 for Inorganics.

Duplicates only will be analyzed for those compounds not covered in the U.S. EPA-HSL (or TSL) list. Method blanks are also analyzed along with samples for all parameters. Results for method blanks are normally reported for organics and metals only. Results for all trip blanks and field blanks will be submitted as part of the final data package.

b) **Laboratory Analytical Protocols**

Analyses for the list of compounds found in (soon to be) 40 CFR 264, Appendix IX (see Appendix E) and 40 CFR 265.92 compounds will be performed in accordance with the following analytical protocols:

- Chlorinated Herbicides per SW-846 (8150).

- Organo Phosphorus Pesticides per SW-846 (8140).

- HSL (TSL) Compounds (Volatiles, BNA's, Organics, and Pesticides/PCB's) per U.S. EPA Contract Laboratory Protocols.

- Chloride per SM 407A; 407B.

- Phenols per SM 510A; 501B.

- Sulfate per SM 426B.

- TOC per EPA 415-1.

- TOX per EPA 450.1.

For those compounds not included in the above parameter groups, the YWC Laboratory will perform a computer-based library search of non-target compounds in the volatile and BNA fractions as per U.S. EPA Contract Laboratory Program Protocols.

8.0 PHASE II - DATA INTERPRETATION - SUPPLEMENTAL INVESTIGATIVE EFFORTS

Upon receipt of analytical results from the laboratory, an extensive data review will be initiated to identify any data inconsistencies or errors in reporting. Necessary reporting corrections will be addressed to ensure the validity of data interpretation. All corrections will be accomplished by drawing a single line through the incorrect data and inserting the correct data. All corrections will be initialed and dated by the person making the correction.

Analytical data for all wells will then be reviewed to identify any chemical constituents of concern. Data from all wells will be compared to define apparent trends or possible contaminant plumes.

Upon completion of the data interpretation phase, preliminary findings and recommendations will be discussed with the City of Torrington, U.S. EPA, and Connecticut DEP officials. An Interim Assessment (First Determination) Report will then be prepared and submitted to the DEP, EPA, and City of Torrington in accordance with 40 CFR 265.93 (d) (5). Supplemental investigative efforts may be addressed at this point in the project, if deemed necessary. A Phase II Work Plan would be prepared to outline all additional tasks to be performed and submitted to the DEP/EPA for comments and approval.

Supplemental efforts which may be performed if analytical results indicate that a contaminant plume does exist include one or more of the following, depending upon the nature and extent of the contaminant(s) parameters detected:

- Installation of additional groundwater monitoring wells to further define both the horizontal and vertical extent of the plume.

- Use of mathematical/computer models to refine conceptualization of the on-site groundwater flow regime, contaminant migration pathways, and contaminant dispersion/retardation characteristics, and to facilitate more accurate placement of additional monitoring wells.

- Additional groundwater analyses (to include only those compounds found to be of concern during Phase I).

- Performance of on-site tests (pump tests, slug tests, etc.) to better define specific aquifer parameters (i.e., hydraulic conductivity, transmissivity, and specific yield) necessary for preparation of mathematical/computer models, and/or evaluation of appropriate remediation alternatives.

Modification of the time schedules outlined in Section 10.0 of this Work Plan would also be discussed and implemented at this point in the program, if necessary.

9.0 PHASE III - GROUNDWATER ASSESSMENT/REMEDIAL INVESTIGATION REPORT

The final task of this Groundwater Assessment Program, preparation of a comprehensive Groundwater Assessment/Remedial Investigation Report, will include the following sub-tasks:

- Final data interpretation/reduction.
- Complete compilation of all analytical data generated, including graphical summaries.
- Documentation of all field activities performed, including well specifications, a description of sampling procedures and materials utilized, and measurements made in the field.
- Graphics/drawings.
- Generation of conclusions and recommendations.
- Submittal of a "Draft" Report to the City of Torrington for review and comment.
- Regulatory correspondence.
- Preparation of a revised Detection Monitoring Plan (if deemed appropriate).
- Submittal of a finalized "Groundwater Assessment/ Remedial Investigation Report" to the Connecticut DEP and U.S. EPA.

10.0 SCHEDULE OF IMPLEMENTATION

This section addresses estimated time requirements and the proposed schedule of implementation for the Site Assessment Program. The ultimate date of project commencement will depend upon the date of final Assessment Plan approval by the Connecticut DEP/U.S. EPA. YWC's proposed schedule for implementation of the various tasks outlined herein is presented in Table 10-1. The time table assumes no major supplemental investigative efforts during the data interpretation/supplemental investigation phase (Phase II). Should additional wells, aquifer tests, mathematical/computer modeling, and/or additional groundwater sampling become necessary due to identification of a contaminant plume(s) during Phase I, then modifications of the proposed time schedule will become necessary.

TABLE 10-1
TORRINGTON LANDFILL
ENVIRONMENTAL ASSESSMENT
SCHEDULE OF IMPLEMENTATION

Task	Commencement Date	Estimated Time For Completion
PHASE I		
Obtain Permission to Install Wells on Land not Owned by City; Project Preparation; Retain Drilling Contractor; Mobilization	Date of Project Approval	5 Weeks+
Well Drilling and Installation; Well Development; Sieve Analysis; Removal of Vandalized Wells; Well Elevation Surveys	5 Weeks After Project Approval	5 Weeks*
Well Sampling	10 Weeks After Project Approval	2 Weeks*
Sample Analysis	12 Weeks After Project Approval	6 Weeks**
PHASE II		
Data Reduction; Graphics; Interim (First Determinatio) Report Submittal to the City of Torrington, DEP, and EPA; Supplemental Investigation Efforts, if Required	18 Weeks After Project	8 Weeks+
PHASE III		
Report Preparation Report Review	Approval	
Estimated Total Time for Project Completion		26 Weeks+

\+ Includes weekends.
* Includes weekends; allowance for inclement weather conditions.
** Includes laboratory data processing; weekends.

BIBLIOGRAPHY

Charles W. Martin, Quadrangle Report No. 25, The Bedrock Geology of the Torrington Quadrangle, State Geology and Natural History Survey of Connecticut, 1970.

Robert M. Gates and Nikolas I. Christensen, The Bedrock Geology of the West Torrington Quadrangle (Quadrangle Report No. 17), State Geological and Natural History Survey of Connecticut, 1965.

Rodger B. Colton, Surficial Geology Map of the Torrington Quadrangle, Litchfield and Hartford Counties, U.S. Geological Survey, 1971.

Rodger B. Colton, Surficial Geology Map of the West Torrington Quadrangle, Litchfield County, Connecticut, U.S. Geological Survey, 1968.

William E. Wilson, Edward L. Burk, Chester E. Thomas, Jr., Water Resources Inventory of Connecticut, Part 5 - Lower Housatonic River Basin, Connecticut Water Resources Bulletin No. 19, U.S. Geological Survey, 1974.

Ralph A. Klass, P.E., City of Torrington, Part B Application, Industrial Sludge Disposal Area, YWC, Inc., July 1984.

Fletcher G. Driscoll, Groundwater and Wells, Johnson Division, 1986.

Ralph C. Heath, Basic Groundwater Hydrology, U.S. Geological Survey Water Supply Paper 2220, U.S.G.S., 1984.

APPENDIX A
ON-SITE MONITORING WELLS - BORING LOGS

ASSOCIATED BORINGS CO., INC.
119 MARGARET CIRCLE
NAUGATUCK, CONN. 06770
PHONE 729-5430

TEST BORING REPORT

PROJ. Torrington Landfill
Torrington, Connecticut

CLIENT YORK WASTEWATER CONSULTANTS, INC.

BORING NO. 1A
LINE & STA.
OFFSET
GR. ELEV.
DATE February 6, 1984

A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B
	Dark Br. M-F Silty Sand & Grav., Cobbles		
6.0	"	Loose Moist	5-4 2
	Red Br. C-F Sand & M-F Grav., Cobbles, Boulders.		
	"	Dense Wet	50
13.0	Gr. F. Silty Sand		
16.0	"	Dense Wet	24-50
	Br. F. Silty Sand		
20.0			
	Refusal-20.0		
	End of Boring-20.0		
	GWO- 8.5		
	Monitor Well Installed:		
	10.0 Sched. #80x2"		
	10.0 Riser		
	3"x60" Steel Protecter w/locking cap.		

BORING NO. 5A
LINE & STA.
OFFSET
GR. ELEV.
DATE February 10, 1984

A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B
	Br. C-F Sand & Grav		
2.0	Dark Br. M-F Silty Sand, some F. Grav.		
	"	M.Comp Moist	2-2 10
7.0	Br. F. Silty Sand		
	"	M.Comp Wet	[illegible]-12 [illegible]
	"	Comp Wet	10-22 20
19.5			
	Refusal-19.5		
	End of Boring-19.5		
	GWO-8.5		
	Monitor Well Installed:		
	10.0 Sched. #80x2"		
	10.0 Riser		
	3"x60" Steel Protecter w/locking cap.		

A Blows on Casing & DRILL [illegible]

ASSOCIATED BORINGS CO., INC.
110 MARGARET CIRCLE
NAUGATUCK, CONN. 06770
PHONE 720-5435

TEST BORING REPORT

PROJ. Torrington Landfill
Torrington, Connecticut

CLIENT York Wastewater Consultants, Inc.

BORING NO. 3
LINE & STA.
OFFSET
GR. ELEV.
DATE April 29, 1982

A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B
	Dark Gr. C-F Sand, Tr. M-F Grav., Tr. Silt, Cobbles, Boulders.		
2.5	Gr. M-F Sand, Tr. M-F Grav., Tr. Rock Frags, Cobbles, Boulders.		
	"	Dense Moist	25/1"
14.1		Dense Wet	50/1"
	Refusal-14.1		
	End of Boring-14.1		
	GWO-		
	Observation Well Installed: Total Length: Screens: Tube:		

BORING NO. 1
LINE & STA.
OFFSET
GR. ELEV.
DATE April 29, 1982

A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B
0.4	Topsoil		
	Br. M-F Sand, some C-F Grav., Cobbles.		
	"	Loose Moist	3-3 3
8.0	Br. M-F Silty Sand, Tr. M-F Grav.		
	"	M. Comp Wet	18-12 14
13.0	Gr. F. Silty Sand, Tr. F. Grav.		
		Dense Wet	12-90/0"
15.5	Refusal-15.5		
	End of Boring-15.5		
	GWO-7.0		
	Observation Well Installed: Total Length: 15.0 Screens: 10.0 Tube: 5.0		

1 COL. A Blows on Casing * DRILL TIME PER FOOT
2 COL. B Blows on 1⅜" Sampler (I.D.)
3 HAMMER = 140#, FALL 30"
4 SAMPLER = O. D. SPLIT SPOON
5 GWO = GROUND WATER OBSERVATIONS

FIELD — % CONTENT

AND	— 40 to 50%
SOME	— 10 to 40%
TRACE	— 0 to 10%

ASSOCIATED BORINGS CO., INC.
119 MARGARET CIRCLE
NAUGATUCK, CONN. 06770
PHONE 729-8435

TEST BORING REPORT

PROJ. TORRINGTON LANDFILL
Torrington, Connecticut

CLIENT YORK WASTEWATER CONSULTANTS, INC.

BORING NO. ~~8~~ #4
LINE & STA.
OFFSET
GR. ELEV.
DATE April 30, 1982-May 3, 1982

BORING NO.
LINE & STA.
OFFSET
GR. ELEV.
DATE

Depth	A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B
2.5		Dark Gr. C-F Sand,Tr. M-F Grav.,Tr. Silt, Cobbles, Boulders.		
8.0		Gr. M-F Sand,Tr. M-F Grav.,Tr. Rock Frags., Cobbles, Boulders.		
10.0		Augered thru C.material		
15.0	5 10 17 10 15	Gneiss Rock,Brown Run#1:10.0 to 15.0 Recovery: 49" Fractured & Seamy		
20.0	10 10 10 5 7	Run#2: 15.0 to 20.0 Recovery: 20 " Fractured & Seamy		
25.0	6 5 11 12 12	Gr. Cneiss Run#3: 20.0 to 25.0 Recovery: 38" Fractured & Seamy		
		End of Boring-25.0 GWO- 2.0 Observation Well Installed: 3.0 into Rock & Sealed. Total Length: 14.0 Screens: None Tube: 14.0 Note: Possible bedrock starting at 8.0		

A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B

1 COL. A Blows on Casing * DRILL TIME PER FOOT
2 COL. B Blows on 1⅜" Sampler (I.D.)
3 HAMMER = 140#, FALL 30"
4 SAMPLER = O. D. SPLIT SPOON
5 GWO = GROUND WATER OBSERVATIONS

FIELD — % CONTENT

AND — 40 to 50%
SOME — 10 to 40%
TRACE — 0 to 10%

ASSOCIATED BORINGS CO., INC.
119 MARGARET CIRCLE
NAUGATUCK, CONN. 06770
PHONE 729-5435

TEST BORING REPORT

PROJ. Torrington Landfill
Torrington, Connecticut
CLIENT York Wastewater Consultants, Inc.

BORING NO. 6
LINE & STA.
OFFSET
GR. ELEV.
DATE April 29, 1982

A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B
	Dark Gr. C-F Sand, Tr. M-F Grav., Tr. Silt, Cobbles, Boulders.		
2.5	Gr. M-F Sand, Tr. M-F Grav., Tr. Rock Frags, Cobbles, Boulders.		
	"	Dense Moist	25/1"
		Dense Wet	50/1"
14.1	Refusal-14.1		
	End of Boring-14.1		
	GWO-		
	Observation Well Installed: Total Length: Screens: Tube:		

BORING NO. 7
LINE & STA.
OFFSET
GR. ELEV.
DATE April 29, 1982

A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B
0.4	Topsoil		
	Br. M-F Sand, some C-F Grav., Cobbles.		
	"	Loose Moist	3-3 3
8.0	Br. M-F Silty Sand, Tr. M-F Grav.		
	"	M.Comp Wet	18-12 14
13.0	Gr. F. Silty Sand, Tr. F. Grav.		
		Dense Wet	12-90/0"
15.5	Refusal-15.5		
	End of Boring-15.5		
	GWO-7.0		
	Observation Well Installed: Total Length: 15.0 Screens: 10.0 Tube: 5.0		

1 COL. A Blows on Casing * DRILL TIME PER FOOT
2 COL. B Blows on 1⅜" Sampler (I.D.)
3 HAMMER = 140#, FALL 30"
4 SAMPLER = O. D. SPLIT SPOON
5 GWO = GROUND WATER OBSERVATIONS

FIELD — % CONTENT
AND — 40 to 50%
SOME — 10 to 40%
TRACE — 0 to 10%

ASSOCIATED BORINGS CO., INC.
119 MARGARET CIRCLE
NAUGATUCK, CONN. 06770
PHONE 729-6430

TEST BORING REPORT

PROJ. TORRINGTON LANDFILL
Torrington, Connecticut

CLIENT YORK WASTEWATER CONSULTANTS, INC.

BORING NO. 8
LINE & STA.
OFFSET
GR. ELEV.
DATE April 30, 1982-May 3, 1982

Depth	A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B
		Dark Gr. C-F Sand, Tr. M-F Grav., Tr. Silt, Cobbles, Boulders.		
2.5				
		Gr. M-F Sand, Tr. M-F Grav., Tr. Rock Frags., Cobbles, Boulders.		
8.0				
		Augered thru C.material		
10.0				
	5	Gneiss Rock, Brown		
	10	Run#1: 10.0 to 15.0		
	17	Recovery: 49"		
	10	Fractured & Seamy		
15.0	15			
	10			
	10			
	10	Run#2: 15.0 to 20.0		
	5	Recovery: 20 "		
20.0	7	Fractured & Seamy		
	6	Gr. Gneiss		
	5	Run#3: 20.0 to 25.0		
	11	Recovery: 38"		
	12	Fractured & Seamy		
25.0	12			

End of Boring-25.0

GWO- 2.0

Observation Well Installed:
3.0 into Rock & Sealed.
Total Length: 14.0
Screens: None
Tube: 14.0

Note:
Possible bedrock starting at 8.0

BORING NO.
LINE & STA.
OFFSET
GR. ELEV.
DATE

A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B

1 COL. A Blows on Casing * DRILL TIME PER FOOT
2 COL. B Blows on 1⅜" Sampler (I.D.)
3 HAMMER = 140 #, FALL 30"
4 SAMPLER = O. D. SPLIT SPOON
5 GWO = GROUND WATER OBSERVATIONS

FIELD — % CONTENT
AND — 40 to 50%
SOME — 10 to 40%
TRACE — 0 to 10%

ASSOCIATED BORINGS CO., INC.
119 MARGARET CIRCLE
NAUGATUCK, CONN. 06770
PHONE 729-5435

TEST BORING REPORT

PROJ. Torrington Landfill
Torrington, Connecticut

CLIENT YORK WASTEWATER CONSULTANTS, INC.

BORING NO. 8A

LINE & STA.

OFFSET

GR. ELEV.

DATE Feb.7,8, 1984

Depth	A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B
		Br. M-F Silty Sand, some M-F Grav., Trash, Rags, Plastic.		
4.0		Black M-F Silty Sand, some F. Grav., Trash.	Loose Moist	5-4 2
8.0		Gr. F. Silty Sand		
		"	Dense Wet	2-2 50/0"
11.5	15 13 13 14 15	Granetic Gneiss Run#1: 11.5 to 16.5 Recovery: 49" Fractured		
16.5	14 17 12 12 14	Granetic Gneiss Run#2: 16.5 to 21.5 Recovery: 60" Fractured		
21.5	13 13 15 14 13	Granetic Gneiss Run#3: 21.5 to 26.5 Recovery: 60" Fractured		
26.5				

End of Boring-26.5

GWO-11.0

Monitor Well Installed:
10.0 2"Sch#80 Riser
3"x60" Steel protecter
W/locking cap.

BORING NO. 9

LINE & STA.

OFFSET

GR. ELEV.

DATE Febuary 9, 1984

Depth	A	STRATUM DESCRIPTION	DENSITY OR CONSIST.	BLOWS PER 6" B
		Br. M-F Sand & C-F Grav., Cobbles, Boulders.		
5.0	10 12 10 11 6 9	Granetic Gneiss Run#1: 5.0 to 11.0 Recovery: 21" Fractured & Seamy		
11.0	10 13 9 11 13	Granetic Gneiss Run#2: 11.0 to 16.0 Recovery: 6" Fractured & Seamy		
16.0				

End of Boring-16.0

GWO-3.0

Monitor Well Installed:
5.0 2" Sched#80 Riser
3"x60" steel protecter
W/locking cap.

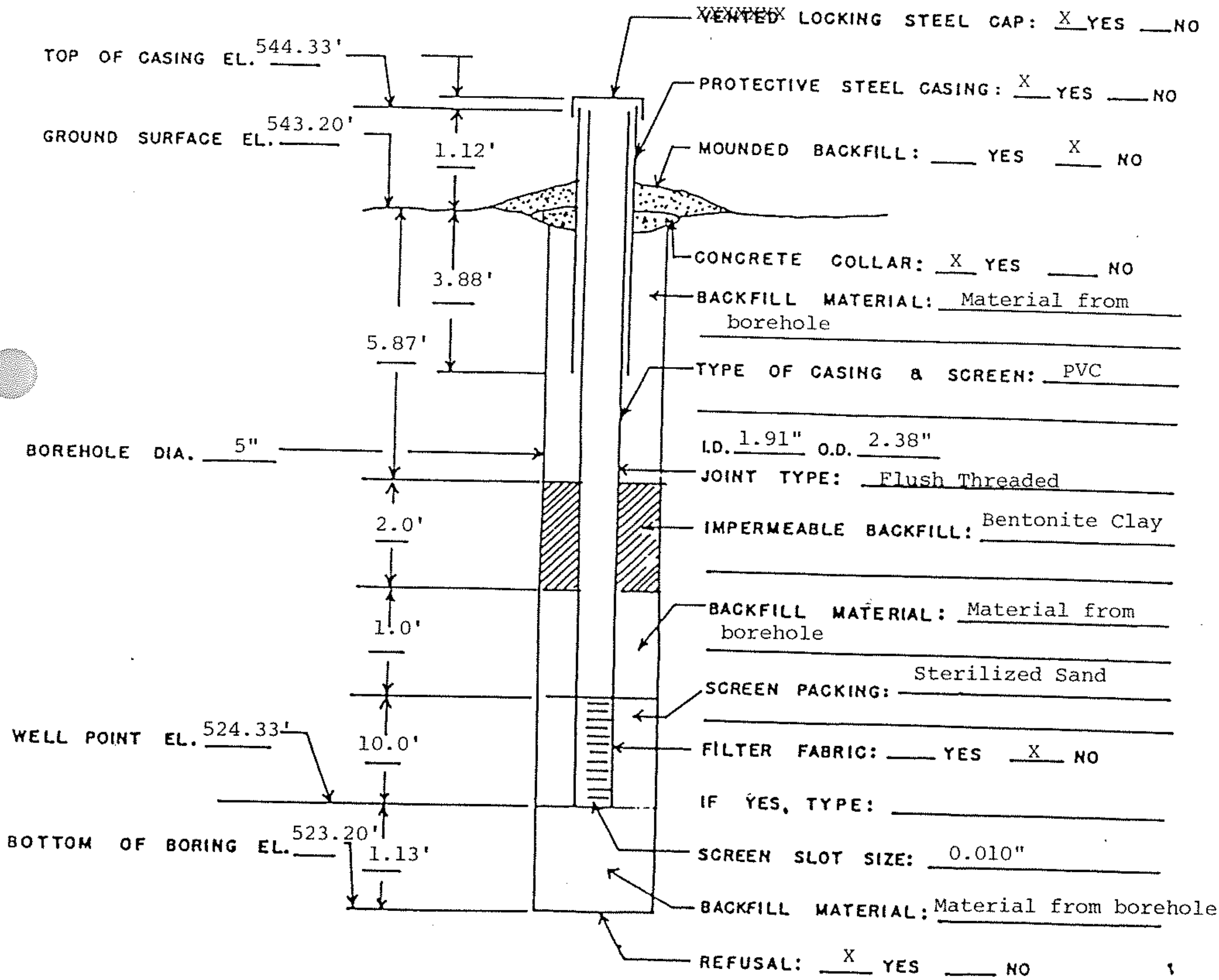
COL. A Blows on Casing * DRILL TIME PER FOOT
COL. B Blows on 2½" Sampler (I.D.)
HAMMER = 140#, FALL 30"

FIELD — [illegible] CONTENT

APPENDIX B
MONITORING WELL CONSTRUCTION DIAGRAMS

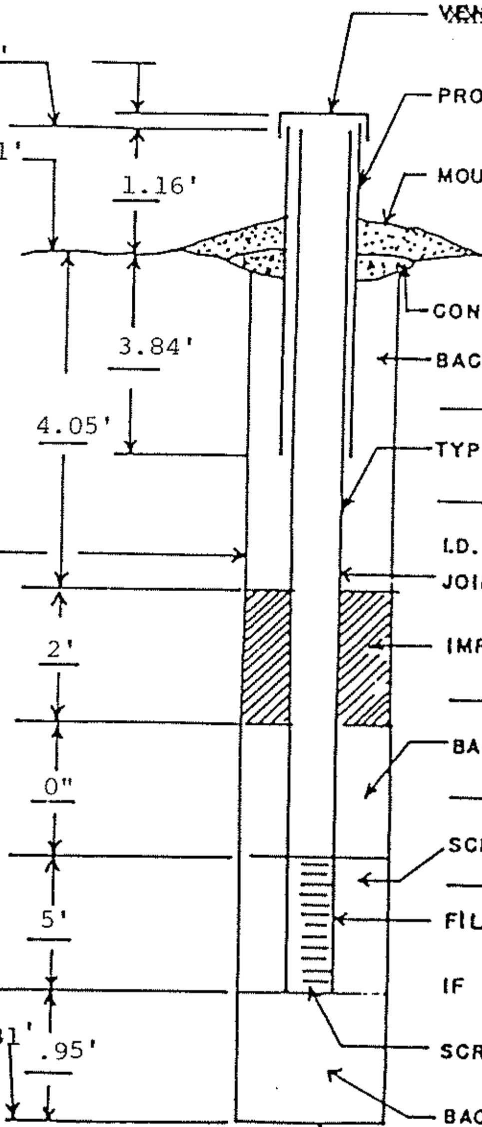
WELL #1A

MONITOR WELL INSTALLATION DETAIL
FOR WELL IN UNCONSOLIDATED DEPOSIT



WELL #2

MONITOR WELL INSTALLATION DETAIL FOR WELL IN UNCONSOLIDATED DEPOSIT



TOP OF CASING EL. 549.09'

GROUND SURFACE EL. 548.31'

BOREHOLE DIA. 5"

WELL POINT EL. 537.26'

BOTTOM OF BORING EL. 536.31'

~~VENTED~~ LOCKING STEEL CAP: x YES ___ NO

PROTECTIVE STEEL CASING: X YES ___ NO

MOUNDED BACKFILL: ___ YES X NO

CONCRETE COLLAR: X YES ___ NO

BACKFILL MATERIAL: Borehole material

TYPE OF CASING & SCREEN: PVC

I.D. 2.05" O.D. 2.38"

JOINT TYPE: Flush Thread

IMPERMEABLE BACKFILL: Bentonite Clay

BACKFILL MATERIAL: None

SCREEN PACKING: Sand

FILTER FABRIC: ___ YES X NO

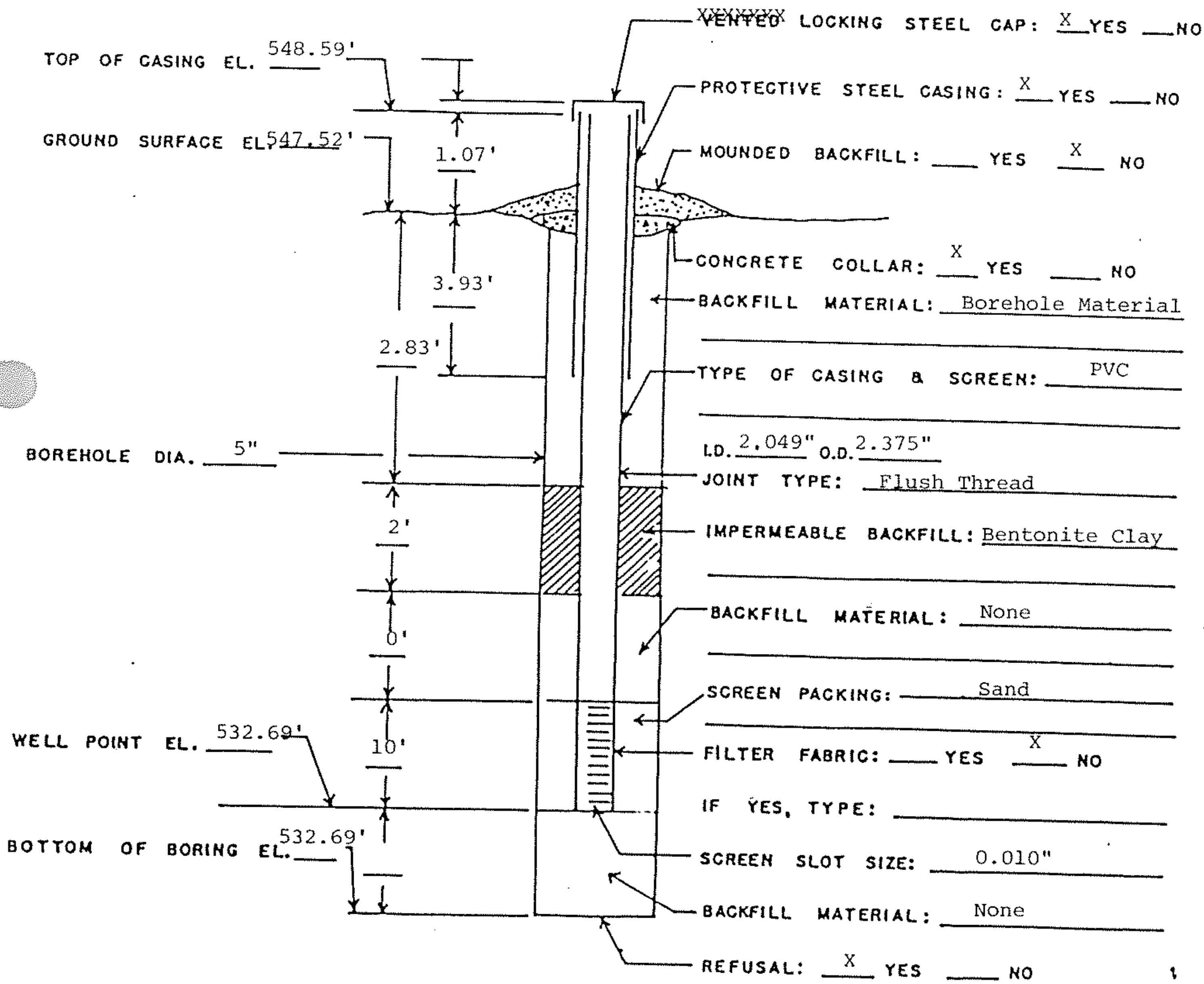
IF YES, TYPE: ___

SCREEN SLOT SIZE: 0.010"

BACKFILL MATERIAL: Borehole Material

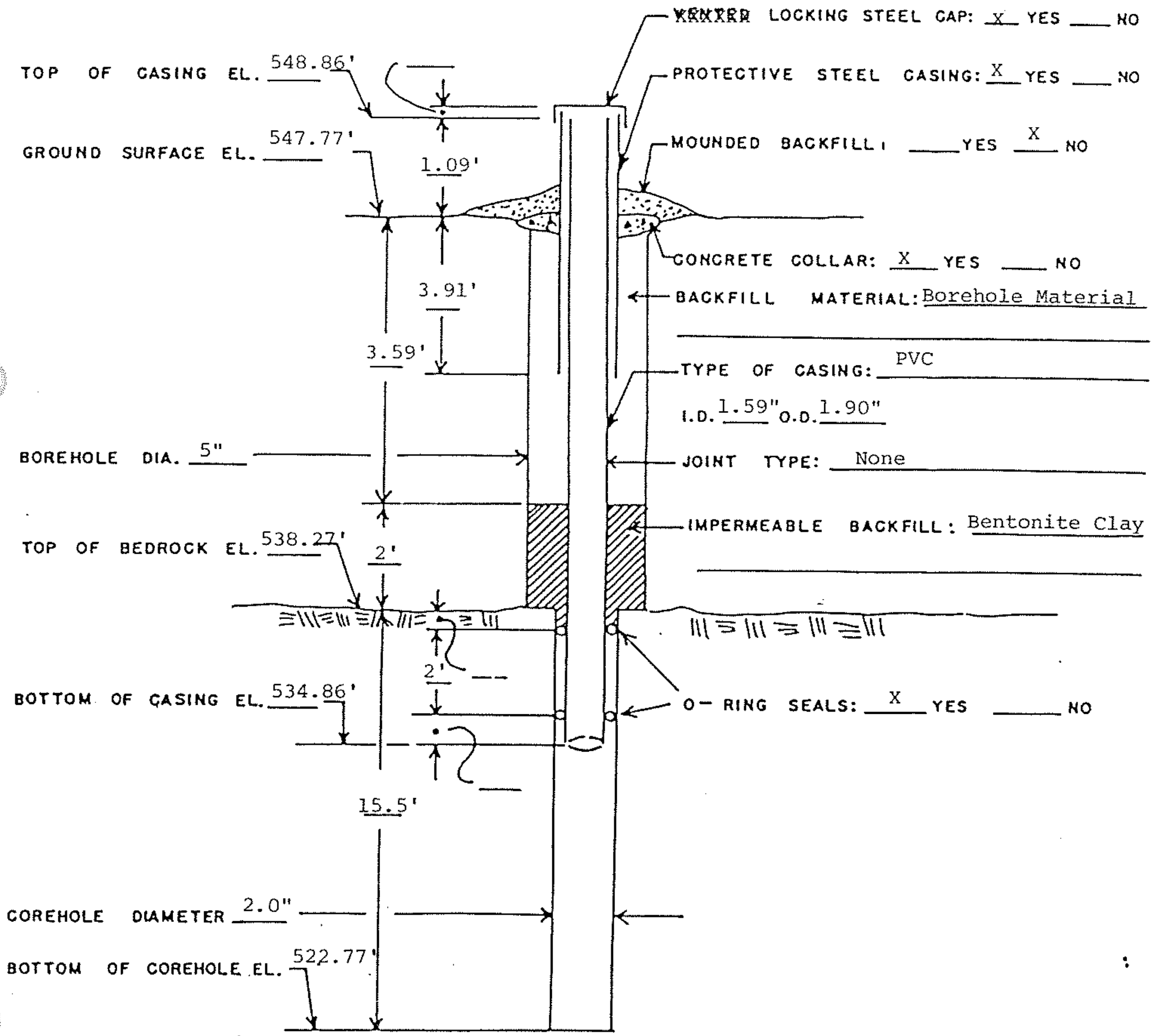
REFUSAL: ___ YES X NO

MONITOR WELL INSTALLATION DETAIL FOR WELL IN UNCONSOLIDATED DEPOSIT



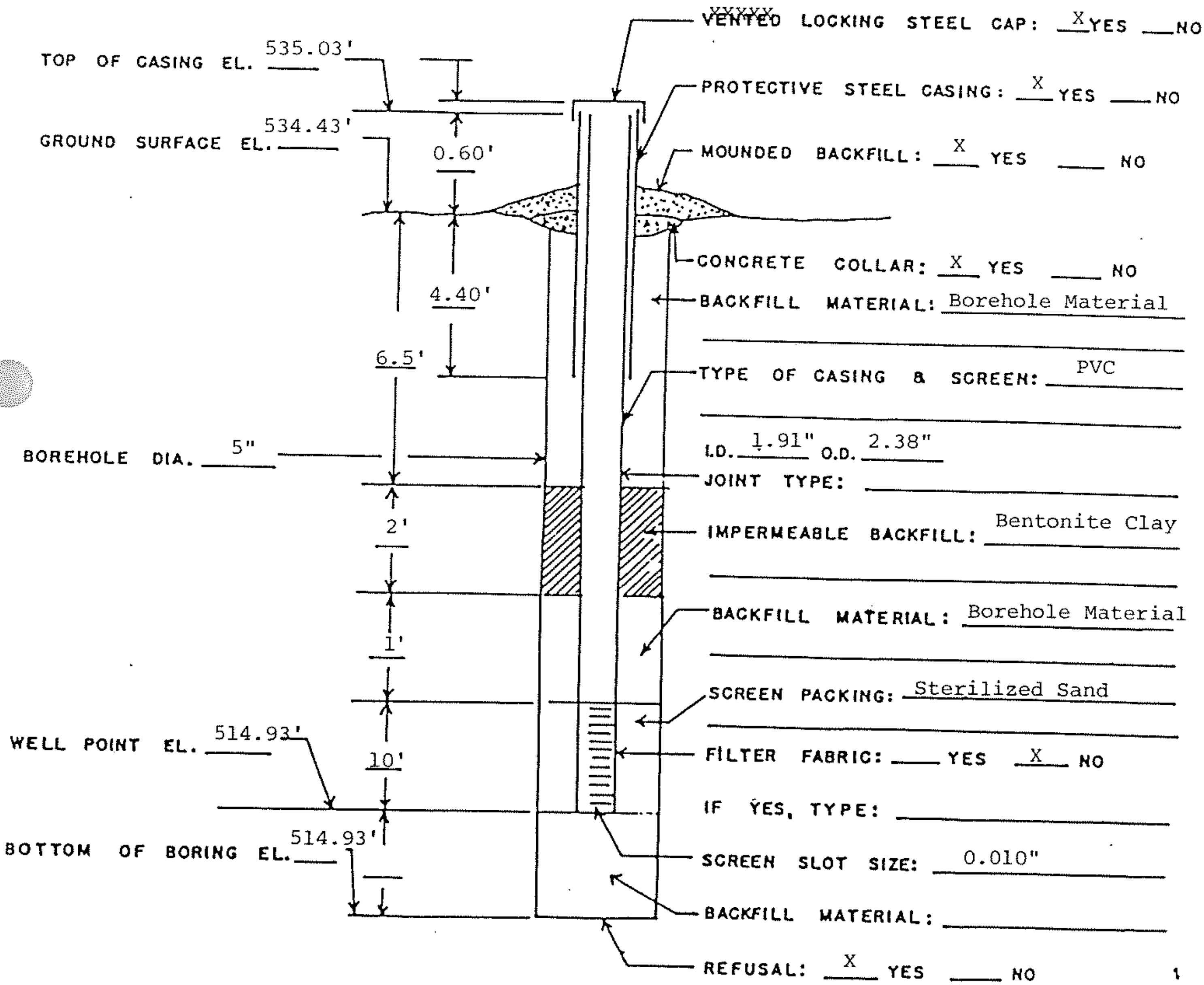
WELL #4

MONITOR WELL INSTALLATION DETAIL
FOR WELL IN BEDROCK

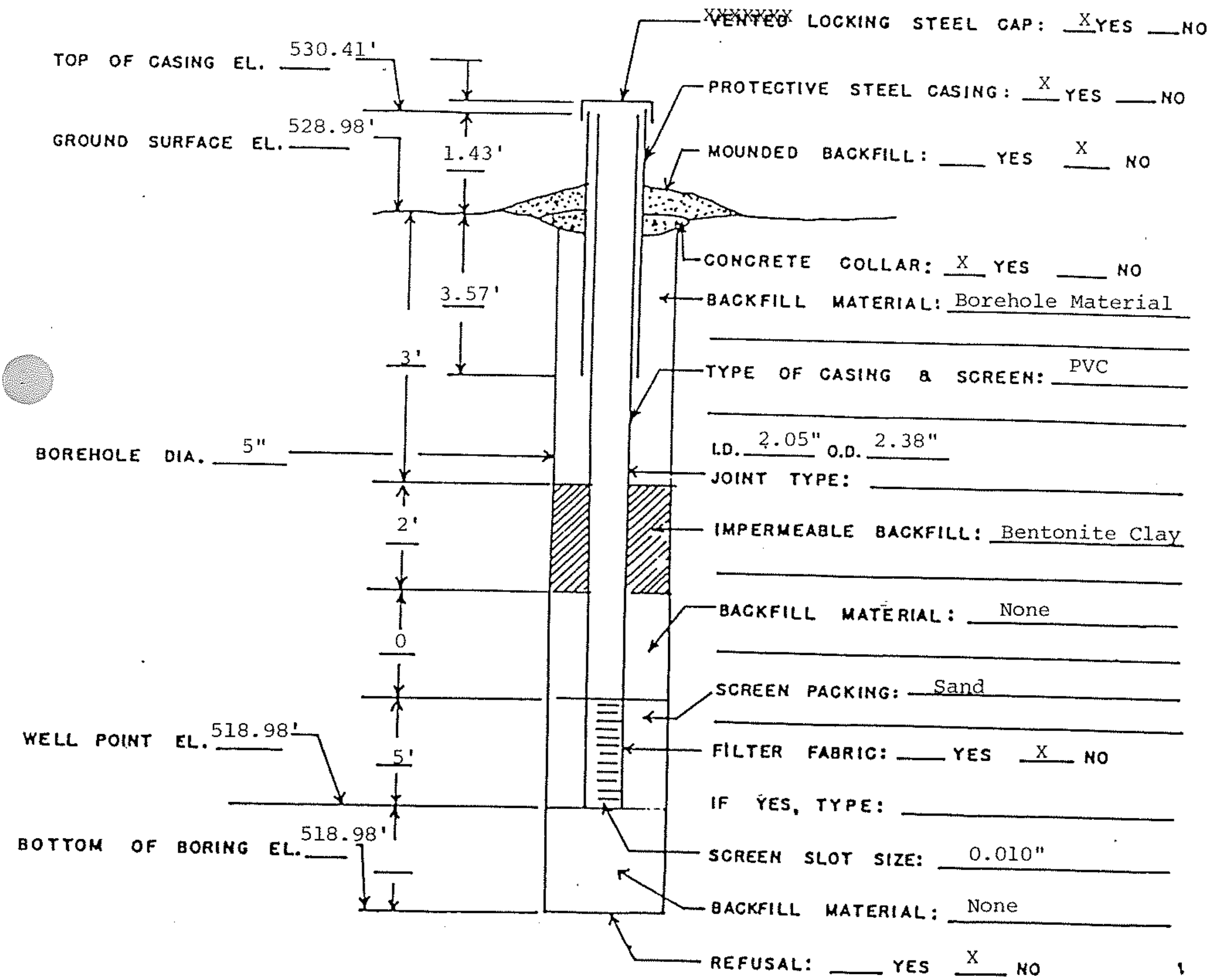


WELL #5A

MONITOR WELL INSTALLATION DETAIL FOR WELL IN UNCONSOLIDATED DEPOSIT

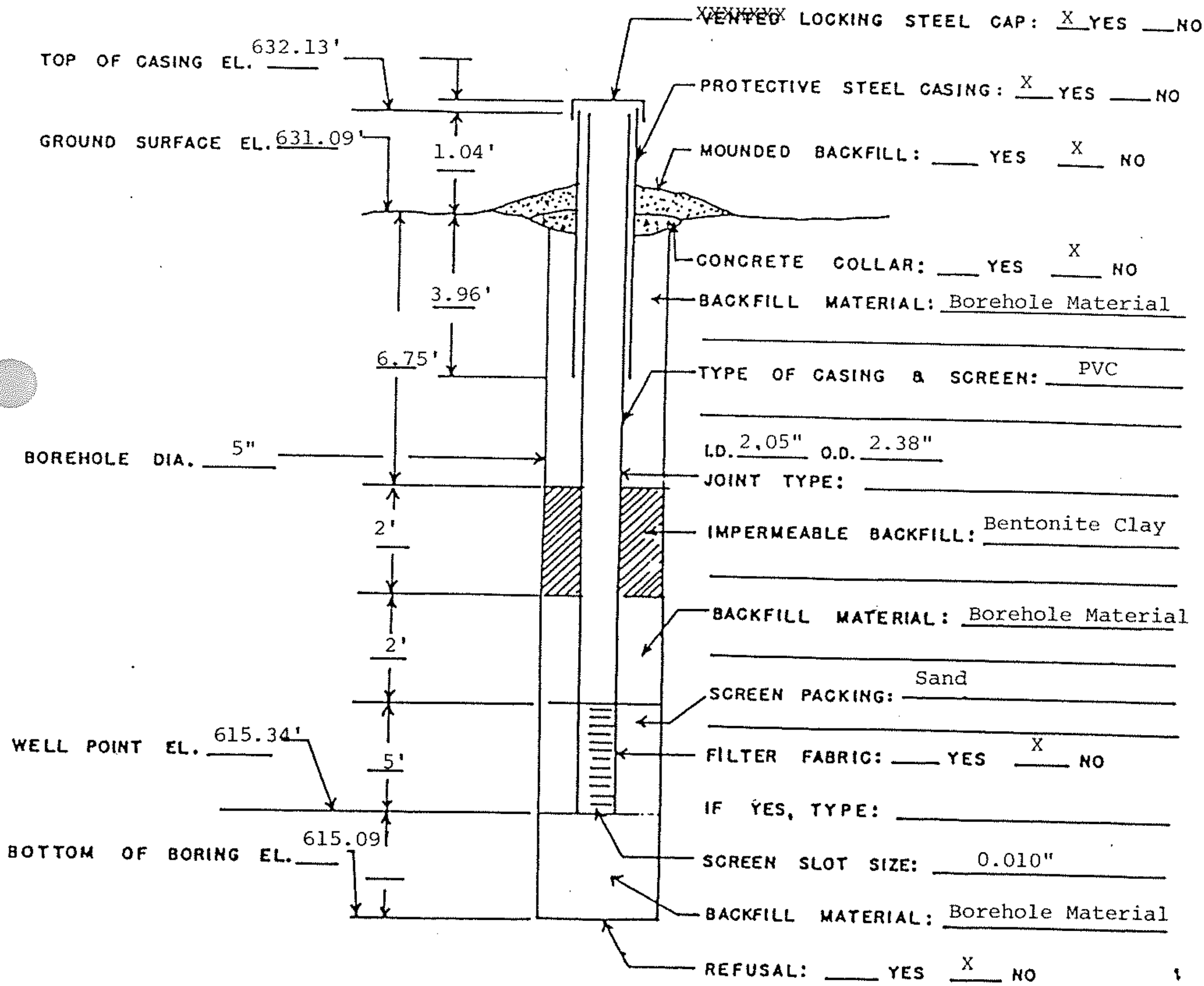


MONITOR WELL INSTALLATION DETAIL FOR WELL IN UNCONSOLIDATED DEPOSIT



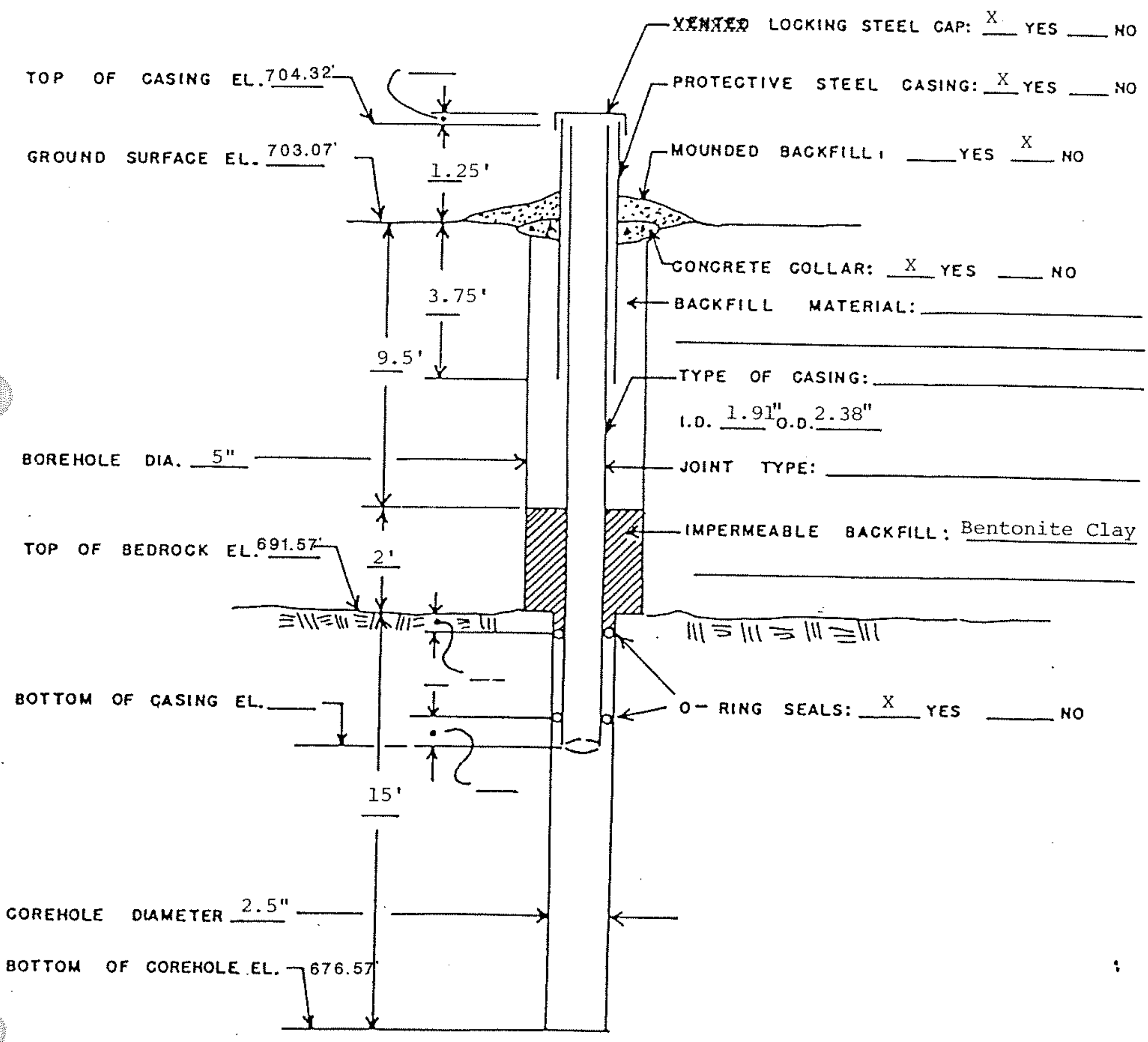
WELL #7

MONITOR WELL INSTALLATION DETAIL FOR WELL IN UNCONSOLIDATED DEPOSIT

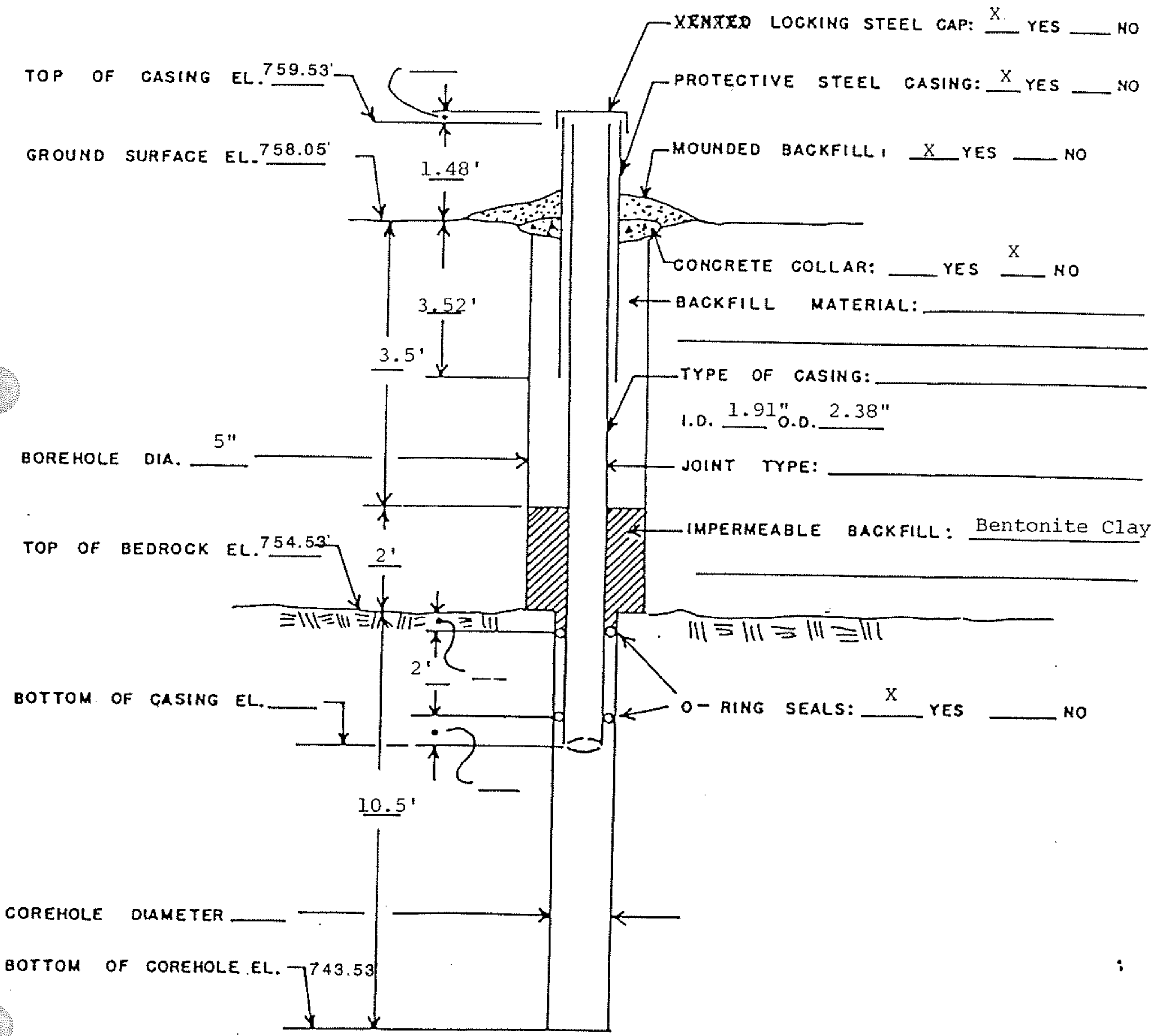


WELL #8A

MONITOR WELL INSTALLATION DETAIL FOR WELL IN BEDROCK



MONITOR WELL INSTALLATION DETAIL FOR WELL IN BEDROCK



APPENDIX C
CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
GUIDANCE DOCUMENT FOR
TORRINGTON SOLID AND HAZARDOUS WASTE DISPOSAL FACILITY
WATER QUALITY MONITORING PROGRAM

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

September 19, 1983

City of Torrington
Public Works Department
Torrington, Connecticut 06790

Attention: Mr. Richard D. Cosgrove

Re: Municipal Landfill
Ground water monitoring

Dear Mr. Cosgrove:

Enclosed is a draft copy of proposed water quality monitoring requirements for the City of Torrington Municipal Landfill and industrial sludge disposal site. Implementation of this program will meet the monitoring requirements of the DEP Solid Waste Management Unit, Hazardous Materials Management Unit, and Water Compliance Unit.

Please call John England or me at 566-3654 to arrange a meeting to discuss the proposed program.

Very truly yours,

Theodore J. Stevens

Theodore J. Stevens
Senior Environmental Analyst
Water Compliance Unit

TJS:zg

Encl.

cc: John England, SWMU
Tom Stark, HMMU
Jim Rokos, TAHD

SEP 2 ? 1983
PUBLIC WORKS DEPARTMENT

Phone:
165 Capitol Avenue • Hartford, Connecticut 06106

TORRINGTON SOLID AND HAZARDOUS WASTE DISPOSAL FACILITY

WATER QUALITY MONITORING PROGRAM

A. Surface water quality monitoring shall be conducted by the town or its consultant at the locations shown on the site plan entitled "Torrington Landfill Water Sample Location Points" by York Wastewater Consultants and also at the northerly inlet to Iffland Pond. To summarize:

Surface water monitoring will be conducted at the following locations:

S-1 (upgradient) - shown as stream sample A on site plan
S-2 (downgradient) - shown as stream sample B on site plan
S-3 (downgradient) - northerly inlet to Iffland Pond

Each quarterly sample shall be analyzed for the following ten leachate indicator parameters:

1. total dissolved solids
2. total suspended solids
3. alkalinity
4. BOD (20)
5. COD
6. total iron
7. total manganese
8. ammonia
9. nitrate
10. chloride

B. Ground water monitoring shall be conducted at the following locations, also shown on the above-referenced site plan:

Replaced by W-1A * W-1 (downgradient) well to be deepened to at least 10 feet below seasonal low ground water table - well #1
W-2 (downgradient) - well #2
W-3 (downgradient) - well #3
W-4 (downgradient) bedrock well - well #4
[Re]placed by W-5A * W-5 (downgradient) well to be repaired - well #5 Vandalized
W-6 (downgradient) - well #6
W-7 (downgradient) - well #7
[Re]placed by W-8A * W-8 (background well for industrial sludge disposal area) well to be deepened to at least 10 feet below seasonal low ground water table - well #8

Following measurement of the water level in the monitoring wells, the wells shall be pumped immediately prior to sampling until at least three (3) times the volume of water standing in the well is evacuated to insure that a representative sample of the ground water is obtained. All ground water samples should be filtered in the field to remove excess suspended solids. A silty water sample will give false results on the suspended solids, COD, iron and manganese analyses. The samples shall be analyzed by a laboratory certified by the State Health Department. All samples shall be placed in the appropriate container for the test to be conducted (i.e. BOD bottle, volatile organics bottle, 1/2 gallon plastic bottle, etc.).

* - monitor wells requiring repair or deepening; work shall be completed prior to next scheduled sampling date.

Each quarter, three replicate samples shall be taken from well #8, for a total of 12 samples annually, which may also be achieved by monthly sampling of well #8. If three replicates are taken quarterly, the well shall be allowed to recover to its original water level between samplings.

Each ground water sample shall be analyzed for the previously listed 10 leachate parameters.

In addition, each ground water sample taken from Well #8, Well #3, Well #4 and Well #5 shall be analyzed for the following:

1. Arsenic
2. Barium
3. Cadmium
4. Chromium
5. Copper
6. Lead
7. Mercury
8. Selenium
9. Silver
10. Nickel
11. Nickel

Annually, in the third quarter (July sampling) each ground water sample shall also be analyzed for the following:

volatile organic scan

C. The water supply wells at the following addresses shall be sampled semi-annually.

PW-1 (Lemanquais Co. Inc., S. Main St., Torrington)
PW-2 (Bonvincini Building Co. Inc., 1500 S. Main St., Torrington)
PW-3 (Barredo Real Estate, 2496 S. Main St., Torrington)
PW-4 (Mrs. Claudia Spiegelhalter, S. Main St., Litchfield)
PW-5 (Agway Inc., S. Main St., Torrington)
PW-6 (J & M Sales Co., Inc., S. Main St., Torrington)
PW-7 (Albreada Refuse Inc., Iffland Pond Rd., Litchfield)
PW-8 (Torrington Scrap, Inc., 1002 S. Main St., Torrington)
PW-9 (Ed's Auto Body, 1109 S. Main St., Torrington)
PW-10 (Blue Seal Feeds, Iffland Pond Rd., Litchfield)

Each semi-annual water sample shall be analyzed for nine (9) of the previously listed leachate indicator parameters (No BOD).

Annually, in the third quarter (July sampling), each water sample shall be analyzed for the following:

volatile organic scan

Tap water should be run vigorously for 5 minutes prior to sample collection and from a tap which bypasses holding tanks and water treatment systems. Samples shall be placed in the appropriate bottle.

This permit condition (C.) is binding only if the property owners grant the applicant permission to collect the well water sample.

D. The sampling and testing performed according to subparagraphs A and B shall be done according to this schedule:

Sampling date	Reporting date
January	March 1
April	June 1
July	September 1
October	December 1

E. The sampling and testing performed according to subparagraph C shall be done according to this schedule:

Sampling date	Reporting date
January	March
July	September

The results shall be reported to the Solid Waste, Hazardous Waste and Water Compliance Units of the Department of Environmental Protection at the State Office Building, Hartford, Ct. 06106. A copy of the sampling results shall also be sent to the Health Officer of the town(s) from which the samples were taken.

Beginning on September 30, 1984 and annually on that date, thereafter, a summary report of the monitoring program shall be submitted for the review and approval of the Commissioner. The report shall include assessments of: changing trends in leachate concentration or constituents. impacts on adjacent surface waters, changes in plume location, changes in the ground water levels, and impacts on nearby water supply wells. The report shall also include: an assessment of the efficacy of the monitoring program; recommendations for revisions to the monitoring program, if applicable; and recommendations for remedial actions, if applicable.

A statistical comparison of downgradient wells #3, #4, and #5 to the background well for the industrial sludge disposal area (well #8) shall be performed annually for all metals using Cochran's Approximation of the students quarterly test at 95% confidence level.

The Commissioner may revise this monitoring schedule at any time with regard to locations to be sampled, frequency, or parameters to be tested, as the need arises.

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

AMENDMENT TO SOLID WASTE PERMIT NO. 143-1L ISSUED TO THE CITY OF TORRINGTON ON MAY 8, 1981, FOR THE CONTINUED USE AND CLOSURE OF THEIR SOLID WASTE DISPOSAL AREA.

The following permit condition, numbered 18, is intended to outline the details of a ground and surface water quality monitoring program to be conducted by the City at the municipal landfill. This paragraph replaces paragraph #18 in the solid waste permit.

18. A. Surface water quality monitoring shall be conducted by the town or its consultant at the locations shown on the site plan entitled, "Torrington Landfill Water Sample Location Points" by York Wastewater Consultants and also at the northerly inlet to Iffland Pond. To summarize:

Surface water monitoring will be conducted at the following locations:

S-1 (upgradient) - shown as stream sample A on site plan
S-2 (downgradient) - shown as stream sample B on site plan
S-3 (downgradient) - northerly inlet to Iffland Pond

Each quarterly sample shall be analyzed for the following ten leachate indicator parameters:

1. total dissolved solids
2. total suspended solids
3. alkalinity
4. BOD (20)
5. COD
6. total iron
7. total manganese
8. ammonia
9. nitrate
10. chloride

B. Ground water monitoring shall be conducted at the following location, also shown on the above-referenced site plan:

Replaced by #1A → *W-1 (downgradient) well to be deepened to at least 10 feet below seasonal low ground water table - well #1
W-2 (downgradient) - well #2
W-3 (downgradient) - well #3
W-4 (downgradient) bedrock well - well #4
Replaced by #5A → W-5 (downgradient) well to be repaired - well #5
W-6 (downgradient) - well #6
W-7 (downgradient) - well #7
Replaced by #8A → *W-8 (background well for industrial sludge disposal area) deepened to at least 10 feet below seasonal low ground water table - well #8
W-9 Background well

Phone:

Following measurement of the water level in the monitoring wells, the wells shall be pumped immediately prior to sampling until at least three (3) times the volume of water standing in the well is evacuated to insure that a representative sample of the ground water is obtained. All ground water samples should be filtered in the field to remove excess suspended solids. A silty water sample will give false results on the suspended solids, COD, iron and manganese analyses. The samples shall be analyzed by a laboratory certified by the State Health Department. All samples shall be placed in the appropriate container for the test to be conducted (i.e. BOD bottle, volatile organics bottle, ½ gallon plastic bottle, etc.)

* - monitor wells requiring repair or deepening; work shall be completed prior to next scheduled sampling date.

Each quarter, three replicate samples shall be taken from well #8 for a total of 12 samples annually, which may also be achieved by monthly sampling of well #8. If three replicates are taken quarterly, the well shall be allowed to recover to its original water level between samplings.

Each ground water sample shall be analyzed for the previously listed 10 leachate parameters.

In addition, each ground water sample taken from well #8, well #3, well #4 and well #5 shall be analyzed for the following:

1. Arsenic
2. Barium
3. Cadmium
4. Chromium
5. Copper
6. Lead
7. Mercury
8. Selenium
9. Silver
10. Nickel
11. Nickel

Annually, in the third quarter (July sampling) each ground water sample shall also be analyzed for the following:

volatile organic scan

C. The water supply wells at the following addresses shall be sampled semi-annually.

PW-1 (Lemanquais Co. Inc., S. Main St., Torrington)
PW-2 (Bonvincini Building Co. Inc., 1500 S. Main St., Torrington)
PW-3 (Barredo Real Estate, 2496 S. Main St., Torrington)
PW-4 (Mrs. Claudia Spiegelhalter, S. Main St., Litchfield)
PW-5 (Agway Inc., S. Main St., Torrington)
PW-6 (J & M Sales Co. Inc., S. Main St., Torrington)
PW-7 (Albreada Refuse Inc., Iffland Pond Rd., Litchfield)

PW-8 (Torrington Scrap, Inc., 1002 S. Main St., Torrington)
PW-9 (Ed's Auto Body, 1109 S. Main St., Torrington)
PW-10 (Blue Seal Feeds, Iffland Pond Rd., Litchfield)

Each semi-annual water sample shall be analyzed for nine (9) of the previously listed leachate indicator parameters (No BOD).

Annually, in the third quarter (July sampling), each water sample shall be analyzed for the following:

volatile organic scan

Tap water should be run vigorously for 5 minutes prior to sample collection and from a tap which bypasses holding tanks and water treatment systems. Samples shall be placed in the appropriate bottle.

This permit condition (C.) is binding only if the property owners grant the applicant permission to collect the well water sample.

D. The sampling and testing performed according to subparagraphs A and B shall be done according to this schedule:

Sampling date	Reporting date
January	March 1
April	June 1
July	September 1
October	December 1

E. The sampling and testing performed according to subparagraph C shall be done according to this schedule:

Sampling date	Reporting date
January	March
July	September

The results shall be reported to the Solid Waste, Hazardous Waste and Water Compliance Units of the Department of Environmental Protection at the State Office Building, Hartford, Connecticut 06106. A copy of the sampling results shall also be sent to the Health Officer of the town(s) from which the samples were taken.

Beginning on September 30, 1984 and annually on that date, thereafter, a summary report of the monitoring program shall be submitted for the review and approval of the Commissioner. The report shall include assessments of: changing trends in leachate concentration or constituents, impacts on adjacent surface waters, changes in plume location, changes in the ground water levels, and impacts on nearby water supply wells. The report shall also include: an assessment of the efficacy of the monitoring program; recommendations for revisions to the monitoring program, if applicable; and recommendations for remedial actions, if applicable.

A statistical comparison of downgradient wells #3, #4, and #5 to the background well for the industrial sludge disposal area (well #8) shall be performed annually for all metals using Cochran's Approximation of the students' quarterly test at 95% confidence level.

The Commissioner may revise this monitoring schedule at any time with regard to locations to be sampled, frequency, or parameters to be tested, as the need arises.

Dated in Hartford, Connecticut this _____ day of _____________, 1983.

State of Connecticut
Department of Environmental Protection
Stanley J. Pac, Commissioner

By ______________________________
Stanley J. Pac, Commissioner

APPENDIX D
RCRA GROUNDWATER AND SURFACE WATER SAMPLING PROGRAM
ANALYTICAL RESULTS FOR 1984, 1985, AND 1986

1984
SUMMARY OF ANALYTICAL
RESULTS BY QUARTER

SUMMARY OF ANALYTICAL RESULTS OF WATER SAMPLES BY QUARTER

The following sample location abbreviations are used:

Monitoring Wells

W-1 - Well #1
W-2 - Well #2
W-3 - Well #3
W-4 - Well #4
W-5 - Well #5
W-6 - Well #6
W-7 - Well #7
W-8 - Well #8

Surface Water

S-1 - Stream Sample Upgradient of Landfill
S-2 - Stream Sample Downgradient of Landfill
S-3 - Northerly Inlet to Iffland Pond

Private Wells

PW-1 - LeManquais Co., Inc., South Main Street
PW-2 - United Construction, South Main Street
PW-3 - Jamieson Manufacturing, 2500 South Main Street
PW-4 - Mrs. Claudia Spiegelhalter, South Main Street
PW-5 - Agway, Inc., South Main Street
PW-6 - J&M Sales Co., Inc., South Main Street
PW-7 - Albreada Refuse, Inc., Iffland Pond Road
PW-8 - Torrington Scrap, Inc., 1002 South Main Street
PW-9 - Ed's Auto Body, 1109 South Main Street
PW-10 - Blue Seal Feeds, Iffland Pond Road

LABORATORY ANALYTICAL RESULTS
CITY OF TORRINGTON LANDFILL
SAMPLES TAKEN MAY 3, 1984 AND
ANALYZED BY ENVIRONMENTAL LABORATORIES, INC.

Indicator Parameters (mg/l)	Groundwater Wells W-1	W-5	W-6	W-8	W-8	W-8	Surface Water S-1	S-2	S-3
Alkalinity	298	247	4.0	990	980	990	5.0	81	39
Total Suspended Solids	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	18	20	24
Total Dissolved Solids	570	396	146	1,094	1,110	1,108	30	122	160
Ammonia-Nitrogen	1.72	16.5	<0.5	35.5	37	38	<0.5	2.0	<0.5
Nitrate-Nitrogen	0.8	3.0	0.7	1.2	1.4	1.2	0.9	1.3	0.8
Nitrite-Nitrogen									
COD	<10.0	<10.0	<10.0	60	79	69	<10.0	<10.0	<10.0
BOD	<1.0	1.8	<1.0	6.6	5.0	6.2	<1.0	5.6	1.7
Iron	1.80	0.50	0.30	80.0	80.0	80.0	0.20	1.30	0.30
Manganese	4.60	0.74	<0.05	1.18	1.17	1.18	<0.05	0.38	<0.05
Chloride	92.97	42.49	2.50	169.95	172.45	169.95	<1.0	27.34	51.48
Metals (mg/l)									
Arsenic		<0.01		<0.01	<0.01	<0.01			
Barium		<1.0		1.2	1.3	1.3			
Cadmium		<0.03		<0.03	<0.03	<0.03			
Chromium		<0.14		0.25	0.22	0.24			
Copper		<0.05		<0.05	<0.05	<0.05			
Lead		<0.20		<0.20	<0.20	<0.20			
Mercury		<0.001		<0.001	<0.001	<0.001			
Nickel		<0.15		<0.15	<0.15	<0.15			
Selenium		<0.01		<0.01	<0.01	<0.01			
Silver		<0.08		<0.08	<0.08	<0.08			
Zinc		0.07		0.09	0.07	0.07			

(1) Three separate samples were analyzed for Well No. 8.

LABORATORY ANALYTICAL RESULTS
CITY OF TORRINGTON LANDFILL
SAMPLES TAKEN JUNE 12, 1984 AND
ANALYZED BY ENVIRONMENTAL LABORATORIES, INC.

Indicator Parameters (mg/l)	Groundwater Monitoring Wells										Surface Water		
	W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8	W-8	W-8	S-1	S-2	S-3
Alkalinity	307	272	752	788	276	20	940	1212	1320	1200	40	350	40
Total Suspended Solids	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3	7
Total Dissolved Solids	560	392	1140	1140	300	20	1680	1620	1676	1612	74	532	131
Ammonia-Nitrogen	2.32	0.73	28.1	30.3	6.0	0.45	40.2	103	100	103	0.30	12.7	0.85
Nitrate-Nitrogen	0.8	1.2	1.2	1.0	1.4	0.6	0.5	0.8	0.8	0.7	0.30	0.8	0.3
Nitrite-Nitrogen	0.007	0.007	0.014	0.014	0.007	0.002	0.005	0.012	0.001	0.013	0.032	0.005	0.003
COD	<10.0	<10.0	42	42	<10.0	<10.0	108	108	130	104	<10.0	26.8	26.8
BOD	<10	<10	<10	<10	<10	<10	78.6	14.6	15.8	11.2	<10	<10	<10
Iron	1.6	22	13.6	12.4	<0.15	<0.15	102	60	60	58	<0.15	1.61	.74
Manganese	5.5	.34	6.0	7.5	0.89	0.20	6.0	1.16	1.10	1.11	<0.05	1.66	.40
Metals (mg/l)													
Arsenic			0.008	0.020	<0.001			<0.001	<0.001	<0.001			
Barium			2.02	2.4	1.92			4.46	3.58	3.08			
Cadmium			<0.03	<0.03	<0.03			<0.03	<0.03	<0.03			
Chromium			<0.14	<0.14	<0.14			0.35	0.31	0.33			
Copper			<0.05	<0.05	<0.05			<0.05	<0.05	<0.05			
Lead			<0.20	<0.20	<0.20			<0.20	<0.20	<0.20			
Mercury			0.0001	0.0002	0.0005			0.0002	<0.0001	0.0001			
Nickel			<0.001	<0.001	<0.001			<0.001	<0.001	<0.001			
Selenium			<0.08	<0.08	<0.08			<0.08	<0.08	<0.08			
Silver			<0.15	<0.15	<0.15			<0.15	<0.15	<0.15			
Zinc			0.05	0.05	0.03			0.05	0.04	0.03			

SUMMARY OF ANALYSIS OF PRIVATE WELLS
TORRINGTON, CONNECTICUT
SAMPLES TAKEN JULY 26, 1984 AND
ANALYZED BY ENVIRONMENTAL LABORATORIES, INC.

Private Wells

Indicator Parameters (mg/l)	PW-1	PW-2	PW-3	PW-4	PW-5	PW-6	PW-7	PW-8	PW-9	PW-10
Alkalinity	60	34	27		89	69	59	105	110	65
Total Suspended Solids	6.0	<1.0	2.0		6.0	8.0	6.0	8.0	10.0	4.0
Total Dissolved Solids	160	90	146		180	178	144	172	296	488
Ammonia-Nitrogen	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	0.61	<0.05	<0.05
Nitrate-Nitrogen	0.1	0.1	0.3		0.1	0.3	<0.1	<0.1	<0.1	<0.1
Nitrite-Nitrogen	<0.002	0.006	0.002		<0.002	0.170	<0.002	0.006	0.006	0.006
COD	<10	<10	<10		<10	<10	<10	<10	<10	<10
Iron	<0.15	0.26	0.32		<0.15	0.18	<0.15	0.63	0.30	<0.15
Manganese	<0.05	<0.05	<0.05		<0.05	0.05	<0.05	1.5	<0.05	0.15
Volatile Organics (ppb)										
1,1-dichloroethane	ND	ND	ND		4.3	3.0	ND	ND	ND	1.4
trans-1,2-dichloroethylene	ND	ND	ND		2.7	ND	ND	ND	ND	9.3
chloroform	ND	ND	ND		10.3	ND	ND	ND	15.0	3.3
1,1,1-trichloroethane	ND	ND	ND		23.0	9.6	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND		12.4	11.4	ND	ND	ND	1.2
trichloroethylene	ND	ND	ND		2.7	5.0	ND	ND	0.4	2.3
tetrachloroethylene	ND	ND	ND		ND	0.69	ND	ND	ND	ND
1,2-dichloroethane	ND	ND	ND		ND	ND	ND	ND	7.1	ND
bromoform	ND	ND	ND		ND	ND	ND	ND	0.7	1.2
bromodichloromethane	ND	ND	ND		ND	ND	ND	ND	0.3	ND
tetrachloroethane	ND	ND	ND		ND	ND	ND	ND	ND	0.5

ND = None Detected

LABORATORY ANALYTICAL RESULTS
CITY OF TORRINGTON LANDFILL
SAMPLES TAKEN JULY 26, 1984 AND
ANALYZED BY ENVIRONMENTAL LABORATORIES, INC.

Indicator Parameters (mg/l)	Monitoring Wells W-1	W-2	W-3	W-4	W-5	W-7	Surface Water S-1	S-2	S-3
Alkalinity	295	447	690	728	190	1052	200	511	49
Total Suspended Solids	4	60	16	12	<1.0	144	4	20	8
Total Dissolved Solids	440	688	980	1036	264	1636	316	908	124
Ammonia-Nitrogen	2.0	1.58	22.1	28.9	4.5	53.0	4.0	17.9	0.25
Nitrate-Nitrogen	1.0	2.5	1.0	0.7	2.2	0.4	1.2	1.9	1.0
Nitrite-Nitrogen	0.019	0.008	0.008	0.017	<0.002	<0.002	0.044	0.051	0.004
COD	50	59	67	76	42	151	210	76	<10
BOD	<10	<10	<10	<10	<10	17.5	<10	10.4	<10
Iron	2.85	33.50	8.40	10.99	<0.15	87.50	0.88	6.37	0.47
Manganese	4.50	0.39	8.00	7.50	1.52	5.50	1.44	3.50	0.15

Metals (mg/l)	W-3	W-4	W-5
Arsenic	0.003	0.022	<0.001
Barium	<0.30	<0.30	<0.30
Cadmium	0.05	0.06	<0.03
Chromium	<0.14	<0.14	<0.14
Copper	<0.05	<0.05	<0.05
Lead	<0.20	<0.20	0.30
Mercury	0.0012	0.0011	0.0007
Nickel	0.15	0.17	0.15
Selenium	<0.001	<0.001	<0.001
Silver	<0.08	<0.08	<0.08
Zinc	0.04	0.02	0.04

LABORATORY ANALYTICAL RESULTS
CITY OF TORRINGTON LANDFILL
SAMPLES TAKEN JULY 26, 1984 AND
ANALYZED BY ENVIRONMENTAL LABORATORIES, INC.

Parameter (ppb)	Groundwater						Surface Water		
	W-1	W-2	W-3	W-4	W-5	W-7	S-1	S-2	S-3
trans-1,2-dichloroethene	ND	ND	ND	ND	ND	ND	ND	20.0	3.0
trans-1,2-dichloroethylene	565	128	10	28	ND	15	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND
methylene chloride	ND	ND	ND	ND	ND	28	ND	ND	ND
chloroform	ND	10	ND	ND	ND	ND	ND	ND	ND
1,1,1-trichloroethane	35	ND	ND	ND	ND	ND	ND	ND	ND
1,1-dichloroethane	ND	11	4	6	ND	23	ND	1.9	ND
chlorobenzene	ND	ND	ND	ND	ND	1	ND	ND	ND
trichloroethylene	ND	1	ND	ND	ND	ND	ND	ND	ND
1,2-dichloroethane	ND	1	ND	ND	ND	ND	ND	ND	ND

LABORATORY ANALYTICAL RESULTS
CITY OF TORRINGTON LANDFILL
SAMPLES TAKEN OCTOBER 9, 1984 AND ANALYZED BY ENVIRONMENTAL LABORATORIES, INC.

Indicator Parameters (mg/l)	Groundwater Monitoring Wells									Surface Water		
	W-1	W-2	W-3	W-4	W-5	W-7	W-8A	W-8B	W-8C	S-1	S-2	S-3
Alkalinity	516	316	880	886	260	954	1392	1340	1200		829	48
Total Suspended Solids	8.0	8.0	34	32	34	162	60	58	60		15.0	7.0
Total Dissolved Solids	850	506	1536	1348	416	1942	1636	1758	1710		1360	112
Ammonia-Nitrogen	4.25	1.5	23.3	31.70	15.5	36.7	89	89	89		27.2	0.50
Nitrate-Nitrogen	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		0.6	<0.5
Nitrite-Nitrogen												
COD	104	661	70	70	35	135	148	187	130		104	96
BOD	<10	<10	<10	<10	<10	20.8	15.7	16.3	15.1		<10	<10
Iron	4.32	3.32	12.80	15.16	27.1	74.6	24.8	20.5	31.2		4.38	0.37
Manganese	5.1	0.26	6.7	7.2	5.0	4.5	3.4	2.5	3.2		3.3	0.18
Chlorides	165	80	305	305	75	405	300	305	300		265	38
Metals (mg/l)												
Arsenic			0.026	0.082	<0.001		0.007	0.004	0.005			
Barium			<0.30	<0.30	<0.30		0.57	0.59	0.57			
Cadmium			0.004	<0.003	0.004		<0.003	<0.003	<0.003			
Chromium			0.03	0.02	0.03		0.14	0.14	0.16			
Copper			<0.05	<0.05	<0.05		<0.05	<0.05	<0.05			
Lead			0.03	0.02	0.04		0.03	0.02	0.03			
Mercury			<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001			
Nickel			<0.15	<0.15	<0.15		<0.15	<0.15	<0.15			
Selenium			0.001	<0.001	<0.001		0.001	<0.001	<0.001			
Silver			<0.05	<0.05	<0.05		<0.05	<0.05	<0.05			
Zinc			0.03	0.02	0.04		0.06	0.06	0.05			

LABORATORY ANALYTICAL RESULTS
CITY OF TORRINGTON LANDFILL
SAMPLES TAKEN OCTOBER 16, 1984 AND ANALYZED BY ENVIRONMENTAL LABORATORIES, INC.

Private Wells

Indicator Parameters (mg/l)	PW-1	PW-2	PW-3	PW-5	PW-6	PW-7	PW-8	PW-9	PW-10
Alkalinity	54	16	25	79	102	40	130	96	78
Total Suspended Solids	5.0	3.0	2.0	2.0	<1.0	<1.0	1.0	2.0	2.0
Total Dissolved Solids	166.0	34.0	160.0	136.0	120.0	122.0	188.0	234.0	428.0
Ammonia-Nitrogen	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrate-Nitrogen	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrite-Nitrogen									
COD	<10.0	<10.0	<10.0	14.4	<10.0	<10.0	<10.0	<10.0	14.4
BOD									
Iron	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.42	0.26	<0.15
Manganese	0.02	<0.01	<0.01	<0.01	0.02	<0.01	3.80	0.06	0.17
Chloride	31.0	<1.0	48.0	12.0	8.0	2.0	9.0	29.0	20.0
Metals (mg/l)									
Arsenic									
Barium									
Cadmium									
Chromium									
Copper									
Lead									
Mercury									
Nickel									
Selenium									
Silver									
Zinc									

1985

SUMMARY OF ANALYTICAL
RESULTS BY QUARTER

SUMMARY OF ANALYTICAL RESULTS OF WATER SAMPLES BY QUARTER

The following sample location abbreviations are used:

Monitoring Wells

W-1A - Well #1 A
W-2 - Well #2
W-3 - Well #3
W-4 - Well #4
W-5A - Well #5 A
W-6 - Well #6
W-7 - Well #7
W-8A - Well #8 A

Surface Water

S-1 - Stream Sample Upgradient of Landfill
S-2 - Stream Sample Downgradient of Landfill
S-3 - Northerly Inlet to Iffland Pond

Private Wells

PW-1 - LeManquais Co., Inc., South Main Street
PW-2 - United Construction, South Main Street
PW-3 - Jamieson Manufacturing, 2500 South Main Street
PW-4 - Mrs. Claudia Spiegelhalter, South Main Street
PW-5 - Agway, Inc., South Main Street
PW-6 - J&M Sales Co., Inc., South Main Street
PW-7 - Albreada Refuse, Inc., Iffland Pond Road
PW-8 - Torrington Scrap, Inc., 1002 South Main Street
PW-9 - Ed's Auto Body, 1109 South Main Street
PW-10 - Blue Seal Feeds, Iffland Pond Road

CITY OF TORRINGTON
SEMI-ANNUAL MONITORING RESULTS

February 8, 1985

PRIVATE WELLS

(Analyzed By YWC, Inc.)

Parameter	Lemanguais Company PW-1	United Steel Erectors PW-2	Jamesion Mfg. PW-3	Agway, Inc. PW-5	J&M Sales PW-6	Albreada Refuse, Inc. PW-7	Torrington Scrap, Inc. PW-8	Ed's Auto Body PW-9	Blue Seal Feeds PW-10
pH, S.U.	6.71	6.14	6.19	7.65	6.83	7.19	6.61	7.43	7.61
Conductivity, umhos/cm	500	100	280	280	325	165	335	405	600
Total Dissolved Solids	326	104	202	182	215	115	227	271	393
Total Suspended Solids	<1.0	<1.0	<1.0	2.3	<1.0	<1.0	1.5	<1.0	<1.0
Alkalinity as $CaCO_3$	65.4	15.4	28.2	88.0	103	65.1	130	111	102
Chloride	117	19.0	26.7	11.9	3.4	4.5	2.7	5.0	3.2
Chemical Oxygen Demand	18.7	3.90	10.3	13.5	11.5	21.0	15.5	7.75	6.98
Iron	0.32	1.34	1.50	3.41	3.58	2.99	3.88	4.07	4.28
Manganese	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.18	0.14	2.69
Ammonia-Nitrogen	0.24	0.08	1.56	0.08	0.15	0.13	0.80	0.07	0.07
Nitrate-Nitrogen	0.17	0.35	0.74	0.25	0.36	0.21	0.05	0.04	<0.01

All results reported in mg/l unless stated otherwise.

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS

February 8, 1985

SURFACE WATER

(Analyzed By YWC, Inc.)

Parameter	1,500' Upstream of Well 7 S-1	O&G Co. 100' South From Gate S-2	Iffland Pond S-3
Conductivity, umhos/cm	30	250	250
Total Dissolved Solids	26.6	141	145
Total Suspended Solids	13.0	145	37.8
Alkalinity as $CaCO_3$	9.7	61.2	9.9
BOD-20	5	27	20
COD	19.9	21.8	77.5
Ammonia-N	0.11	0.84	0.26
Nitrate-N	0.32	0.62	1.25
Chloride	4.8	5.8	71.7
Iron	0.24	0.13	0.16
Manganese	<0.05	<0.05	0.29
pH, S.U.	6.35	6.92	5.62

All results reported in mg/l unless stated otherwise.

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CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS

February 8, 1985 WELLS

(Analyzed By YWC, Inc.)

Parameter	Well 1A	Well 2	Well 3	Well 4	Well 5	Well 7	Well 8A[1]	Well 8A	Well 8A
Conductivity, umhos/cm	500	660	2,750	2,900	1,380	2,500	2,500	2,500	2,500
Total Dissolved Solids	267	360	1,480	1,510	694	1,660	1,150	1,080	1,160
Total Suspended Solids	8.5	70.2	927	33.6	536	530	203	190	215
Alkalinity as $CaCO_3$	179	258	914	876	367	1,090	1,030	966	1,160
BOD-20	9	4	8	9	7	75	25	27	22
COD	23.3	24.0	114	68.2	101	238	192	185	173
Ammonia-N	1.19	0.41	33.6	15.8	13.1	52.0	81.5	82.7	58.9
Nitrate-N	<0.10	<0.10	0.13	<0.10	0.42	<0.10	<0.10	<0.10	<0.10
Chloride	6.4	45.0	193	205	53.7	38.1	29.9	38.9	19.6
Iron	0.18	0.14	<0.10	0.14	0.37	0.15	0.19	0.21	0.15
Manganese	1.48	0.41	5.70	6.29	4.52	3.31	1.47	1.09	1.38
pH, S.U.	7.54	6.88	7.26	6.90	6.41	6.77	6.90	6.67	6.77
Arsenic	N/A	N/A	<0.002	<0.002	<0.002	N/A	<0.002	<0.002	<0.002
Barium	N/A	N/A	0.32	0.25	0.15	N/A	1.92	1.65	2.24
Cadmium	N/A	N/A	0.008	0.006	0.006	N/A	<0.004	<0.004	<0.004
Chromium	N/A	N/A	0.02	<0.02	<0.02	N/A	<0.02	<0.02	<0.02
Copper	N/A	N/A	0.05	<0.02	0.10	N/A	0.02	0.02	0.02
Lead	N/A	N/A	<0.04	<0.04	<0.04	N/A	<0.04	<0.04	<0.04
Mercury	N/A	N/A	<0.0002	<0.0002	<0.0002	N/A	<0.0002	<0.0002	<0.0002
Selenium	N/A	N/A	<0.002	<0.002	<0.002	N/A	<0.002	<0.002	<0.002
Silver	N/A	N/A	<0.01	<0.01	<0.01	N/A	<0.01	<0.01	<0.01
Nickel	N/A	N/A	<0.03	<0.03	<0.03	N/A	<0.03	<0.03	<0.03
Zinc	N/A	N/A	0.08	0.01	0.06	N/A	0.06	0.05	0.06
Water Level Elevations (Ft.)	533.13	544.46	543.25	543.33	522.49	619.84	695.97	-	-

All results reported in mg/l unless stated otherwise.
N/A = Not Analyzed.
[1]Three separate samples were analyzed for Well 8A.

CITY OF TORRINGTON
QUARTERLY GROUNDWATER MONITORING

February 8, 1985

WELL WATER LEVELS

(Analyzed By YWC,Inc.)

Top Of PVC Elevation	Sample Location	Water Level[1]	Water Level Elevation	Well Depth
544.33	Well #1A	10'6"	533.13	20'
549.09	Well #2	4'6.5"	544.55	11.83'
548.59	Well #3	4'9"	543.84	15.9'
548.86	Well #4	4'8"	544.19	26.09'
535.03	Well #5A	12'6.5"	522.49'	20.1'
–	Well #6[2]			
632.13	Well #7	12'3.5"	619.84'	16.79'
712.97	Well #8A	17'00"	695.97'	27.48'

[1]Distance to PVC.
[2]Vandalized - Unable to Sample.

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
May 21, 1985 SURFACE WATER

(Analyzed By YWC, Inc.)

Parameter	1,500' Upstream of Well 7 S-1	O&G Co. 100' South From Gate S-2	Iffland Pond S-3
Conductivity, umhos/cm	48	610	79
Total Dissolved Solids	30.3	188	421
Total Suspended Solids	11.9	135	105
Alkalinity as $CaCO_3$	10.4	79.0	24
BOD-20	<1.0	7.8	1.9
COD	10.1	26.0	10.4
Ammonia-N	0.14	0.73	0.33
Nitrate-N	<0.10	0.53	<0.10
Chloride	7.3	99	26.6
Iron	0.26	1.24	0.22
Manganese	<0.05	0.68	<0.05
pH, S.U.	6.3	6.9	6.79

All results reported in mg/l unless stated otherwise.

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
May 21, 1985 WELLS

(Analyzed By YWC, Inc.)

Parameter	Well 1A	Well 2	Well 3	Well 4	Well 5A	Well 7	Well 8A[1]	Well 8A	Well 8A	Well 9
Conductivity, umhos/cm	465	468	2,190	2,180	230	2,380	1,700	(2)		
Total Dissolved Solids	280	380	1,620	1,720	720	1,850	1,300	1,250	1,275	210
Total Suspended Solids	14.8	120	830	630	550	630	200	210	220	12.4
Alkalinity as $CaCO_3$	158	275	818	770	378	1,200	920	900	935	32.0
BOD-20	<1.0	2.0	4.6	7.0	<1.0	52.5	23.0	21.5	22.6	<1.0
COD	20.4	21.7	82.6	85.6	23.6	189	170	183	178	4.4
Ammonia-N	1.30	0.37	27.0	11.2	10.1	40	75.4	80.3	77.2	0.13
Nitrate-N	<0.10	0.45	0.16	0.12	0.38	0.62	0.46	0.14	0.48	<0.10
Chloride	141	28.6	323	318	93.7	70.6	23.4	25.3	22.4	33.8
Iron	1.75	28.2	11.3	9.7	0.68	85.1	51.9	51.0	50.6	0.29
Manganese	2.46	0.32	6.29	5.50	1.56	3.68	1.05	1.01	0.97	<0.05
pH, S.U.	6.28	6.46	6.48	6.9	6.1	6.18	6.38			6.4
Arsenic	N/A	N/A	<0.002	<0.002	<0.002	N/A	<0.002	<0.002	<0.002	<0.002
Barium	N/A	N/A	0.32	0.37	0.18	N/A	3.92	4.04	4.20	<0.10
Cadmium	N/A	N/A	0.004	<0.004	<0.004	N/A	<0.004	<0.004	<0.004	<0.004
Chromium	N/A	N/A	<0.02	<0.02	<0.02	N/A	<0.02	<0.02	<0.02	<0.02
Copper	N/A	N/A	<0.02	<0.02	<0.02	N/A	<0.02	<0.02	<0.02	<0.02
Lead	N/A	N/A	<0.04	<0.04	<0.04	N/A	<0.04	<0.04	<0.04	<0.04
Mercury	N/A	N/A	<0.0002	<0.0002	<0.0002	N/A	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	N/A	N/A	<0.002	<0.002	<0.002	N/A	<0.002	<0.002	<0.002	<0.002
Silver	N/A	N/A	<0.01	<0.01	<0.01	N/A	<0.01	<0.01	<0.01	<0.01
Nickel	N/A	N/A	<0.02	<0.02	<0.02	N/A	0.03	0.02	0.02	0.02
Zinc	N/A	N/A	0.02	0.02	0.04	N/A	0.02	0.03	0.02	0.05
Water Level Elevations (Ft.)	533.18	544.79	544.06	544.73	524.93	620.38	696.00	-	-	

All results reported in mg/l unless stated otherwise.
N/A = Not Analyzed.
1 Three separate analyses were analyzed for Well 8A.
2 pH and conductivity taken once in the field.

CITY OF TORRINGTON
SEMI-ANNUAL MONITORING RESULTS
July 26, 1985 PRIVATE WELLS

(Analyzed By YWC, Inc.)

Parameter	Lemanguais Company PW-1	United Steel Erectors PW-2	Jamesion Mfg. PW-3	Agway, Inc. PW-5	J&M Sales PW-6	Albreada Refuse, Inc. PW-7	Torrington Scrap, Inc. PW-8	Ed's Auto Body PW-9	Blue Seal Feeds PW-10
Total Dissolved Solids	298	210	264	201	233	98	257	278	520
Total Suspended Solids	3.4	2.8	3.7	5.6	1.2	1.4	4.2	3.9	5.9
Alkalinity as $CaCO_3$	64.9	15.3	17.2	78.2	93.5	32.4	113	115	64.9
Chloride	70.2	52.1	85.7	20.6	25.3	11.4	35.1	35.6	30.4
Chemical Oxygen Demand	13.0	4.3	9.1	19.0	11.9	9.9	9.2	2.6	14.8
Iron	0.23	0.24	0.09	0.05	0.05	0.17	0.83	0.43	0.30
Manganese	<0.05	0.24	<0.05	<0.05	0.07	<0.05	3.44	0.84	0.14
Ammonia-Nitrogen	<0.04	<0.04	<0.04	0.12	<0.04	0.05	0.60	0.12	<0.04
Nitrate-Nitrogen	0.22	0.30	0.62	0.21	0.32	<0.10	<0.10	<0.10	<0.10

All results reported in mg/l.

CITY OF TORRINGTON
ANNUAL MONITORING RESULTS
VOLATILE PRIORITY POLLUTANTS
July 26, 1985 PRIVATE WELLS

(Analyzed By YWC, Inc.)

Compound	PW-1	PW-2	PW-3	PW-5	PW-6	PW-7	PW-8	PW-9	PW-10
chloromethane	<10	<10	<10	<10	<10	<10	<10	<10	<10
bromomethane	<10	<10	<10	<10	<10	<10	<10	<10	<10
vinyl chloride	<10	<10	<10	<10	<10	<10	<10	<10	<10
chloroethane	<10	<10	<10	<10	<10	<10	12	<10	<10
methylene chloride	<10	<10	<10	<10	<10	<10	<10	<10	<10
trichlorofluoromethane	<10	<10	<10	<10	<10	<10	<10	<10	<10
acrolein	<100	<100	<100	<100	<100	<100	<100	<100	<100
acrylonitrile	<100	<100	<100	<100	<100	<100	<100	<100	<100
1,1-dichloroethene	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,1-dichloroethane	<10	<10	<10	<10	<10	<10	<10	<10	<10
trans-1,2-dichloroethene	<10	<10	<10	<10	<10	<10	<10	<10	<10
chloroform	<10	<10	<10	11	11	<10	<10	<10	<10
1,2-dichloroethane	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,1,1-trichloroethane	<10	<10	<10	25	<10	<10	<10	<10	<10
carbon tetrachloride	<10	<10	<10	<10	<10	<10	<10	<10	<10
bromodichloromethane	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-chloroethylvinyl ether	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,2-dichloropropane	<10	<10	<10	<10	<10	<10	<10	<10	<10
trans-1,3-dichloropropene	<10	<10	<10	<10	<10	<10	<10	<10	<10
trichloroethylene	<10	<10	<10	<10	<10	<10	<10	<10	<10
benzene	<10	<10	<10	<10	<10	<10	<10	<10	<10
cis-1,3-dichloropropene	<10	<10	<10	<10	<10	<10	<10	<10	<10
dibromochloromethane	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,1,2-trichloroethane	<10	<10	<10	<10	<10	<10	<10	<10	<10
bromoform	<10	<10	<10	<10	<10	<10	<10	<10	<10
tetrachloroethylene	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,1,2,2-tetrachloroethane	<10	<10	<10	<10	<10	<10	<10	<10	<10
toluene	<10	<10	<10	<10	<10	<10	<10	<10	<10
chlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10
ethyl benzene	<10	<10	<10	<10	<10	<10	<10	<10	<10

All results reported in ug/l.

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
July 26, 1985 SURFACE WATER

(Analyzed By YWC, Inc.)

Parameter	1,500' Upstream of Well 7 S-1	O&G Co. 100' South From Gate S-2	Iffland Pond S-3
Conductivity, umhos/cm	48	146	75
Total Dissolved Solids	46.0	104	64.5
Total Suspended Solids	127	598	7.1
Alkalinity as $CaCO_3$	11.4	33.4	21.9
BOD-20	4.85	27.7	5.5
COD	136	157	15.9
Ammonia-N	0.12	1.66	0.08
Nitrate-N	<0.10	1.25	<0.10
Chloride	4.6	17.0	10.8
Iron	<0.10	0.60	<0.10
Manganese	<0.05	0.44	<0.05
pH, S.U.	5.81	6.44	6.51

All results reported in mg/l unless stated otherwise.

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CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
July 26, 1985 WELLS

(Analyzed By YWC, Inc.)

Parameter	Well 1A	Well 2	Well 3	Well 4	Well 5A	Well 7	Well 8A[1]	Well 8A	Well 8A	Well 9
Conductivity, umhos/cm	750	560	2,250	2,380	620	2,450	2,320	-	-	38
Total Dissolved Solids	530	331	1,475	1,500	405	1,790	1,268	1,203	1,235	42.2
Total Suspended Solids	5.0	1,169	81.8	30.1	3.6	265	148	142	141	111
Alkalinity as $CaCO_3$	314	219	896	886	262	994	983	985	999	8.59
BOD-20	15.6	27.2	3.2	58.9	20.8	32.5	14.7	24.1	23.2	<1.0
COD	24.7	304	92.9	106	26.9	219	209	171	173	1.48
Ammonia-N	1.71	0.34	38.6	38.6	11.8	57.9	83.3	81.7	85.8	<0.04
Nitrate-N	<0.10	<0.10	<0.10	<0.10	1.46	0.15	<0.10	0.13	<0.10	<0.10
Chloride	109	516	1,084	1,187	71.2	1,445	633	619	671	4.6
Iron	0.86	3.85	0.10	0.36	<0.10	32.0	2.47	3.65	1.17	<0.02
Manganese	3.25	0.48	5.40	5.80	3.42	3.51	1.28	1.26	1.24	<0.05
pH, S.U.	6.34	6.72	6.36	6.54	6.13	6.55	6.43	-	-	5.49
Arsenic	N/A	N/A	<0.002	<0.002	<0.002	N/A	<0.002	<0.002	<0.002	<0.002
Barium	N/A	N/A	0.15	<0.10	<0.10	N/A	0.85	0.76	<0.10	<0.10
Cadmium	N/A	N/A	<0.004	<0.004	<0.004	N/A	<0.004	<0.004	<0.004	<0.004
Chromium	N/A	N/A	<0.025	<0.02	<0.02	N/A	<0.02	<0.02	<0.02	<0.02
Copper	N/A	N/A	<0.02	<0.02	<0.02	N/A	0.03	0.02	<0.02	<0.02
Lead	N/A	N/A	0.09	0.09	<0.04	N/A	0.07	0.07	0.07	0.03
Mercury ← NICKEL	N/A	N/A	<0.0002 <0.02	<0.0002 <0.02	<0.0002 <0.02	N/A	<0.0002 <0.02	<0.0002 <0.02	<0.0002 <0.02	<0.0002 <0.02
Selenium	N/A	N/A	<0.002	<0.002	<0.002	N/A	<0.002	<0.002	<0.002	<0.002
Silver	N/A	N/A	0.012	0.12	<0.01	N/A	<0.01	<0.01	<0.01	<0.01
Zinc	N/A	N/A	0.01	0.02	0.01	N/A	0.05	0.01	0.02	0.01
Water Level Elevations (Ft.)	532.66	544.09	543.30	543.74	523.41	619.88	695.47	-	-	-7.25[2]

All results reported in mg/l unless stated otherwise.
N/A = Not Analyzed.
[1]Three separate analyses were analyzed for Well 8A.
[2]Well elevation unknown. Number reported is distance to water level from top of PVC pipe.

CITY OF TORRINGTON
ANNUAL MONITORING RESULTS
VOLATILE PRIORITY POLLUTANTS
July 26, 1985 WELLS AND SURFACE WATER

(Analyzed By YWC, Inc.)

Compound	Well 1A	Well 2	Well 3	Well 4	Well 5A	Well 7
chloromethane	<50	<10	<10	<10	<10	<50
bromomethane	<50	<10	<10	<10	<10	<50
vinyl chloride	66	40	<10	<10	<10	<50
chloroethane	150	14	40	200	170	620
methylene chloride	<50	<10	<10	<10	<10	<50
trichlorofluoromethane	<50	<10	<10	<10	<10	<50
acrolein	<500	<100	<100	<100	<100	<500
acrylonitrile	<500	<100	<100	<100	<100	<500
1,1-dichloroethene	<50	<10	<10	<10	<10	<50
1,1-dichloroethane	<50	<10	<10	<10	<10	<50
trans-1,2-dichloroethene	380	73	<10	17	<10	<50
chloroform	<50	<10	<10	<10	<10	<50
1,2-dichloroethane	<50	<10	<10	<10	<10	<50
1,1,1-trichloroethane	<50	<10	<10	<10	<10	<50
carbon tetrachloride	<50	<10	<10	<10	<10	<50
bromodichloromethane	<50	<10	<10	<10	<10	<50
2-chloroethylvinyl ether	<50	<10	<10	<10	<10	<50
1,2-dichloropropane	<50	<10	<10	<10	<10	<50
trans-1,3-dichloropropene	<50	<10	<10	<10	<10	<50
trichloroethylene	<50	<10	<10	<10	<10	<50
benzene	<50	<10	<10	<10	<10	<50
cis-1,3-dichloropropene	<50	<10	<10	<10	<10	51
dibromochloromethane	<50	<10	<10	<10	<10	<50
1,1,2-trichloroethane	<50	<10	<10	<10	<10	<50
bromoform	<50	<10	<10	<10	<10	<50
tetrachloroethylene	<50	<10	<10	<10	<10	<50
1,1,2,2-tetrachloroethane	<50	<10	<10	<10	<10	<50
toluene	<50	<10	<10	<10	<10	<50
chlorobenzene	<50	<10	<10	<10	<10	<50
ethyl benzene	<50	<10	<10	<10	<10	54

All results are reported in ug/l.

(Cont'd.)

CITY OF TORRINGTON
ANNUAL MONITORING RESULTS
VOLATILE PRIORITY POLLUTANTS
July 26, 1985 WELLS AND SURFACE WATER

(Analyzed By YWC, Inc.)

Compound	Well 8A	Well 9	S-1	S-2	S-3
chloromethane	<10	<10	<10	<10	<10
bromomethane	<10	<10	<10	<10	<10
vinyl chloride	<10	<10	<10	<10	<10
chloroethane	47	<10	<10	<10	<10
methylene chloride	<10	<10	<10	<10	<10
trichlorofluoromethane	<10	<10	<10	<10	<10
acrolein	<100	<100	<100	<100	<100
acrylonitrile	<100	<100	<100	<100	<100
1,1-dichloroethene	<10	<10	<10	<10	<10
1,1-dichloroethane	<10	<10	<10	<10	<10
trans-1,2-dichloroethene	<10	<10	<10	<10	<10
chloroform	<10	<10	<10	<10	<10
1,2-dichloroethane	<10	<10	<10	<10	<10
1,1,1-trichloroethane	<10	<10	<10	<10	<10
carbon tetrachloride	<10	<10	<10	<10	<10
bromodichloromethane	<10	<10	<10	<10	<10
2-chloroethylvinyl ether	<10	<10	<10	<10	<10
1,2-dichloropropane	<10	<10	<10	<10	<10
trans-1,3-dichloropropene	<10	<10	<10	<10	<10
trichloroethylene	<10	<10	<10	<10	<10
benzene	<10	<10	<10	<10	<10
cis-1,3-dichloropropene	<10	<10	<10	<10	<10
dibromochloromethane	<10	<10	<10	<10	<10
1,1,2-trichloroethane	<10	<10	<10	<10	<10
bromoform	<10	<10	<10	<10	<10
tetrachloroethylene	<10	<10	<10	<10	<10
1,1,2,2-tetrachloroethane	<10	<10	<10	<10	<10
toluene	<10	<10	<10	<10	<10
chlorobenzene	<10	<10	<10	<10	<10
ethyl benzene	<10	<10	<10	<10	<10

All results are reported in ug/l.

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
October 28, 1985 SURFACE WATER

(Analyzed By YWC, Inc.)

Parameter	500' Upstream of Well 7 S-1	O&G Co. 100' South From Gate S-2	Iffland Pond S-3
Conductivity, umhos/cm	37	190	60
pH, S.U.	6.17	7.17	6.95
Arsenic	<0.002	<0.002	<0.002
Barium	<0.10	<0.10	<0.10
Cadmium	<0.004	<0.004	<0.004
Chromium	<0.02	<0.02	<0.02
Copper	<0.02	<0.02	0.02
Iron	<0.02	0.44	<0.02
Lead	<0.04	<0.04	<0.04
Manganese	<0.05	0.39	<0.05
Mercury	<0.0002	<0.0002	<0.0002
Selenium	<0.002	<0.002	<0.002
Silver	<0.01	<0.01	<0.01
Zinc	0.03	0.05	0.03
Nickel	<0.02	<0.02	<0.02

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
***October 28, 1985* WELLS**

(Analyzed By YWC, Inc.)

Parameter	Well 1A	Well 2	Well 3	Well 4	Well 5A	Well 7	Well 8A[1]	Well 8A	Well 8A	Well 9
Conductivity, umhos/cm	380	360	2,170	2,130	400	330	200	(2)	-	22
Total Dissolved Solids	N/A	N/A	1,465	1,470	456	N/A	1,070	1,061	1,055	38.8
Total Suspended Solids	N/A	N/A	40	38	8.8	N/A	132	129	126	1,370
Alkalinity as $CaCO_3$	N/A	N/A	887	904	216	N/A	962	984	968	7.5
BOD-20	N/A	N/A	2.80	58	31	N/A	41	39	34	6
COD	N/A	N/A	104	108	25.5	N/A	161	149	149	1.9
Ammonia-N	N/A	N/A	34.9	31.3	9.3	N/A	78.3	81.4	79.2	<0.04
Nitrate-N	N/A	N/A	0.10	<0.10	0.50	N/A	0.12	0.10	0.12	<0.10
Chloride	N/A	N/A	335	350	97.5	N/A	166	157	162	2.3
Iron	0.77	2.60	0.13	0.44	<0.02	44.6	2.33	2.17	1.88	<0.02
Manganese	2.80	0.33	4.80	4.39	2.79	3.70	1.20	1.28	1.30	<0.05
pH, S.U.	6.88	6.81	6.64	6.61	5.90	6.55	6.34	-	-	5.37
Arsenic	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Barium	<0.10	0.72	0.34	0.34	0.12	0.36	2.52	2.54	2.51	<0.10
Cadmium	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Chromium	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Copper	0.36	0.03	0.06	0.15	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
Lead	<0.04	0.07	0.05	<0.07	<0.04	0.06	0.05	0.04	0.07	0.05
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	<0.02	0.04	0.04	0.04	0.02	0.05	0.03	0.03	0.04	0.03
Zinc	0.14	0.03	0.06	0.13	0.03	0.02	0.05	0.03	0.02	0.06
Water Level Elevations (Ft.)	533.46	545.26	544.61	544.38	523.70	620.76	696.22	-	-	-

All results reported in mg/l unless stated otherwise.
N/A = Not Analyzed.
[1]Three separate analyses were analyzed for Well 8A.
[2]pH and conductivity taken once in the field.

CITY OF TORRINGTON
SEMI-ANNUAL MONITORING RESULTS
JANUARY 1986 - PRIVATE WELLS

(Analyzed By YWC, Inc.)

Parameter	Lemanguais Company PW-1	United Construction & Engineers PW-2	Jamesion Mfg. PW-3	Agway, Inc. PW-5	J&M Sales PW-6	Albreada Refuse, Inc. PW-7	Torrington Scrap, Inc. PW-8	Ed's Auto Body PW-9	Blue Seal Feeds PW-10
Total Dissolved Solids	236	176	264	208	254	98	305	311	496
Total Suspended Solids	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.6	5.0	<1.0
Alkalinity as $CaCO_3$	76.4	12.0	36.4	82.1	109	28.6	148	109	88.4
Chloride	51.4	48.9	83.5	22.8	30.4	17.3	29.9	31.4	28.9
Chemical Oxygen Demand	1.21	1.21	7.27	3.23	20.2	13.3	2.02	7.27	3.23
Iron	0.24	0.32	<0.02	<0.02	0.22	0.05	0.84	1.4	0.12
Manganese	<0.02	0.03	<0.02	<0.02	0.25	<0.02	3.6	0.03	0.15
Ammonia-Nitrogen	0.35	0.12	0.17	0.52	0.19	0.36	0.64	0.14	0.12
Nitrate-Nitrogen	<0.10	<0.10	1.00	<0.10	0.30	0.31	<0.10	<0.10	<0.10
pH	6.44	5.35	5.85	6.83	6.28	6.19	6.17	7.02	7.09
Conductivity	300	200	390	250	340	100	395	375	660

All results reported in mg/l.

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
JANUARY 1986 - WELLS

(Analyzed By YWC, Inc.)

Parameter	Well 1A	Well 2	Well 3	Well 4	Well 5A	Well 7	Well 8A[1]	Well 8A	Well 8A	Well 9
Conductivity, umhos/cm	330	380	1,250	1,350	420	2,000	1,800	-	-	20
Total Dissolved Solids	319	304	7,020	1,240	401	1,490	1,130	1,140	1,150	14.4
Total Suspended Solids	6.4	108	26.9	21.7	5.0	204	122	121	121	109
Alkalinity as $CaCO_3$	244	265	827	900	296	1,160	1,150	1,150	1,180	5.2
BOD-20	7	7	48	48	36	45	50	34	27	3.00
COD	24.4	32.5	73.2	93.5	24.4	191	168	172	188	4.00
Ammonia-N	0.95	0.05	19.7	26.2	5.11	53.4	79.5	79.5	80.8	<0.04
Nitrate-N	<0.10	<0.10	<0.10	<0.10	5.38	<0.10	<0.10	<0.10	<0.10	<0.10
Chloride	56.8	62.1	238	262	58.9	407	199	201	209	2.12
Iron	4.01	31.0	6.20	9.20	0.28	77.2	50.0	66.0	65.0	<0.02
Manganese	2.40	0.45	4.10	6.80	0.80	5.00	1.10	1.10	1.10	0.02
pH, S.U.	6.94	6.80	6.70	6.35	6.40	6.67	6.54	-	-	5.06
Arsenic	N/A	N/A	<0.010	<0.01	<0.01	N/A	<0.01	<0.01	<0.01	<0.01
Barium	N/A	N/A	0.4	0.4	0.2	N/A	2.0	2.2	2.6	0.10
Cadmium	N/A	N/A	<0.004	<0.004	<0.004	N/A	<0.004	<0.004	<0.004	<0.004
Chromium	N/A	N/A	<0.02	<0.02	<0.02	N/A	<0.02	<0.02	<0.02	<0.02
Copper	N/A	N/A	<0.02	<0.02	<0.02	N/A	<0.02	<0.02	<0.02	<0.02
Lead	N/A	N/A	<0.04	<0.04	<0.04	N/A	<0.04	<0.04	<0.04	<0.04
Mercury	N/A	N/A	<0.0002	<0.0002	<0.0002	N/A	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	N/A	N/A	<0.02	<0.02	<0.02	N/A	<0.02	<0.02	<0.03	<0.02
Selenium	N/A	N/A	<0.005	<0.005	<0.005	N/A	<0.005	<0.005	<0.005	<0.005
Silver	N/A	N/A	<0.01	<0.01	<0.01	N/A	<0.01	<0.01	<0.01	<0.01
Zinc	N/A	N/A	0.04	0.01	0.02	N/A	0.01	0.01	0.01	0.01
Water Level Elevations (Ft.)	533.46	545.01	544.30	545.03	524.70	620.26	688.74[2]	-	-	754.70

All results reported in mg/l unless stated otherwise.
N/A = Not Analyzed.
[1]Three separate analyses were analyzed for Well 8A.
[2]Well elevation taken from top of well cap.

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
JANUARY 1986 - SURFACE WATER

(Analyzed By YWC, Inc.)

Parameter	500' Upstream of Well 7 S-1	O&G Co. 100' South From Landfill Gate S-2	Iffland Pond S-3
Conductivity, umhos/cm	20	400	25
Total Dissolved Solids	23.5	433	34.6
Total Suspended Solids	1580	1.7	<1.0
Alkalinity as $CaCO_3$	10.4	265	10.4
BOD-20	19	35	3
COD	28.1	24.1	4.00
Ammonia-N	<0.4	5.30	<0.04
Nitrate-N	0.28	2.87	0.31
Chloride	82.39	93.5	4.78
Iron	<0.02	2.40	0.12
Manganese	<0.02	0.84	0.02
pH, S.U.	5.80	7.25	6.89

All results reported in mg/l unless stated otherwise.

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
APRIL 1986 - WELLS[1]

Parameter	Well 1A	Well 2	Well 3	Well 4	Well 5A	Well 7	Well 8A	Well 9
Conductivity, umhos/cm	450[3]	500	1,200	1,400	350	2,100	1,900	45
Total Dissolved Solids	481	385	963	1,090	339	1,520	1,250	37.8
Total Suspended Solids	10.5	104	47.8	15.3	8.1	249	121	132
Alkalinity as $CaCO_3$	269	229	688	748	229	1,020	1,100	5
BOD-20	10	10	55	16	8	76	34	<1
COD	27.2	35	63	77	26	219	193	9.43
Ammonia-N	1.50	0.18	21.0	27.5	5.44	108	61.7	<0.04
Nitrate-N	<0.10	<0.10	<0.10	<0.10	4.21	<0.10	<0.10	<0.10
Chloride	93.3	86.4	164	213	30.4	433	232	0.30
Iron	3.34	33.8	4.06	7.26	0.68	91.2	54.2	0.45
Manganese	3.16	0.45	3.38	5.96	1.60	3.36	1.14	0.02
pH, S.U.	7.00	6.92	6.89	6.81	6.58	6.70	6.61	5.95
Arsenic	N/A[2]	N/A	<0.01	0.03	<0.01	N/A	<0.01	<0.01
Barium	N/A	N/A	0.32	0.22	0.13	N/A	1.97	<0.01
Cadmium	N/A	N/A	<0.004	<0.004	<0.004	N/A	<0.004	<0.004
Chromium	N/A	N/A	<0.02	<0.02	<0.02	N/A	<0.02	<0.02
Copper	N/A	N/A	<0.02	<0.02	<0.02	N/A	<0.02	<0.02
Lead	N/A	N/A	<0.04	<0.04	<0.04	N/A	<0.04	<0.04
Mercury	N/A	N/A	<0.0002	<0.0002	<0.0002	N/A	<0.0002	<0.0002
Selenium	N/A	N/A	<0.005	<0.005	<0.005	N/A	<0.005	<0.005
Silver	N/A	N/A	<0.01	0.02	<0.01	N/A	<0.01	<0.01
Nickel	N/A	N/A	<0.02	<0.02	<0.02	N/A	<0.02	<0.02
Zinc	N/A	N/A	0.02	0.03	0.01	N/A	0.02	0.05
Water Level Elevations (Ft.)	533.33	544.84	544.84	545.69	525.45	620.71	688.904[4]	755.28

[1]All results reported in mg/l unless stated otherwise.
[2]N/A = Not Analyzed.
[3]pH and conductivity taken once in the field.
[4]Well elevation taken from top of well cap.

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
APRIL 1986 - SURFACE WATER

Parameter	500' Upstream of Well 7 S-1	O&G Co. 100' South From Gate S-2	Iffland Pond S-3
Conductivity, umhos/cm	20	190	45
Total Dissolved Solids	92.6	199	65.6
Total Suspended Solids	386	88.3	22.6
Alkalinity as $CaCO_3$	10	90	10
BOD-20	6	15	6
COD	19.2	15.6	17.3
Ammonia-N	<0.04	1.94	0.42
Nitrate-N	<0.10	0.94	0.10
Chloride	4.96	37.72	10.9
Iron	0.49	1.31	0.28
Manganese	<0.01	0.53	0.03
pH, S.U.	6.97	7.65	7.25

All results reported in mg/l unless stated otherwise.

CITY OF TORRINGTON
SEMI-ANNUAL MONITORING RESULTS
JULY 1986 - PRIVATE WELLS

Parameter	Lemanguais Company PW-1	United Construction & Engineers PW-2	Jamesion Mfg. PW-3	Agway, Inc. PW-5	J&M Sales PW-6	Albreada Refuse, Inc. PW-7	Torrington Scrap, Inc. PW-8	Ed's Auto Body PW-9	Blue Seal Feeds PW-10
Total Dissolved Solids	204	309	256	219	251	127	205	236	461
Total Suspended Solids	2.2	3.8	4.5	3.5	2.4	2.3	5.9	97.7	<1.0
Alkalinity as $CaCO_3$	72	25	35	95	105	55	125	115	90
Chloride	33.6	28.4	73.2	19.8	30.2	9.9	19.9	31.9	28.9
Chemical Oxygen Demand	<1.0	<1.0	11.6	<1.0	12.0	11.2	3.6	<1.0	<1.0
Iron	0.90	3.50	<0.04	0.04	0.03	0.07	1.92	0.25	0.13
Manganese	<0.01	0.07	<0.01	<0.01	0.03	<0.01	2.52	0.05	0.17
Ammonia-Nitrogen	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.28	<0.04	<0.04
Nitrate-Nitrogen	0.15	0.13	0.92	0.22	0.56	0.18	<0.10	<0.10	<0.10
pH	6.20	6.51	6.63	6.60	6.61	7.04	5.84	6.27	6.63

All results reported in mg/l.

CITY OF TORRINGTON
ANNUAL MONITORING RESULTS
VOLATILE PRIORITY POLLUTANTS
JULY 1986 - PRIVATE WELLS

Dilution Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	Lower Limit of Detectio With No Dilution[1]
Compound	PW-1	PW-2	PW-3	PW-5	PW-6	PW-7	PW-8	PW-9	PW-10	
chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
bromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
vinyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
acrolein	ND	ND	ND	ND	ND	ND	ND	ND	ND	100
acrylonitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	100
1,1-dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
1,1-dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
trans-1,2-dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	10	10
chloroform	ND	ND	ND	14	ND	ND	ND	ND	22	10
1,2-dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
1,1,1-trichloroethane	ND	ND	ND	27	ND	ND	ND	ND	ND	10
carbon tetrachloride	ND	ND	ND	ND	48	ND	ND	ND	ND	10
bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
2-chloroethylvinyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
1,2-dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
trans-1,3-dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
trichloroethylene	ND	ND	ND	ND	15	ND	ND	ND	ND	10
benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
cis-1,3-dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
1,1,2-trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
tetrachloroethylene	ND	ND	ND	ND	11	ND	ND	ND	ND	10
1,1,2,2-tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
ethyl benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10

All results reported in ug/l.
[1]Lower limits of detection are increased by the sample dilution factor.

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CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
JULY 1986 - WELLS

Parameter	Well 1A	Well 2	Well 3	Well 4	Well 5A	Well 7	Well 8A	Well 9
Conductivity, umhos/cm	850	675	3,750	4,500	600	6,500	3,250	50
Total Dissolved Solids	759	1,020	1,540	1,410	292	2,180	1,590	536
Total Suspended Solids	166	474	89.1	26.9	4.2	242	115	177
Alkalinity as $CaCO_3$	320	250	755	760	190	1,080	1,100	17
BOD-20	9	38	132	49	14	180	36	<1.0
COD	29.0	23.0	79.4	63.5	23.8	218	191	<1.0
Ammonia-N	1.53	0.35	35.7	29.0	6.48	52.4	106	<0.04
Nitrate-N	<0.10	<0.10	<0.10	<0.10	1.47	<0.10	<0.10	<0.10
Chloride	10.7	70.8	21	269	291	50.7	269	37.7
Iron	3.74	33.3	5.50	11.1	0.68	87.5	43.6	0.09
Manganese	3.36	0.48	7.10	7.90	1.88	3.50	2.20	<0.01
pH, S.U.	6.39	7.16	6.86	6.72	5.92	6.79	6.60	5.84
Arsenic	N/A	N/A	<0.010	<0.01	<0.01	N/A	<0.01	<0.01
Barium	N/A	N/A	0.22	0.19	<0.10	N/A	1.43	<0.10
Cadmium	N/A	N/A	0.006	<0.004	<0.004	N/A	<0.004	<0.004
Chromium	N/A	N/A	<0.02	<0.02	<0.02	N/A	<0.02	<0.02
Copper	N/A	N/A	<0.02	<0.02	<0.02	N/A	<0.02	<0.02
Lead	N/A	N/A	0.05	<0.04	<0.04	N/A	<0.04	<0.04
Mercury	N/A	N/A	<0.0002	<0.0002	<0.0002	N/A	<0.0002	<0.0002
Nickel	N/A	N/A	<0.02	<0.02	<0.02	N/A	0.04	<0.02
Selenium	N/A	N/A	<0.005	<0.005	<0.005	N/A	<0.005	<0.005
Silver	N/A	N/A	<0.01	<0.01	<0.01	N/A	<0.01	<0.01
Zinc	N/A	N/A	0.006	<0.004	0.01	N/A	0.02	<0.004
Water Level Elevations (Ft.)	532.29	543.74	543.92	544.57	523.11	619.86	686.41[1]	748.62

All results reported in mg/l unless stated otherwise.
N/A = Not Analyzed.
[1]Well elevation taken from top of well cap.

CITY OF TORRINGTON
ANNUAL MONITORING RESULTS
VOLATILE PRIORITY POLLUTANTS
JULY 1986 - WELLS AND SURFACE WATER

Dilution Factor	10.00	1.00	1.00	1.00	1.00	20.00	Lower Limits of Detection With No Dilution[1]
Compound	Well 1A	Well 2	Well 3	Well 4	Well 5A	Well 7	
chloromethane	ND	ND	ND	ND	ND	ND	10
bromomethane	ND	ND	ND	ND	ND	ND	10
vinyl chloride	96	140	ND	ND	ND	ND	10
chloroethane	200	38	160	190	81	940	10
methylene chloride	ND	ND	ND	ND	ND	ND	10
trichlorofluoromethane	ND	ND	ND	ND	ND	ND	10
acrolein	ND	ND	ND	ND	ND	ND	100
acrylonitrile	ND	ND	ND	ND	ND	ND	100
1,1-dichloroethene	ND	20	ND	ND	ND	ND	10
1,1-dichloroethane	ND	130	ND	ND	ND	ND	10
trans-1,2-dichloroethene	560	ND	ND	30	ND	ND	10
chloroform	ND	ND	ND	ND	ND	ND	10
1,2-dichloroethane	ND	ND	ND	ND	ND	ND	10
1,1,1-trichloroethane	ND	ND	ND	ND	ND	ND	10
carbon tetrachloride	ND	ND	ND	ND	ND	ND	10
bromodichloromethane	ND	ND	ND	ND	ND	ND	10
2-chloroethylvinyl ether	ND	ND	ND	ND	ND	ND	10
1,2-dichloropropane	ND	ND	ND	ND	ND	ND	10
trans-1,3-dichloropropene	ND	ND	ND	ND	ND	ND	10
trichloroethylene	ND	ND	ND	ND	ND	ND	10
benzene	ND	ND	ND	ND	ND	ND	10
cis-1,3-dichloropropene	ND	ND	ND	ND	ND	ND	10
dibromochloromethane	ND	ND	ND	ND	ND	ND	10
1,1,2-trichloroethane	ND	ND	ND	ND	ND	ND	10
bromoform	ND	ND	ND	ND	ND	ND	10
tetrachloroethylene	ND	ND	ND	ND	ND	ND	10
1,1,2,2-tetrachloroethane	ND	ND	ND	ND	ND	ND	10
toluene	ND	ND	ND	ND	ND	ND	10
chlorobenzene	ND	ND	ND	ND	ND	ND	10
ethyl benzene	ND	ND	ND	ND	ND	ND	10

All results are reported in ug/l.
[1]Lower limits of detection increased by dilution factor of the sample.

(Continued)
CITY OF TORRINGTON
ANNUAL MONITORING RESULTS
VOLATILE PRIORITY POLLUTANTS
JULY 1986 - WELLS AND SURFACE WATER

Dilution Factor	1.00	1.00	1.00	1.00	1.00	Lower Limits of Detection With No Dilution[1]
Compound	Well 8A	Well 9	S-1	S-2	S-3	
chloromethane	ND	ND	ND	ND	ND	10
bromomethane	ND	ND	ND	ND	ND	10
vinyl chloride	ND	ND	ND	17	ND	10
chloroethane	ND	ND	ND	49	ND	10
methylene chloride	ND	ND	ND	ND	ND	10
trichlorofluoromethane	ND	ND	ND	ND	ND	10
acrolein	ND	ND	ND	ND	ND	100
acrylonitrile	ND	ND	ND	ND	ND	100
1,1-dichloroethene	ND	ND	ND	ND	ND	10
1,1-dichloroethane	ND	ND	ND	ND	ND	10
trans-1,2-dichloroethene	ND	ND	ND	20	ND	10
chloroform	ND	ND	ND	ND	ND	10
1,2-dichloroethane	ND	ND	ND	ND	ND	10
1,1,1-trichloroethane	ND	ND	ND	ND	ND	10
carbon tetrachloride	ND	ND	ND	ND	ND	10
bromodichloromethane	ND	ND	ND	ND	ND	10
2-chloroethylvinyl ether	ND	ND	ND	ND	ND	10
1,2-dichloropropane	ND	ND	ND	ND	ND	10
trans-1,3-dichloropropene	ND	ND	ND	ND	ND	10
trichloroethylene	ND	ND	ND	ND	ND	10
benzene	ND	ND	ND	ND	ND	10
cis-1,3-dichloropropene	ND	ND	ND	ND	ND	10
dibromochloromethane	ND	ND	ND	ND	ND	10
1,1,2-trichloroethane	ND	ND	ND	ND	ND	10
bromoform	ND	ND	ND	ND	ND	10
tetrachloroethylene	ND	ND	ND	ND	ND	10
1,1,2,2-tetrachloroethane	ND	ND	ND	ND	ND	10
toluene	ND	ND	ND	ND	ND	10
chlorobenzene	ND	ND	ND	ND	ND	10
ethyl benzene	ND	ND	ND	ND	ND	10

All results are reported in ug/l.
[1]Lower limits of detection increased by dilution factor of the sample.

CITY OF TORRINGTON
QUARTERLY MONITORING RESULTS
JULY 1986 - SURFACE WATER

Parameter	500' Upstream of Well 7 S-1	O&G Co. 100' South From Landfill Gate S-2	Iffland Pond S-3
Conductivity, umhos/cm	80	7,250	110
Total Dissolved Solids	64.2	1,350	74.8
Total Suspended Solids	2.9	21.9	3.0
Alkalinity as $CaCO_3$	51	730	36
BOD-20	<1.0	155	2
COD	<1.0	55.6	9.12
Ammonia-N	0.91	21.9	<0.04
Nitrate-N	<0.10	2.35	<0.10
Chloride	3.77	243	12.2
Iron	0.15	1.39	0.24
Manganese	0.05	2.58	0.02
pH, S.U.	6.90	7.79	8.50

All results reported in mg/l unless stated otherwise.

CITY OF TORRINGTON
FOURTH QUARTER MONITORING RESULTS
OCTOBER 9, 1986 - LANDFILL WELLS

Parameter	Well 1A	Well 2	Well 3	Well 4	Well 5A	Well 7	Well 8A	Well 9	EPA Drinking Water Standards (mg/l)
Conductivity, umhos/cm	950	675	2,600	2,500	800	3,400	2,400	50	--
Total Dissolved Solids	562	39.3	1,450	1,500	432	1,830	1,130	33.4	--
Total Suspended Solids	34.2	201	149	65.0	30.8	270	233	198	--
Alkalinity as $CaCO_3$	330	220	820	800	270	1,160	910	15	--
BOD-20	29	19	207	94	7	74	204	7	--
COD	20.4	21.3	101	94.8	26	225	162	7.6	--
Ammonia-N	1.77	0.44	30.0	32.3	11.6	64.4	67.1	0.07	--
Nitrate-N	<0.10	3.21	2.02	4.23	2.63	<0.10	0.66	0.93	--
Chloride	112	89.8	314	304	89.8	487	180	6.30	--
Iron	2.63	34.8	3.93	9.98	2.96	0.48	38.9	0.14	--
Manganese	3.26	0.43	2.83	6.20	4.30	0.50	1.21	<0.01	--
pH, S.U.	6.55	6.95	6.88	6.89	6.77	6.96	6.51	6.45	--
Arsenic	NA	NA	<0.010	0.023	<0.010	NA	<0.010	<0.010	0.05
Barium	NA	NA	<0.20	0.25	<0.10	NA	1.29	<0.20	1.0
Cadmium	NA	NA	<0.005	<0.005	<0.005	NA	<0.005	<0.005	0.01
Chromium	NA	NA	<0.01	<0.01	<0.01	NA	<0.01	0.01	0.05
Copper	NA	NA	<0.02	<0.02	<0.02	NA	<0.02	<0.02	--
Lead	NA	NA	<0.05	<0.05	<0.05	NA	<0.05	<0.05	0.05
Mercury	NA	NA	<0.002	<0.002	<0.002	NA	<0.002	<0.002	0.002
Nickel	NA	NA	<0.04	0.04	<0.04	NA	<0.04	<0.04	--
Selenium	NA	NA	<0.005	<0.005	<0.005	NA	<0.005	<0.005	0.01
Silver	NA	NA	<0.01	<0.01	<0.01	NA	<0.01	<0.01	0.05
Water Level Elevation (MSL)	532.98	543.92	543.86	544.19	522.11	619.61	685.11	752.30	--
Top of PVC Elevation (MSL)	544.33	549.09	548.59	548.86	535.03	632.13	704.32	759.53	--

All results reported in mg/l unless stated otherwise.
N/A = Not Analyzed

CITY OF TORRINGTON
FOURTH QUARTER MONITORING RESULTS
OCTOBER 9, 1986 - SURFACE WATER

Parameter	500' Upstream of Well 7 S-1	O&G Co. 100' South From Landfill Gate S-2	Iffland Pond S-3
Conductivity, umhos/cm	75	1,750	110
Total Dissolved Solids	54.6	1,040	64.8
Total Suspended Solids	23.0	30.2	20.0
Alkalinity as $CaCO_3$	15	600	20
BOD-20	23	61	8
COD	<1.0	46.8	13.4
Ammonia-N	0.17	16.1	0.15
Nitrate-N	<0.10	5.11	<0.10
Chloride	6.7	206	13.8
Iron	0.15	1.78	0.27
Manganese	0.01	1.46	0.04
pH, S.U.	6.87	7.10	7.06

All results reported in mg/l unless stated otherwise.

SUMMARY OF
GROUNDWATER ELEVATIONS

(Analyzed By YWC, Inc.)

Well No.	5/3/84	6/12/84	7/26/84	10/9/84	2/85	5/85	7/85	10/85	1/86	4/86
1	531.33	532.73	532.43	531.33	*	*	*	*	*	*
1A	+	+	+	+	533.13	533.18	532.66	533.46	533.46	533.33
2	-	545.49	544.39	542.49	544.46	544.79	544.09	545.26	545.01	544.84
3	-	545.39	544.69	542.89	543.25	544.06	543.30	544.61	544.30	544.84
4	-	545.86	544.36	543.16	543.33	544.73	543.74	544.38	545.03	545.69
5	527.03	526.53	523.33	523.03	522.49	**	**	**	**	**
5A	+	+	+	+	+	524.93	523.41	523.70	524.70	525.45
6	527.41	526.91	**	**	**	**	**	**	**	**
7	-	621.13	620.42	618.93	619.84	620.38	619.88	620.76	620.76	620.71
8	*	*	*	*	*	**	**	**	**	**
8A	+	+	+	+	695.97	696.00	695.47	696.22	NA	688.65
9							752.28	NA	754.70	755.28

* Dry
+ Not installed on date of sampling
**Vandalized - No longer usable
* Well elevation data not available

APPENDIX E
PROPOSED
40 CFR 264 - APPENDIX IX
LIST OF ANALYTICAL PARAMETERS

TABLE 1

PROPOSED GROUND-WATER MONITORING ANALYSIS LIST

- Acenaphthalene
- Acenaphthene
- Acetone[1]
- Acetonitrile[2]
- Acetophenone
- 2-Acetylaminofluorene[2]
- Acrolein
- Acrylonitrile
- Aldrin
- Allyl alcohol[2]
- Aluminum (total)[1]
- 4-Aminobiphenyl
- Aniline[2]
- Anthracene
- Antimony (total)
- Aramite
- Aroclor 1016
- Aroclor 1221
- Aroclor 1232
- Aroclor 1242
- Aroclor 1248
- Aroclor 1254
- Aroclor 1260
- Arsenic (total)
- alpha-BHC
- beta-BHC
- delta-BHC
- gamma-BHC
- Barium (total)
- Benz[a]anthracene
- Benzene
- Benzenethiol[2]
- Benzidine[2]
- Benzo[b]fluoranthene
- Benzo[k]fluoranthene
- Benzo[g,h,i]perylene
- Benzo[a]pyrene
- Benzoic acid[1]
- p-Benzoquinone[2]
- Benzyl alchohol[1]
- Beryllium (total)
- Bis(2-chloroethoxy) methane
- Bis(2-chloroethyl) ether
- Bis(2-chloroisopropyl) ether
- Bis(2-ethylhexyl) phthalate
- Bromodichloromethane
- Bromomethane
- 4-Bromophenyl phenyl ether
- Butyl benzyl phthalate
- 2-sec-Butyl-4,6-dinitrophenol[2]
- Cadmium (total)
- Calcium (total)[1]
- Carbon disulfide
- Carbon tetrachloride
- Chlordane
- Chloroethane
- p-Chloroaniline
- Chlorobenzene
- Chlorobenzilate
- 2-Chloro-1,3-butadiene[2]
- p-Chloro-m-cresol
- Chlorodibromomethane
- 2-Chloroethyl vinyl ether
- Chloroform
- Chloromethane
- 2-Chloronaphthalene
- 2-Chlorophenol
- 4-Chlorophenyl phenyl ether[1]
- 3-Chloropropene[2]
- 3-Chloropropionitrile[2]
- Chromium (total)
- Chrysene
- Cobalt (total)[1]
- Copper (total)
- o-Cresol
- p-Cresol
- Cyanide
- DDD
- DDE
- DDT
- Dibenz[a,h]anthracene
- Dibenzo[a,e]pyrene[2]
- Dibenzo[a,h]pyrene[2]
- Dibenzo[a,i]pyrene[2]
- Dibenzofuran[1]
- 1,2-Dibromo-3-chloropropane
- 1,2-Dibromoethane
- Dibromomethane[2]
- Di-n-butyl phthalate
- o-Dichlorobenzene
- m-Dichlorobenzene
- p-Dichlorobenzene
- 3,3'-Dichlorobenzidine
- t-1,4-Dichloro-2-butene
- Dichlorodifluoromethane[2]
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- t-1,2-Dichloroethene
- 1,1-Dichloroethylene
- Dichloromethane
- 2,4-Dichlorophenol
- 2,6-Dichlorophenol
- 2,4-Dichlorophenoxyacetic acid[2]
- 1,2-Dichloropropane
- cis-1,3-Dichloropropene
- t-1,3-Dichloropropene
- Dieldrin
- Diethyl phthalate
- O,O-Diethyl O-2-pyrazinyl phosphorothioate
- 3,3'-Dimethoxybenzidine
- p-Dimethylaminoazobenzene
- 7,12-Dimethylbenz[a]anthracene
- 3,3'-Dimethylbenzidine
- alpha,alpha-Dimethylphenethylamine[2]
- 2,4-Dimethylphenol
- Dimethyl phthalate
- m-Dinitrobenzene
- 4,6-Dinitro-o-cresol
- 2,4-Dinitrophenol
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- Di-n-octyl phthalate
- 1,4-Dioxane[2]
- Diphenylamine[2]
- 1,2-Diphenylhydrazine
- Di-n-propylnitrosamine
- Disulfoton
- Endosulfan I
- Endosulfan II
- Endrin
- Endrin aldehyde
- Ethyl benzene[1]
- Ethyl cyanide[2]
- Ethylene oxide[2]
- Ethyl methacrylate
- Famphur
- Fluoranthene
- Fluorene
- Fluoride
- Heptachlor
- Heptachlor epoxide
- Hexachlorobenzene
- Hexachlorobutadiene
- Hexachlorocyclopentadiene
- Hexachlorodibenzo-p-dioxins
- Hexachlorodibenzofurans
- Hexachloroethane
- Hexachlorophene[2]
- Hexachloropropene
- 2-Hexanone[1]
- Indeno[1,2,3-cd]pyrene
- Iodomethane[2]
- Iron (total)[1]
- Isobutyl alcohol[2]
- Isodrin[2]
- Isophorone[1]
- Isosafrole[2]
- Kepone[2]
- Lead (total)
- Magnesium (total)[1]
- Malononitrile[2]
- Manganese (total)[1]
- Mercury (total)
- Methacrylonitrile[2]
- Methapyrilene
- Methoxychlor
- 3-Methylcholanthrene

TABLE 1--Continued

PROPOSED GROUND-WATER MONITORING ANALYSIS LIST

- 4,4'Methylenebis(2-chloroaniline)
- Methyl ethyl ketone
- Methyl methacrylate[2]
- Methyl methanesulfonate
- 2-Methylnaphthalene[1]
- Methyl parathion
- 4-Methyl-2-pentanone[1]
- Naphthalene
- 1,4-Naphthoquinone
- 1-Naphthylamine
- 2-Naphthylamine
- Nickel (total)
- 2-Nitroaniline[1]
- 3-Nitroaniline[1]
- p-Nitroaniline
- Nitrobenzene
- 2-Nitrophenol[1]
- 4-Nitrophenol
- N-Nitrosodimethylamine[2]
- N-Nitrosodi-n-butylamine
- N-Nitrosodiethylamine
- N-Nitrosodiphenylamine
- N-Nitrosomethylethylamine[2]
- N-Nitrosomorpholine
- N-Nitrosopiperidine
- N-Nitrosopyrrolidine
- 5-Nitro-o-toluidine
- Osmium (total)
- Parathion
- Pentachlorobenzene
- Pentachlorodibenzo-p-dioxins
- Pentachlorodibenzofurans
- Pentachloroethane
- Pentachloronitrobenzene
- Pentachlorophenol
- Phenacetin
- Phenanthrene
- Phenol
- Phorate
- 2-Picoline[2]
- Potassium (total)[1]
- Pronamide
- 2-Propyn-1-ol[2]
- Pyridine
- Pyrene
- Resorcinol[2]
- Safrole
- Selenium (total)
- Silver (total)
- Silvex
- Sodium (total)[1]
- Styrene[1]
- Sulfide
- 2,4,5-T
- 1,2,4,5-Tetrachlorobenzene
- 2,3,7,8-Tetrachlorodibenzo-p-dioxin
- Tetrachlorodibenzo-p-dioxins
- Tetrachlorodibenzofurans
- 1,1,1,2-Tetrachloroethane
- 1,1,2,2-Tetrachloroethane
- Tetrachloroethene
- 2,3,4,6-Tetrachlorophenol
- Tetraethyldithiopyrophosphate[2]
- Thallium (total)
- Tin (total)[1]
- Toluene
- Toxaphene
- Tribromomethane
- 1,2,4-Trichlorobenzene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- Trichloroethene
- Trichloromethanethiol
- Trichloromonofluoromethane
- 2,4,5-Trichlorophenol
- 2,4,6-Trichlorophenol
- 1,2,3-Trichloropropane
- Tris(2,3-dibromopropyl)phosphate[2]
- Vanadium (total)
- Vinyl acetate[1]
- Vinyl chloride
- Xylene (total)[1]
- Zinc (total)

[1]Chemicals that are not listed in Appendix VIII, but that are commonly found at Superfund sites.

[2]EPA is requesting comments on the analytical feasibility of these chemicals.

Source: EPA.

ter, Appendix VIII ionic compounds were replaced with individual ions or elements. Compounds that decompose in water within two days were excluded.

- Organometallic compounds were deleted; EPA standard test methods do not accurately analyze them.

- Constituents that do not have commercially available standards were excluded.

- Appendix VIII constituents were segregated into categories, and one or more representative chemicals were selected from each.

COMMENTS REQUESTED

EPA is requesting comments on the analytical feasibility of several chemicals for which it has received conflicting data. Most of these chemicals have been included in the ground-water monitoring list and they are identified in Table 1.

The chemicals that have been excluded from the list, but which are being considered for inclusion, if additional information shows that they can be accurately analyzed, are listed below.

- m-Cresol
- Crotonaldehyde
- 1,3-Dichloro-2-propanol
- Dimethoate
- Diallate
- Endosulfan sulfate
- Endrin ketone
- Paraldehyde
- Strontium (total)
- o-Toluidine

All comments must be submitted by September 22, 1986.

APPENDIX F
YWC ANALYTICAL
LABORATORY QA/QC

1.0 INTRODUCTION

Our business as an environmental consulting laboratory involves providing qualitative and quantitative data to a variety of clients who utilize this information for decision making. To be valuable, the data must accurately describe the characteristics and concentrations of constituents in the samples submitted. These data may impact significantly on process, legal and cost decisions, and therefore must be able to stand on its own merit from a QA/QC standpoint.

The following Standard Operating Procedures were prepared by laboratory management and address the following key items:

- Personnel Responsibilities for Implementation of the Standard Operating Procedures:

  a. Vice President/Division Project Manager
  b. Chief Chemist/Quality Assurance Control Coordinator
  c. Laboratory Manager//Sample/Analysis Coordinator
  d. Sample Custodian

- Chain of Custody Procedures:

  a. Sample Receipt, Handling, Storage and Control
  b. Security, Chain-of-Custody, and Document Control

- General Laboratory Operations:

  a. Sample Integrity
  b. Glassware Preparation
  c. Reagents
  d. Calibration Standards
  e. Sample Considerations
  f. Workplace Atmosphere
  g. Cross-Contamination Considerations
  h. Instrumentation/Maintenance Logs
  i. Sample Preparation Log
  j. Personal Notebooks
  k. Reporting Results
  l. Data Handling Procedure
  m. Preventive Maintenance

n. Analyst Certification
o. Quality Control Samples
p. Method Validation
q. Corrective Action
r. Client Interface
s. Waste Handling/Disposal Procedures
t. Laboratory Safety
u. Technical Procedure Revision

- Specific Laboratory Techniques (Instrumental):

  a. Gas Chromatography/Mass Spectrometry
  b. Gas Chromatography
  c. Atomic Absorption Spectrophotometry/ICP
  d. Total Organic Carbon Analysis
  e. pH Measurement
  f. Conductivity
  g. UV-Vis Spectrophotometry
  h. Bomb Calorimetry
  i. Elemental Analysis (C,H,N)
  j. Infrared Spectrophotometry
  k. Analytical Balances

The analytical methods used in our laboratory conform to the following criteria:

- The selected methods should measure the desired constituents of the samples in the presence of normal interferences with sufficient accuracy and precision to meet the client's needs.

- The selected procedures should utilize the skills and equipment we possess.

- The selected methods have been sufficiently tested to have established their validity.

- The methods are practical and sufficiently rapid to permit routine use if required.

- The methods are theoretically sound, all factors considered, and can be practically applied to various sample types and are referenced in the available literature.

On a routine basis, most of our analytical work is described in the following documents:

1. Standard Methods for the Examination of Water and Wastewater (USPHS), 15th Edition, 1980.

2. "Chemical Analysis of Water and Wastes" (EPA-600/4-79-020, 1979) and updates.

3. "Chemical Analyses of Bottom Sediments and Elutriation Testing" (EPA).

4. "The Federal Register".

5. "Analysis of Pesticides in Human and Environmental Samples" (EPA).

6. American Society for Testing and Materials (ASTM) Methods.

7. American Society of Mechanical Engineers (ASME) Power Test Codes.

8. Association of Offical Analytical Chemists (AOAC) Methods.

9. Scott's Standard Methods for Chemical Analysis.

10. United States Pharmacopeiea Methods Manual.

11. Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057, July, 1982 and updates.

12. Test Methods for Evaluating Solid Waste, U.S. EPA SW-846 and SW-846B, 1980 and updates.

13. Procedures for Handling and Chemical Analysis of Sediment and Water Samples, EPA/CE-81-1, May, 1981.

14. "Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration", 7/85 Revision, IFB WA 85-J176, 177, and 178.

The specific QA/QC references utilized by the laboratory and which were used as a basis for this program are listed as follows:

- <u>Handbook for Analytical Quality Control in Water and Wastewater Laboratories</u>, EPA 600/4-79-019, March, 1979.

- <u>Manual of Analytical Quality Control for Pesticides in Human and Environmental Media</u>, EPA 600/1-76-017, February, 1976.

- <u>Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater</u>, EPA-600/4-82-057, July 1982.

- IFB WA85-J176, 177, 178, "Statement of Work for Organics analysis, Multi-Media, Multi-Concentration," 7/85 Revision, U.S. EPA.

2.0 PERSONNEL RESPONSIBILITIES

Independent of the magnitude of a project, a team is designated to address the proper performance of QA/QC. Generally this team is comprised of four individuals who share the various related duties. In the York organization the individuals (by job title) and their resoective QA/QC roles are noted in the following table.

Table 1
QA/QC Role Delineations

Title	QA/QC Role
Vice President, Laboratory Director	Division Project Manager
Chief Chemist	Quality Control/Assurance Coordinator
Laboratory Manager	Sample/Analysis Coordinator
Sample Custodian	Receipt, Log-In, Custody of Samples.

The specific duties of each individual of the QA/QC team are described in the following paragraphs.

Laboratory Division Project Manager (P.M.)/Vice President

The responsibility of the Division Vice President/P.M. is to control and assure the quality of all Laboratory data generated. Specific duties to comply with these responsibilities include:

- Preparation of project specific work plan which includes analytical and QA/QC Methods to be utilized.
- Direct and coordinate with the Chief Chemist//QA/QC Coordinator on work plan implementation.
- Coordinate with and direct the Laboratory Manager/Analysis Coordinator regarding logistics such as personnel, instrumentation and supplies for scheduling purposes and that properly trained personnel are available, and that analyses or sample extractions are performed in accordance with holding time and contract stipulated turn-around-times.

- Coordinate with and direct the Sample Custodian to ensure sample integrity considerations to include chain-of-custody, sample log-in, tracking of samples through analyses, receipt of all data and presentation of data to the Chief Chemist/QA-QC coordinator for result verification.

- Develop external QA monitoring protocol through the use of "blind" samples prepared by the U.S. EPA for water/wastewater and hazardous waste analysis.

<u>Chief Chemist/QA/QC Coordinator</u>

The QA/QC Coordinator's responsibilities include implementation, enforcement and monitoring of all QA/QC procedures. In addition, the following duties are also the responsibility of the QA/QC Coordinator.

- Coordinate with the P.M. in the development of the QA work plan including numbers and types of blanks, spikes, replicates.

- Certify that each analyst is thoroughly trained and "checked out" on applicable procedures.

- Maintain and inspect instrumentation logs to include calibration and performance records.

- Review QC data to verify analyses results are within acceptable limits; construct and maintain control charts for each parameter to monitor system problems.

- Coordinate with the sampling personnel or Engineering Project Manager to determine the appropriate sampling equipment and containers.

- Ensure that all sample containers destined for project use are prepared for sampling to eliminate contamination.

- Prepare field spikes, blanks, duplicates and QC spikes (in-house) as called for in the work program.

- Assess final data for presentation clarity, consistency, and completeness.

Laboratory Manager-Sample Analysis Coordinator

The Sample Analysis Coordinator has full charge of the Laboratory operation regarding sample preparation/analysis logistics and has the following related responsibilities.

- Coordinate with the Division P.M. and QA/QC Coordinator regarding the Analytical plan and ensure that all QC measures are executed.

- Assign all work to Laboratory staff.

- Ensure that all chemists and technicians assigned to the project are properly trained as evidenced through performance checks.

- Follow sample traffic and prepare weekly status reports (CLP), or contact clients with status as required.

- Verify that procedural consideratons as outlined in the specific work program are met (i.e.: GC/MS conditions, etc.).

- Follow-up procedural verification through the program to ensure that initial compliance with work program elements is carried through.

- Ensure that sample holding times are met and contract required deliverables are achieved.

Sample Custodian

The Laboratory Sample Custodian is responsible for sample receipt, chain-of-custody compliance, and sample storage/disposal. The specific duties of this position are as follows:

- The Sample Custodian examines the shipping container (when applicable) and records the following information in a logbook or on an appropriate form. (sample attached, Figure 1, one case per form(s)):

  - Presence/absence of custody seal(s) on the shipping container(s);

  - Condition of custody seal (i.e. intact, broken).

- The Sample Custodian opens the shipping container, removes the enclosed sample documents and records the sample control record form:

  - Presence/absence of the chain-of-custody record(s);

  - Presence/absence of SMO form (Traffic Reports, Chronicles);

  - Presence/absence of airbills and/or bills of lading documenting shipment of samples.

- Removes sample containers and record the following on the sample control form:

  - Condition of samples (intact, broken, leaking, etc.);

  - Presence/absence of samples tags;

    If sample tags are present:

  - Record sample tag document control numbers;

  - Compare with chain-of-custody record(s) - if tag numbers are listed, do they match the sample tag numbers received?

    1. Document both the fact that these numbers agree, or if there is a discrepancy between tag numbers received and those listed on the chain-of-custody record;

2. If sample tag numbers are not listed on the chain-of-custody records, record this fact.

- Compare the following documents to verify agreement among the information contained on them:

  - Chain-of-Custody Records;
  - Sample Tags;
  - Sample Management Office (SMO forms (CLP);
  - Airbills or bills of lading.

- Document both agreements among the forms and any discrepancies found. If discrepancies are found, the client or SMO (CLP) is contacted for clarification and notify appropriate laboratory personnel.

- If all samples recorded on the chain-of-custody record were received by the lab and there are no problems observed with the sample shipment, the sample custodian will sign the field chain-of-custody record in the "received for laboratory by" box on the document.

- If problems are noted, sign for shipment and note problems in the section on the lab custody sheet for remarks or reference to other form detailing the problems.

- Ensure that client or protocol dictated sample storage times are met. Where applicable, ensure that proper disposal of samples is performed, including drum or lab-pack storage for disposal by a licensed commercial disposal firm.

3.0 CHAIN-OF-CUSTODY PROCEDURES

3.1 Sample Receipt, Handling, Storage and Control

Upon receipt of samples at York Laboratories, the receptionist immediately notifies the Sample Custodian. The samples and associated documentation are immediately transferred to the sample receiving/log-in room where log-in is initiated by the Sample Custodian.

The log-in procedure is as follows:

Referring to Figure 3.1, the sample label center strip is filled in with the appropriate sample description then affixed to the Laboratory Services Request Sheet (See Figure 3.2). The Sample Custodian then assigns the York job number (3 0 x x x x x), client name, other data, and storage location(s) which are entered on the label. For EPA organic CLP samples two refrigerators are dedicated, one for VOA samples, the other for extractables work-in-progress. The respective freezers of these refrigerators are exclusively for extract storage until analysis and subsequent archiving. The top portion of the label is affixed to one bottle of the sample, while the bottom labels are used for other portions of the same sample (e.g. B/N/A's, VOA vials, Pesticide/PCB's). The sample seal is used by field staff when performing actual sampling.

The Sample Custodian then places the samples in the proper storage locations (e.g. refrigerators for organic samples). The sample control record (Laboratory Custody Chronicle) is then properly filled in and all documentation is placed in the case (job) files. The EPA CLP case files are kept in a separate lockable file cabinet throughout the work-in-progress stages and for final archiving.

All samples are stored in the Sample Receiving Room under the direct control of the Sample Custodian.

YORK LABORATORIES DIV. YWC, INC.

JOB NUMBER | CLIENT

2382

SAMPLE NUMBER | DATE

1 2 3 4 5 6 7 8 9 10 11 12 13 14

STORAGE LOCATION(S)

SAMPLE DESCRIPTION

2382

SAMPLE DESCRIPTION

YWC SAMPLE SEAL

2382 2382 2382 2382 2382 2382 2382 2382 2382

FIGURE 3.1

YORK
Laboratories
Division of Y.W.C., Inc.

LABORATORY SERVICES REQUEST

Client: ____________________ Job No. ____________

Logged by: ________________________________

Quote: $________________________________

Received by: ____________________ Date: ____________

Sample Identification	Parameters to be Determined

FIGURE 3.2

Special Instructions:

Sample Disposition ____________

Finalization of the log-in procedure involves input of the job (case) number, client, date received, date due, and parameters to determine into York's sample tracking system. The computer program allows Laboratory Management to assign work and to track the status of any project with respect to due date, parameters, and the like.

3.2 Security, Chain-of-Custody and Document Control

The security of samples at York is under the control of the Sample Custodian. All samples are stored in a controlled access area (sampling receiving room). This room is a secure area under lock and key before and after business hours, and under Sample Custodian (or designate) scrutiny during business hours.

Access to the laboratory is through a monitored reception area. Other access doors to the laboratory are kept locked.

All visitors sign in at the reception area and are escorted at all times.

Any transfer of samples into and out-of-storage is documented on the project (case) sample control record (See Figure 3.3) which is maintained by the Sample Custodian.

Personnel involved in analysis or preparation of the samples are responsible for sample custody until samples are returned to the secure area (by the end of the work day, ideally, subsequent to use).

The chain-of-custody is initiated by the Sample Custodian log-in procedure. The samples are stored in the sample receiving room (secure area). Each analyst transferring samples from and back to storage records such transfer on the case (job) sample control record.

Document Control at York is an assurance to the client that all the documents for a particular project (case) are orderly and complete at project completion.

YORK LABORATORIES DIVISION

YWC

SAMPLE CONTROL RECORD

Laboratory Custody Chronicle

Date: ______
Sample Custodian Signature ______
Document Control # ______
Case Number ______
Airbill Number ______

1. Custody Seal — present/absent; intact/not intact
2. Chain-of-Custody — present/absent
3. Sample Tags — present/absent; listed/not listed on chain-of-custody
4. SMO Forms — present/absent

LABORATORY SAMPLE NUMBER	REMOVED BY	DATE AND TIME REMOVED	REASON	DATE AND TIME RETURNED

REMARKS

The following procedures are utilized for document control:

- Any results, sample weight, observations, or other pertinent data not entered on preprinted data sheets are entered into bound, permanent laboratory notebooks. Each analyst is supplied his or her own notebook which never leaves the building.

  All notebook data recorded and referenced with the following items at the top of the page:

  - Project (case) Number
  - Date
  - Analyst Signature

  Only one project (or case) is allowed per notebook page for EPA CLP cases.

  When data from a project (case) is compiled, copies of all notebook entries are included.

  All entries to notebooks are made in ink. Corrections are made by drawing a line through the error and entering the correct information.

  Other corrections to non-personal notebooks are made in the sample fashion, but are dated and initialed.

- Each item comprising the data and other documentation is inventoried and each item in a case is assigned a serialized number.

The document control procedure for each project (case) is as follows:

1. Organization and assembly of all documents relating to each project are implemented by the Sample Custodian (or designated person).

2. The following is utilized and ensures that all documents are compiled in one location for submission to

EPA, in single project/case files arranged by sample number.

Prepare Case File Folders:

a. Using appropriate file folders, assign one folder to each project according to York Labs project number (or SMO case number for EPA).

b. Place all documents, sample tags, SMO forms, and laboratory generated data pertaining to one case in the folder.

c. Documents should be arranged by document type within the project folders i.e., all sample tags together, all Traffic reports together, all hard-copy Mass Spectra together, etc.

d. These document case files will be filed in one location and stored in lockable file cabinets.

3. Assignment of accountable numbers to laboratory-generated data:

a. Each document of a case is inventoried and assigned a serialized number (an identifier) associating it with a particular project.

b. All documents pertaining to each case including, but not limited to, the following are numbered and inventoried:

1. Sample traffic records, weekly reports;
2. Custody records, sample tags, airbills, internal custody records;
3. Laboratory logbooks, personal logbooks, instrument logbooks, benchsheets;
4. Laboratory data (sorted by sample), calibration and quality control results;
5. Data summaries and reports;
6. All other documents, forms, or records referencing the samples.

4. Preparation of a document inventory:

   a. A document inventory list provides a record of all documents and their corresponding document numbers, that are included in the completed case file.

   b. A separate document inventory list is prepared for each case.

The flow of data and control of all project documents follows a predetermined regimen described as follows:

- Sample Custodian initiates project log-in and prepares master project (case) file containing all pertinent documentation;

- Analysis is assigned by Laboratory Manager;

- Subsequent to analysis, each analyst places raw data, notebook copies, and any preprinted data sheets into the project file;

- Laboratory Manager reviews file for completeness and forwards to Group Leaders for QA/QC review of respective areas or responsibility and then to QA/QC Coordinator for final review;

- Approved data is then given to the Laboratory Manager for report package preparation;

- Finalized draft of data/report package is reviewed by the Division Vice President;

- Clerical interaction for final type, copying, and archiving in file cabinets.

4.0 GENERAL LABORATORY OPERATIONS

Integral to successful QA/QC is good laboratory technique. In turn, good technique is strongly rooted in the preliminary steps of preparation for analysis. Sample integrity, glassware preparation, reagent preparation, sample considerations, instrument maintenance, and results reporting are all prerequisite parameters for proper QA/QC.

4.1 Sample Integrity

The worth of an analytical result to a client is directly related to the confidence one has in the sample itself regarding representativeness, changes due to volatilization, instability, photodecomposition, etc. To minimize these stability concerns, samples should be preserved, where appicable, utilizing standard techniques. In any case, if unstable materials are suspected, refrigeration, deep-freezing or other techniques are to be applied.

Regarding representativeness, it is our duty as a consulting laboratory to be sure the samples are representative enough for regulatory scrutiny, client considerations or other applications. In cases where clients provide samples to us, we must consult with the client regarding his satisfaction that the samples we are analyzing are representative for his ultimate use of the data generated.

4.2 Glassware Preparation

One of the most critical preliminary aspects of a laboratory analysis is the cleaning of glassware to help eliminate artifacts. A few basic principles should be borne in mind when cleaning glassware.

Initially all glassware should be rinsed with water, or appropriate solvent and placed on a dirty glassware cart. Most glassware can be cleaned with warm soapy water. Markings can easily be removed by scrubbing. After cleaning in soap, the glassware should be rinsed with tap water, then twice with laboratory distilled/deionized water.

This procedure will suffice for most of the routine glassware used in the laboratory.

Glassware for metal analyses, including related volumetric glassware, should be rinsed with 1+1 acid (hydrochloric or nitric) followed by rinsing with laboratory water prior to use. This will suffice for all metal analyses except mercury.

Glassware for mercury must be doubly rinsed in 1+1 nitric acid followed by triplicate rinsing with laboratory water. This includes <u>all glassware used in the digestion and analysis</u>.

Certain other types of analyses require special glassware cleaning. Glassware used for pesticide or PCB analysis must be rinsed with nanograde solvent (toluene or hexane) prior to use. Muffling at 400°C is also an acceptable technique, but sometimes impractical considering the size of the glassware used.

Glassware for volatile organic analyses should be rinsed with methanol and then dried at 200°C for at least 30 minutes in the oven specifically designated for this operation.

Keep in mind that the purpose of cleaning glassware is to eliminate a source of error in <u>your</u> analysis and hence is an important aspect of the analysis worth the time and effort.

4.3 Reagents

The use of proper reagents is critical to attaining good results. If materials of questionable quality are used, quality data is compromised. All chemicals utilized in the laboratory are of analytical reagent grade quality, pesticide quality, or chromotographic grade quality as dictated by its intended use. On receipt, all chemicals are dated and initialed by the receiving individual. All standards for GC and GC/MS use are dated, initialed, and vendor and log number are recorded in the commercially purchased standards log book.

Most indicators do not require exact weights or volumes. (Exceptions are redox indicators like ferroin used in the COD analysis). Whenever a direction states so many grams per liter can also be made up using the graduations on a beaker or directly in the appropriate container, do not waste time using volumetric glassware for these types of solutions.

All reagents should be stored in an appropriate container, not a volumetric flask. The container should be well marked with the reagent name, concentration, initials of whoever made it up, and the date.

Base/Neutral Extractable, GC/MS, and GC standards should be stored in silanized teflon lined amber vials. Volatiles standard should be stored in GC autosampler vials with as little head space as possible.

4.4 Traceability of Calibration

All calibration standards to be utilized for the contract for organics analysis are traceable to the U.S. EPA. Volatile compounds, Base/Neutral/Acid Extractables and PCB/Pesticide Standards are procured from EPA/Cincinnati or Las Vegas. Standards not available from these locations are procured from the EPA Repository or certified commercial sources (when available) such as Cambridge Isotope Laboratories, Radian, or Supelco.

Standards for other analytes are purchased as NBS certified materials from commercial suppliers including Fisher (Atomic Absorption Standards) and American Scientific Products (99+ mol %) next materials, or AR grade chemical. In instances where gravimetric procedures are used to prepare stock standards, five place (±0.01 mg) balances are used which are calibrated (service contract) to the National Bureau of Standards and checked regularly with Class S weights.

4.5 Sample Considerations

The size of a sample needed for a given analysis depends upon what and how much of it one expects to find.

Initially the sample should be as homogeneous as possible. Liquids are generally not a problem, but solids usually demand grinding with a mortar and pestle unless protocol pre-empts this. Any knowledge of sample history is helpful.

The volume of a liquid one takes for a water analysis should be the sample size recommended in Standard Methods or other appropriate reference unless sample history indicates low or high levels which might require deviations from normal volumes. Other exceptions are made when the total sample volume is small compared to the volume needed for all analyses requested. In this case a smaller sample size is usually dictated.

For EPA CLP organics work, protocol dictates exact sample size for preparation, screening, and analysis.

Samples, whether they be water, sludge, soils, or other solids reach the laboratory in various conditions. Handling them in the proper fashion to keep their chemical integrity is important.

Most samples that York Labs receive require refrigeration to prevent losses due to degredation. Certain parameters require preservation to remain stable. Samples that reach our doors from outside sources that are not properly preserved should be done by us as soon as we receive them as well as contacting the client to inform them of concern. A list of routine parameters listing preservatives, holding times and sample volumes needed is listed in the EPA Chemical Analysis of Water and Wastes Manual.

Attention should be made to the amount of sample submitted for analysis. External clients and internal engineering Project Managers are instructed to submit more than enough sample to allow for possible double checks on analyses that seem questionable or for further analysis. Every analyst should be aware of sample volume present before preceding with preparation. Thought should be taken of the amount of sample available, the amount needed for your particular analysis, and analyses remaining to be performed before your aliquot is taken. This will assure that enough sample will be available for all, as well as extra sample for rechecking or additional analysis. This is important because many times the sample submitted is all that is available. If more sample is needed, the analyses already run may be meaningless due to the changes in concentration of pollutants at the source.

4.6 Workplace Atmosphere

In order to prevent workplace atmosphere contamination and potential health problems arising from use of solvents, pyridine, acid and alkali, the following procedures are followed. All use of solvents <u>for any purpose</u> is performed in the solvent fume hoods located in the sample preparation laboratory. These hoods are to be used for solvents only. When loading GC or GC/MS autosamplers, hoods must also be used. A 4 ft^3. portable hood is used for these operations.

All acids/bases (ammonium hydroxide) are also handled in fume hoods. These hoods are designed from a material of construction viewpoint to handle concentrated acid/alkali fumes.

One exception is the use of perchloric acid which is not to be used except in the main lab perchloric acid hood. This acid is not to be used even in the proper hood while other work is being done in that hood. These measures will help eliminate stray chemical odors from entering undesired areas such as the offices, instrumentation, and microbiology labs.

4.7 Cross-Contamination Considerations

Two areas of major concern with respect to cross-contamination are air quality and sample storage.

In order to mitigate airborne solvents or other contaminants in the laboratory, fume hoods are utilized as mentioned previously. Additionally, the Instrumentation Laboratory is supplied by its own recirculated air handling system to help eliminate influx of solvents or acid fumes which can create problems with blanks and corrode key board contacts.

From a sample storage viewpoint, all volatile samples are stored in separate refrigerators with suspected high level samples stored away from other samples.

Extremely odoriferous samples such as those containing sulfide, mercaptans or acrylates are stored separately from "normal" samples. For volatiles, a storage blank is placed with each project at the time of storage of the samples to verify sample integrity with respect to cross-contamination.

4.8 Instrumentation/Maintenance Logs

All analyses of blanks, standards, and samples on all GC's and GC/MS's are documented by entry into individual instrumentation logs. These logs are permanently bound books located in the Instrumentation Laboratory which contain project information data file reference, operator, date, and autosampler bottle number.

Each GC and GC/MS system as part of the same bound log contains a Maintenance Log. Any and all maintenance performed on each system is logged. The attached figures (4.1 and 4.2) are copies of recent instrumentation/maintenance logs for GC/MS and GC systems.

4.9 Sample and Standards Preparation Logs

All samples for Base/Neutral/Acid extractables and Pesticide/PCB extractions are recorded in the extractions sample preparation log. This provides one central location for retrieval of sample volumes, weights, percent moistures, pH and other observations for all samples.

LABORATORY NOTEBOOK

YWC, INC.

YWC

200 Monroe Turnpike [illegible] Connecticut 06468

INSTRUMENT LOG

GC/MS # 1

- Injection and Maintenance Activity

START: 3/12/85

YORK LABORATORIES

DIV. YWC, INC.

FIGURE 4.1

TITLE INJECTION LOG

Project No. ALL
Book No. 1

From Page No. X

CLIENT	JOB #	SAMPLE #	TYPE	Bottle #	DATE file Name	DATE	Oprtr
(below)	VARIOUS	DFTPP 3.45 g/a Cal. ck.		01	>D0002.A1	3/12/85	BB
DAILY CK.	VARIOUS	BIN cal. ck std. 50 ppm	BIN/A-water	02	>E0001	3/12/85	BB
DAILY CK.	VARIOUS	Acid cal ck std. 50 ppm	BIN/A-water	03	>E0002	3/12/85	BB
ALL BELOW	ALL BELOW	METHOD Blank (HR)	BIN/A-H2O's	04	>E0003	3/12/85	BB
... & THOMAS	30850-507	0262		05	>E0004		
"	-507	0263		06	>E0005		
"	-628	1039		07	>E0006		
"	-609	0377		08	>E0007		
"	-609	0376		09	>E0008		
...G	30850-593	0480		10	>E0009		
"	-593	0481		11	>E0010		
"	-593	0482		12	>E0011		
"	-593	0483		13	>E0012		
...S	61630-WO	1335		14	>E0013		
"		1336		15	>E0014		
"		1337		16	>E0015		
"		1338		17	>E0016		
"							

FIGURE 4.1

To Page No. 2

...nessed & Understood by me,	Date	Invented by	Date
			3/12/...

From Page No. X

DESCRIPTION	DATE	Operator
- changed injection port septum - cleaned Autosampler syringe - aligned autosampler - manual tuned instrument stored in MT7801 - changed LIQUID CO_2 TANK CO_2 SOLENOID plugged - removed and blew out with zero air; solenoid developed leak at inlet connection and stem - retape w/teflon tape - still leaked but... had to run so I'll live with it - Ordered 2 backup solenoids from AUTOMATIC SWITCH Florham Park, NJ. In addition, ordered 2 particulate filters for CO_2 line. after sample #8* was injected I replaced the solenoid (not the magnetic portion but the actual stem) with one from the old HP5730A GC which was not being used. THIS WAS SUCCESSFUL!!! * see injection log for 3/12/85	3/12/85 Tues.	F Bradley

DESCRIPTION	DATE
- RESTORED DATA files for [illegible] >V0118-136 from Tape to car. 01 - Autosampler syringe plunger corkscrewed - replaced syringe - changed injection port septum	3/13/85 Weds.

FIGURE 4.1

To Page No. 42

Witnessed & Understood by me,	Date	Invented by	Date
		[illegible signature]	3/12-13

LABORATORY NOTEBOOK

YWC, INC.

YWC

INSTRUMENT LOG

GC SIGMA 3 #2 ECD/FID

Injection and Maintenance Activity

START: 3/12/85

YORK LABORATORIES

DIV. YWC, INC.

FIGURE 4.2

Project No. ACL
Book No. 1

COPY

LE INJECTION LOG

m Page No. April 16 1985 (overnight)

Column 1.5% SP2250/1.95% SP2401 on Supelcoport 210°C isothermal

Inj #	Client	GC Sample	Vial
1	EPA	Evaluation Pest mix A Std	00
2		Evaluation Pest mix B Std	02
3		Evaluation Pest mix C Std	04
4		EPA Pesticide mix Std, .05 ug/ml	06
5		Methoxychlor EPA Std .5 ug/ml	08
6		Endrin Ketone EPA Std .1 ug/ml	10
7		Toxaphene EPA Std 2.0 ug/ml	12
8		Chlordane EPA Std .2 ug/ml	14
9		PCB-1242	16
10		PCB-1248	18
11		PCB-1254	20
12		PCB-1260	22
13		EPA Pest. sample AmB (water)	24
14		EPA Pest sample A	26
15		EPA Pest sample AmS	28
16		EPA Pest sample AmSD	30
17		EPA Pest sample BmB soil	32
18		Evaluation Pest mix std B	34
19		EPA Pest sample B soil	36
20		EPA Pest sample BD soil	38
21		PCB 1260 EPA Std 2.0 ug/ml	40
22		PCB 1242 EPA Std .2 ug/ml	42
23		EPA Pesticide mix std .05 ug/ml	44

FIGURE 4.2

To Page No.

essed & Understood by me,	Date	Invented by	Date

MAINTENANCE LOG

Project No. 4U

Book No. 1

COPY

ge No.

1/12/85 Replace glasswool on column
Removed and silanized injector port on G.C.
to lessen Breakdown of Endrin & DDT
Baked out column overnight

1/13/85 Changed Nitrogen tank
-- Changed ECD detector, put in reconditioned ECD
- old ECD sensitivity for [illegible] appears low @ 1.0 na standing current; put new (second) ECD cell in and baked overnight @ 375°C (RQB)

4/14/85 - Balance is good on "new" cell - fried cell @ 0.5; 1 and 2 na standing currents looks good! - conditioned w/ 5μl n-hexane, then injected 5μl EPA Eval. MIX B - Aldrin looks very good!! RQB

Actual standard current vs. mV (-bal mV);

STANDING CURRENT	Setting	mV (actual)
0.5 na	4	5.1
1.0 "	3	9.3
2.0 "	2	18.9

1/85 Worked on autosampler readjusted sample position knob
Changed Injection port septa & autosampler septa before autosampler run (MFC)

FIGURE 4.2

To Page No.

ed & Understood by me,	Date	Invented by	Date	

Additionally, all preparation of standards for organics and inorganics analysis are recorded in the Standard Preparation Log.

Copies of recent entries are included in the following figures (4.3 and 4.4).

SAMPLE PREP. LOG

Project No. ALL
Book No. 1

Client	Job#	Sample #	Sample TYPE	wt.(gm)/Aliquot(ml)	Final Volume	Date Surrogate	Initial
GE/MEDFORD	30850-	5481	AS received Soil	20.29205 gm	10.0 ml	3/12/85	gl
Wehran Eng.	30850-641	1080	air dried soil	20.07775 gm	10.0	"	gl
Wehran Eng.	"	1081	"	20.35061 gm	10.0	"	gl
Wehran Eng.	"	1083	"	19.92771 gm	10.0	"	gl
City of Gloucester	30850-425	0074	"	20.40751 gm	LOST	"	gl
GE/MEDFORD	" -	9281	AS received soil	20.43799 gm	10.0 ml	3/13/85	gl
Nepcco	" -733	7467	"	20.47532 gm	2.0 ml	"	gl
Nepcco	"	7464	"	20.40606 gm	2.0 ml	"	gl
Nepcco	"	7476	"	20.42134 gm	2.0 ml	"	gl
Nepcco	"	7479	"	20.15578 gm	2.0 ml	"	gl
Nepcco	"	7470	"	20.44923 gm	2.0 ml	"	gl
Nepcco	"	7471	"	20.39150 gm	2.0 ml	"	gl
Nepcco	"	7472	"	20.14347 gm	2.0 ml	"	gl
Nepcco	"	7473	"	20.38591 gm	2.0 ml	"	gl
NEPCCO.	"	BLANK	—	—	2.0 ml	3/13/85	KR

FIGURE 4.3

Page No. ___ To Page No. ___

...sed & Understood by me, | Date | Invented by | Date

EPA, in single project/case files arranged by sample number.

Prepare Case File Folders:

a. Using appropriate file folders, assign one folder to each project according to York Labs project number (or SMO case number for EPA).

b. Place all documents, sample tags, SMO forms, and laboratory generated data pertaining to one case in the folder.

c. Documents should be arranged by document type within the project folders i.e., all sample tags together, all Traffic reports together, all hard-copy Mass Spectra together, etc.

d. These document case files will be filed in one location and stored in lockable file cabinets.

3. Assignment of accountable numbers to laboratory-generated data:

a. Each document of a case is inventoried and assigned a serialized number (an identifier) associating it with a particular project.

b. All documents pertaining to each case including, but not limited to, the following are numbered and inventoried:

1. Sample traffic records, weekly reports;
2. Custody records, sample tags, airbills, internal custody records;
3. Laboratory logbooks, personal logbooks, instrument logbooks, benchsheets;
4. Laboratory data (sorted by sample), calibration and quality control results;
5. Data summaries and reports;
6. All other documents, forms, or records referencing the samples.

LABORATORY NOTEBOOK

YWC, INC.

YWC

SAMPLE EXTRACTIONS

LOG

BNA'S , Pesticides and pcb's

START:3/13/[illegible]

YORK LABORATORIES

DIV. YWC, INC.

FIGURE 4.3

SAMPLE PREP LOG

Project No. AU
Book No. 1

COPY

Page No.

CLIENT	JOB #	SAMPLE #	SAMPLE TYPE	WT (g.)/ALIQUOT (ml)	FINAL VOLUME (ml)	DATE	Surrogate	INITIAL
GE BPT		#1042	WATER	500 ml	1.0	3/13/85	✓	H.R
GE BPT		#1043	WATER	1110 ml	1.0	3/13/85	✓	H.R
GE BPT		#1044	WATER	1260 ml	1.0	3/13/85	✓	H.R
USM		#1059	WATER	990 ml	1.0	3/13/85	✓	H.R
BLANK		—	WATER	~1000.0 ml	1.0	3/13/85	✓	H.R
LBG		0484	Water	965 ml	1.0	3/26/85	✓	JH
"		0486	"	1000 ml	1.0	3/26/85	✓	JH
"		0487	"	~~1000~~ JH 3/26/85 965 ml	1.0	3/26/85	✓	JH
Globe Slicing		1188	"	1000 ml	1.0	3/29/85	✓	JH
Eco. Testing	30850.759	1650	Water	920	1.0	3/29/85	✓	JH
		1651	"	917	1.0	3/29/85	✓	JH
		1652	"	900	1.0	3/29/85	✓	JH
		1654	"	977	1.0	3/29/85	✓	JH

FIGURE 4.3

To Page No.

...ssed & Understood by me, | Date | Invented by | Date

TITLE Preparation of Pesticide Matrix Spiking Solution

Project No.____ Book No. 1

COPY

1

From Page No.__ 3/19/85

Compound	Weight
lindane	0.02026 g/100 ml MEOH
heptachlor	0.02169 "
aldrin	0.01984 "
dieldrin	0.05068 g/100 ml MEOH
endrin	0.05002 "
4,4' DDT	0.04822 "

Transferred to Pesticide notebook page # 26

The desired final concentrations are 0.2 ug/1.0 ml for the first three compounds on the list and 0.5 ug/1.0 ml for the last three compounds listed above.

The concentration of the stock solution is 200.0 ug/ml a 1:1000 dilution of stock to methanol was made.

100 ul of stock into 100 ml MEOH ⇒ Sample spiking solution.

all glassware washed, methanol rinsed, oven dried and placed in dessicator for 15 min. Samples were weighed into a weighed erlenmeyer flask and dissolved in several ml's MEOH. The standards were transferred to a 100 ml volumetric and brought to a final volume of 100 ml. The erlenmeyer was rinsed twice with a small volume MEOH. The standards were transferred to screw top, teflon lined vials, And labeled [STOCK] matrix solution.

100 ul of the stock solution was brought to a 100 ml vol with MEOH and labeled Matrix solution.

0.02 g/100 ml or 20 mg/10 ml or .2 mg/1 ml = 200 ug/ml STOCK

.2 ug/ml MATRIX SOLN.

FIGURE 4.4

To Page No.____

Witnessed & Understood by me,	Date 3/19/85	Invented by Heidi Rydene	Date

rom Page No. 4 3/29/85

Compound	Conc ng/µl	Added Vol (µl) (*)	Final conc (ng/µl)
1,4 Dichlorobenzen-d_4	5000	160	400
Naphthalene-d_8	5000	160	4000
Acenaphthene-d_{10}	2000	400	400
Phenanthrene-d_{10}	5000	160	400
Chrysene-d_{12}	1000	400	200
Perylene-d_{12}	2000	400	400

Sample compounds were initially transferred from amber ampules into silanized teflon lined screw top vials.

Using a solvent rinsed gas tight syringe the volumes of compounds (*) above were delivered to a silanized vial and brought to a final volume of 2.0 ml by adding 320 ml $MeCl_2$.

FIGURE 4.4

To Page No.

4.10 Personal Notebooks

Each analyst is assigned a permanently bound, sequential page numbered notebook for all laboratory activity.

These notebooks are utilized for all entries not made on preprinted forms. Any corrections are made by drawing a single line through the entry to be corrected and entering the corrected value. Any future corrections are initialed and dated.

Notebooks are the property of York Laboratories, and are not permitted to leave the premises at any time.

4.11 Reporting Results

All results reporting is the responsibility of the analyst. In most cases, preprinted forms are available for data entry. For analytes where this is not the case, data are recorded on the Results of Analysis data sheet which is found in the project file. Figure 4.5 is a copy of this particular data sheet. In all cases, significant figures are reported in accordance with Handbook for Analytical Quality Control, EPA-600/4-79-019.

4.12 Data Handling Procedures

Once data have been generated and placed in the project folders, the Laboratory Manager reviews the package for completeness. He then transmits the package to the QA/QC coordinator who, in conjunction with the applicable Group Leader, reviews the data for accuracy, recovery, and again for completeness. The entire data package including custody and other documents is then given to the Division Vice President for final review and certified report transmittal cover letter preparation.

Copies of the data package contents are then transferred to the completed project files and archieved under lock and key.

YORK

RESULTS OF ANALYSES

Project No. ________

Client ____________

PARAMETER						Analysts Initials	Date Analyzed	Notebook/page*	Checked by

FIGURE 4.5

The data validation for all projects is as follows:

- Verification on a regular basis by the QA/QC Coordinator that all raw data have been referenced in the laboratory chain-of-custody records.

- Examination of at least 5 percent of the raw data (e.g. Quantitation reports, chromatograms, AAS recorder chart) by the QA/QC Coordinator to verify adequacy of documentation and confirm the analyst's data reduction and interpretation methods.

- Verification by the Laboratory Manager that all deliverables are included with each project as required by contract, or good laboratory practice.

4.13 Preventative Maintenance

An important factor in maintaining accuracy and precision, achieving required holding times, and addressing contract schedule is preventive maintenance. All instrumentation at York Labs is under service contract to Hewlett-Packard for GC/MS/computer systems, and Laemmerhirt, Inc. for GC, Atomic Absorption, Infrared, and UV/Visible Systems.

In addition, experience plays a major role in preventative maintenance. Regularly scheduled in-house maintenance includes, but is not limited to the following items for the GC/MS Systems:

- Injection port liner (capillary) replacement or cleaning and deactiviting on a daily basis;

- Removal of 2-3 inches of the front part of the capillary column each day;

- Septum replacement each day (minimum);

- Manually tuning each Mass Spectrometer daily;

- Ion Source cleaning as needed (indicated through daily tuning and DFTPP/BFB criteria);

- Checking water levels in cooling water circulators-weekly;
- Check liquid CO_2 tanks - daily;
- Checking helium tanks - daily;
- Leak checking all Tekmar Purge and Trap sparger connections with GOW-MAC leak detector - on use;
- Autosampler (liquid) cycle test - weekly.

Routine preventative maintenance on the GC systems include:

- Septa replacement - daily (minimum);
- Autosampler septa replacement (daily);
- Injection port liner repacement or cleaning and resilanizing (for non on-column injection);
- Removal of front end of column glass wool and first few centimeters of packing, then repack with silanized glass wool - weekly (or sooner if indicated by data);
- Detector bake-out (monthly, or sooner as dictated by change in sensitivity).

York maintains a number of spare items for GC and GC/MS system repair. These include, but are not limited to, spare jet separators, capillary and packed columns, roughing pumps, electron multipliers, ion source filaments, injection port liners, VOA Traps, purge and trap units and the like.

4.14 Analyst Certification

The proficiency of all analysts is demonstrated through internal check samples. The QA/QC Coordinator prepares two (minimum) unknown which are submitted to the analyst in duplicate. Each sample is analyzed and the results used to verify that the analyst can produce accurate and precise data. Once accuracy and precision within historical values is attained the analyst is allowed to work on project samples.

4.15 Quality Control Samples

Each project is unique and therefore in each work plan or contract, the numbers and types of blank, duplicate, and spiked samples will be specified. The frequency of these analyses must be related to the purpose of the study, but the following serve as general guidelines for the development of the quality control portion of the work plan.

The EPA CLP protocols definitely assign the related QC procedures to be followed. In cases where protocol does not specifically address the number of method blanks, matrix spikes, or matrix spike duplicates the following procedures should be used.

At the initiation of an analytical procedures for trace organics, the apparatus and the reagents necessary for analysis of samples will be assembled and a series of blank determinations will be performed. These blank determinations will involve all reagent solvents and glassware as required in a standard method of analysis, and will determine when background peaks are sufficiently low (or absent) to permit the analysis of the sample to proceed. If satisfactory blanks are not obtained in these initial samples, then additional steps will be taken to determine the cause and eliminate it. Once the initial methodology has been established, then blank determinations will be performed as a routine procedure throughout the program as samples are analyzed. A blank sample will normally be analyzed along with every ten samples.

The following tests will normally be run with each batch of samples for analysis:

- one method blank
- one standard at a median concentration
- one spiked sample for determination of recovery
- duplicate analyses of one samples from the batch for repeatability

Other sample types and their uses are given in the following table.

Type	Purpose
Field Blank	Evaluate handling and shipping procedures
Field Spike	Evaluate laboratory performance
Laboratory spike into sample (2 samples)	Determine matrix effects on recovery and reproducibility)

If appropriate to the purpose of the study, these will be incorporated into the work plan and implemented.

The use of duplicate samples provides assurance that the methodology is performing within previously established limits of accuracy and precision. The frequency of duplicate analyses on samples or repeated injections/aspirations of extracts should be related to the purpose of the program and the eventual end use of the data, but should not be less than ten percent of the samples.

4.16 Method Validation

If a method is to be used for which no accuracy and precision statements are available and with which this laboratory has no familiarity, then a series of samples will be run to determine these characteristics. The following program is patterned after "Analytical Quality Control".

The study should include concentrations at three different levels; near the sensitivity limit, near the upper bound of expected values, and in between the two. Seven replicate analyses of each concentration should be made, with all the normal procedural steps involved. The recommended order of analysis is seven sequences of low, medium, then high concentrations, which allows for the maximum interferences during operation.

Accuracy and precision statements will be devloped from these data. These will take the form:

"Recoveries of_______, _______, and _______%, respectively were obtained using this method at concentrations of _____ , _______, and _______."

"Standard deviations of _______, _______, and _______, were obtained, respectively, using this method at concentrations of _______, _______, and _______."

For calculation of average percent recovery and associated standard deviations, consult the EPA Quality Control manual.

4.17 Corrective Action

For each analytical method employed, precision and accuracy will be regularly tracked by computing the standard deviation of the range of the results of replicate analyses. Determination of recovery of the surrogates will be tabulated. The mean recovery and the standard deviation of replicate sets will be computed. When either the relative standard deviation of replicate results, the average recovery, or the relative standard deviation of replicate results, the average recovery, or the relative standard deviation of replicate recoveries exceeds the performance goals, corrective action will be taken to improve performance prior to analysis of the next lot.

If during system or performance audits, weaknesses or problems are uncovered, corrective action will be initiated immediately.

Corrective action will include, but not necessarily be limited to recalibration of instruments using freshly prepared calibration standards; replacement of lots of solvent or other reagents having unacceptable blank values; additional training of laboratory personnel in correct sample preparation and analyses methods; and reassignment of personnel, if necessary, to improve the overlap between operator skills and method requirements.

Whenever a long-term corrective action is required to eliminate nonconformance, the following closed-loop system* will be used to implement the corrective action procedure and verify its effectiveness:

- The problem will be defined,
- Responsibility for investigation will be assigned,
- The cause of the problem will be investigated and determined,
- Responsibility for implementing corrective action will be assigned and accepted,
- The action will be implemented and its effectiveness evaluated,
- Verification that the action has eliminated the problem will be established.

4.18 Client Interface

Daily, weekly, biweekly, and monthly status reports on all projects are transmitted (verbal or in writing) by the Laboratory Manager, on an as-required basis. This system serves to track all projects in terms of expected delivery of data and any problems with samples. York Labs sample tracking system allows daily status reports to be generated for work assignment purposes and client interface.

Additionally, the Laboratory Manager interfaces with the EPA SMO by transmitting weekly or other reports as required by the contract.

4.19 Waste Handling/Disposal Procedures

At York Laboratories, the normal waste types generated from Laboratory operations include acids from sample preservation, digestion and glassware rinsing, solvents from

*Reference: "Quality Assurance Handbook for Air Pollution Measurement Systems. Volume 1: Principles" EPA-600/4-76-005. January, 1976.

extractions and glassware rinsing operations, PCB containing solvents from extracts, and glassware cleanup and pyridine from cyanide analyses.

All alkali waste is blended with acid waste under controlled conditions to neutrality. The logistics of waste disposal and handling are listed by waste type as follows.

Copies of recent manifest forms are included as Figures 4.6, 4.7, 4.8, and 4.9 in the following figures for reference purposes.

- <u>Acid Wastes</u>

  All acidic solutions are collected in two 5 gallon polypropylene drums located in two central locations within the wet laboratory. These drums are transferred when 4/5 full to 55 gallon drums to await disposal by a waste treatment firm. All glassware that has had acid solutions in it are rinsed into these disposal drums as well. The acid waste is disposed of by neutralization by Environmental Waste Removal, 130 Freight Street, Waterbury, CT 06702, Telephone #(203) 755-2263, U.S. EPA I.D. #CTD 072138969. The amount of acid waste accumulated by York Labs is approximately 220 gallons every 6 weeks.

- <u>Organic Solvent Waste</u>

  All organic solvent waste is stored in 5-gallon metal drums and placed in a 55 gallon drum for disposal when full. The disposal firm used is Environmental Waste Removal, 130 Freight Street, Waterbury, CT 06702, Telephone #(203) 733-2263, U.S. EPA I.D. #CTD 072138969. The amount of organic solvent waste accumulated is 100 gallons per year.

- <u>Pyridine Waste</u>

  Pyridine waste is generated by the analysis of cyanide. This waste is stored in 5 gallon polyethylene drums and transferred to a 55 gallon drum when full.

NEW HAMPSHIRE DIVISION OF PUBLIC HEALTH SERVICES
OFFICE OF WASTE MANAGEMENT
Health and Welfare Building
Hazen Drive
Concord, NH 03301

Please print or type. (Form designed for use on elite (12 pitch) typewriter.)

Form Approved OMB No 2000 0404 Expires 7-31-86

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: SHALL GENERATE — Manifest Document No:
2. Page 1 of 1

Information in the shaded areas is not required by Federal law, but may be required by State Law.

A. State Manifest Document Number: NH A 0003005
B. State Generator's ID:

3. Generator's Name and Mailing Address: YORK LABORATORIES, 200 MONROE TPKE, MONROE, CT.
4. Generator's Phone (203) 261-4458
5. Transporter 1 Company Name: TRANSFORMER SERVICE INC. — 6. US EPA ID Number: NHD018902874

C. State Transporter's ID: NH 914679
D. Transporter's Phone: 603-224-4006

7. Transporter 2 Company Name: — 8. US EPA ID Number:

E. State Transporter's ID:
F. Transporter's Phone:

9. Designated Facility Name and Site Address: TRANSFORMER SERVICE INC., REGIONAL DR., CONCORD, N.H. 03301 — 10. US EPA ID Number: N.H. D018902874

G. State Facility's ID: SAME AS 9
H. Facility's Phone: 603-224-4006

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. WASTE POLYCHLORINATED BIPHENYLS LIQUID, RQ, NOS, ORM-E, UN-2315	001	DM	2 gall	G	CR01 D000
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
a. T c.
b. d.

K. Handling Codes for Wastes Listed Above
a. T-06 c.
b. d.

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations, and state laws and regulations.

Printed/Typed Name: DANIEL F. OTT — Signature: Daniel F. Ott — Date (Month Day Year): 12 27 84

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Michael J. Lavoie — Signature: [signature] — Date (Month Day Year): 12 27 84

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: — Signature: — Date (Month Day Year):

19. Discrepancy Indication Space

FIGURE 4.6

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: A SERZANS — Signature: A. Serzans — Date (Month Day Year): 12 28 84

EPA Form 8700-22 (3-84)

NH A 0003005

GENERATOR COMPLETED COPY

TO REPORT AN OIL SPILL: NHWSPCC (271-3440) ... OR 1-800-852-3345

STATE OF CONNECTICUT

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Hazardous Waste MANIFEST SECTION, State Office Building, Hartford, CT 06106

Please print or type (Form designed for use on elite (12-pitch) typewriter.)

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No: 806
Manifest Document No.: 00004
2. Page 1 of 1

Information in the shaded areas is not required by Federal law, but may be required by State law.

A. State Manifest Document Number: 0001047

3. Generator's Name and Mailing Address:
YMC, Inc.
209 Monroe Turnpike
Monroe, CT 06468

4. Generator's Phone: (203) 261-4438

B. State Gen. ID: SAME

5. Transporter 1 Company Name: Environmental Waste Removal
6. US EPA ID Number: CTD 072138969

C. State Tran. ID
D. Tran. Phone: (203) 755-2283

7. Transporter 2 Company Name:
8. US EPA ID Number:

E. State Tran. ID
F. Tran. Phone

9. Designated Facility Name and Site Address:
Environmental Waste Removal
130 Freight Street
Waterbury, CT 06702

10. US EPA ID Number: CTD 072138969

G. State Facility's ID: SAME
H. Facility's Phone: (203) 755-2283

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. Waste Acid, Liquid, NO.S., Corrosive Material, NA 1760	4	DM	220	G	D002
b. Waste Solvent, N.O.S. Flammable Liquid, NA 1993	1	DM	55	G	F003
c.					
d.					

J. Additional Description for Materials Listed Above
a. c.
b. d.

K. Handling Codes for Waste Listed Above
a. c.
b. d.

15. Special Handling Instructions and Additional Information
11A - EWR Stream #A-11692
11B - EWR Stream #A-13413

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations, and all applicable State laws and regulations.

Printed/Typed Name | Signature | Date: Month Day Year

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Date: Month Day Year

18. Transporter 2 Acknowledgement or Receipt of Materials

Printed/Typed Name | Signature | Date: Month Day Year

19. Discrepancy Indication Space

FIGURE 4.7

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name | Signature | Date: Month Day Year

GENERATOR / TRANSPORTER / FACILITY

FOR SPILLS WITHIN CONNECTICUT CONTACT CT DEP – OIL AND CHEMICAL SPILLS AT (203) 566-3338

COPY 8: GENERATOR: Retained by Generator

0001047

EPA Form 8700-22 (3-84) Form Approved OMB No. 2000-0404 Expires 7-31-86

COPY 8: GENERATOR: Retained by Generator

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Hazardous Waste MANIFEST SECTION, State Office Building, Hartford, CT 06106

Please print or type (Form designed for use on elite (12-pitch) typewriter.)

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: SQG — Manifest Document No.: 00003
2. Page 1 of 1
Information in the shaded areas is not required by Federal law, but may be required by State law.

3. Generator's Name and Mailing Address: YWC, Inc., 200 Monroe Turnpike, Monroe, CT 06468
4. Generator's Phone: 203 261-4458
5. Transporter 1 Company Name: Environmental Waste Removal
6. US EPA ID Number: CTD 072138969
7. Transporter 2 Company Name:
8. US EPA ID Number:
9. Designated Facility Name and Site Address: Environmental Waste Removal, 130 Freight Street, Waterbury, CT 06702
10. US EPA ID Number: CTD-072138969

A. State Manifest Document Number: 0001046
B. State Gen. ID: SAME
C. State Tran. ID: CT/E 79657
D. Tran Phone: 203-755-2283
E. State Tran. ID:
F. Tran Phone:
G. State Facility's ID: SAME
H. Facility's Phone: 203-755-2283

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. Waste Acid, Liquid, N.O.S., Corrosive Material, NA1760	4	DM	220	G	D002
b.					
c.					
d.					

J. Additional Description for Materials Listed Above
a. c.
b. d.

K. Handling Codes for Waste Listed Above
a. T01 c.
b. d.

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations, and all applicable State laws and regulations.

Printed/Typed Name: DANIEL F. OTT — Signature: Daniel F Ott — Date: Month 01 Day 23 Year 85

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: RICHARD L EMMONS JR — Signature: [signature] — Date: Month 01 Day 23 Year 85

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: — Signature: — Date: Month Day Year

19. Discrepancy Indication Space

FIGURE 4.8

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: MICHELE DRIGGS — Signature: Michele Driggs — Date: Month 01 Day 23 Year 85

EPA Form 8700-22 (3-84) Form Approved OMB No. 2000-0404 Expires 7-31-86

COPY 3: GENERATOR COMPLETED COPY

COPY 3: GENERATOR COMPLETED COPY

0001046

Please print or type.

HAZARDOUS WASTE MANIFEST

P.O. Box 12820, Albany, New York 12212

Form Approved. OMB No. 2000-0404. Expires 7-31-86

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA No. SQG
Manifest Document No.
2. Page 1 of 1
Information in the shaded areas is not required by Federal Law.

3. Generator's Name and Mailing Address
YWC INC
200 MONROE TURNPIKE
MONROE CONN 06468
4. Generator's Phone (203) 261 4438
5. Transporter 1 (Company Name)
FREEHOLD CARTAGE BOX 11 ...
Freehold, NJ 07728
6. US EPA ID Number NJD054126164
7. Transporter 2 (Company Name)
8. US EPA ID Number
9. Designated Facility Name and Site Address
FRONTIER CHEMICAL WASTE PROCESS
4626 ROYAL AVE
NIAGARA FALLS, NY 14302
10. US EPA ID Number NYD043815703

A. State Manifest Document No. NY A 103070 7
B. State generator's ID SAME
C. State Transporter's ID NJ TV 138N
D. Transporter's Phone (201) 462-1001
E. State Transporter's ID
F. Transporter's Phone ( )
G. State Facility's ID
H. Facility's Phone (716) 285-8208

11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. WASTE PYRIDINE Flammable LIQUID UN 1282	001	DM	0156	G	F005
b.					
c.					
d.					

J. Additional Descriptions for Materials listed Above
a. 104 c.
b. d.

K. Handling Codes for Wastes Listed Above
a. D c.
b. d.

15. Special Handling Instructions and Additional Information
FRONTIER # 1173 206

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations and state laws and regulations.

Printed/Typed Name: DANIEL Ott
Signature: Daniel Ott
DATE Month Day Year: 01 23 85

17. Transporter 1 (Acknowledgement of Receipt of Materials)
Printed/Typed Name
Signature
DATE Month Day Year

18. Transporter 2 (Acknowledgement or Receipt of Materials)
Printed/Typed Name
Signature
DATE Month Day Year

19. Discrepancy Indication Space

FIGURE 4.9

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name: WILLIAM MEWEIS
Signature
DATE Month Day Year

NY A 103070 7

EPA Form 8700-22 (3-84) COPY 3—Generator—mailed by TSD facility

This waste is disposed of by Frontier Chemical Waste Process, 4646 Royal Avenue, Niagara Falls, NY 14302, Telephone #(716) 285-8208, U.S. EPA I.D. #NYD 043815703. The amount of pyridine waste accumulated is approximately 15 gallons per year.

- <u>Polychlorinated Biphenyl Waste</u>

PCB waste is collected in a 5 gallon metal drum that is contained in a plastic 15 gallon drum (as contami-nent). This waste is disposed of before 12 months from initial drum activity by Transformer Service, Inc., Regional Drive, Concord, NH 03301, Telephone #(603) 224-4006, U.S. EPA I.D. #NHD 018902874. Amount of PCB waste accumulated is 2-5 gallons per year.

4.20 <u>Laboratory Safety</u>

The arrangements for laboratory safety in a given facility may be chosen from one of several alternatives as appropriate to the physical size, numbers of staff and nature and range of hazards encountered.

At York, laboratory safety is under the direction of the Laboratory Safety Officer. This individual is knowledgeable and experienced in all the day-to-day operations of the laboratory and possesses fundamental management characteristics necessary for strict enforcement of safety rules.

Our laboratory safety officer is the Chief Chemist whose duties in addition to technical direction include keeping a watchful eye on the day-to-day activities in the laboratory and keeping abreast of developments in the safety field and develop new safety arrangements as required.

<u>General Attitude to Laboratory Safety</u>

The attitude of staff members toward laboratory safety is directly related to its success. Most accidents are related to housekeeping problems. An untidy laboratory is a direct encouragement to staff to become slack in their general attitude to safety. To eliminate this problem, 15-20 minutes at the end of each day are set aside to clear work spaces of unnecessary glassware and equipment. In addition, once per week, one full hour is spent cleaning work benches of other unnecessary items.

<u>Fire Prevention</u>

The annual cost of fire losses in laboratories has been and is steadily rising (Cooke, A.J.D. 1976, <u>A Guide to Laboratory Law</u>, 1976). Many fires arise from simple oversights such as instrumentation or other electronic equipment left on overnight, self-ignition of packing materials, etc. At York we have a code of practice for the prevention of fire whose secondary aim is to increase the chance of successful containment of fire once it has started so that the resultant damage may be reduced.

The Safety Officer at York minimizes fire chances through enforcement of the following key items:

- Daily removal of rubbish;
- Storage and disposal of combustible packing material to a safe (isolated from lab operations) place;
- Storage of solvents (flammable) in explosion proof cabinets;
- Relay information to staff on fire hazards of new materials from storage and use viewpoints;
- Proper disposal of waste solvents;
- Monitoring of electrical connections and wiring;
- Smoking is confined to appropriate areas;
- Non-laboratory personnel traffic is kept to a minimum;
- Routine checkout of fire/smoke detectors and alarms;
- Routine checkout of fire-fighting equipment including foam, CO_2, powder and CCl_4 extinguishers;
- Semi-annual fire-drill initiation.

Cylinders of Compressed Gas

The number of gas cylinders in use in our laboratory is kept to a practicable minimum. They are always firmly fixed or supported by means of chains or straps and are never used in situations where the temperature is likely to rise significantly, e.g. near radiators, in direct sunlight or in hot-rooms.

Cylinders of compressed gas are also always used with the appropriate control heads or pressure regulators together with suitable non-return valves and, where apprpriate, flame traps. Control heads, pressure regulators and non-return valves are never oiled or greased. If connected to any thin-walled metal appratus (and certainly when connected to any apparatus constructed of glass or plastic) there is provision for automatic pressure release so that the apparatus is not submitted to undue stress.

Cylinders are always transported in properly constructed cylinder trolleys and never dropped.

Cryogenic Substances

Our laboratories use liquid gases or cryogenic mixtures such as solid carbon dioxide, and liquid nitrogen, in order to produce low temperatures in cooling baths or traps. These liquids and mixtures may produce very painful and severe burns and destruction of tissue if allowed to come into contact with the body, and therefore suitable protective clothing is worn when handling them. Gloves, face masks and aprons are provided. Rubber boots, if provided, are worn inside trousers to prevent spilled liquid falling into the boot which may be extremely difficult to remove quickly in the event of a spillage. For the same reasons it is inadvisable to wear gauntlet-type gloves.

There are a number of precautions that are observed when using cryogenic substances.

(1) Liquid nitrogen, solid carbon dioxide (or mixtures containing it) should not be used or stored in confined spaces or rooms with little or no ventilation, since there is considerable risk that the air in such a room will be rapidly depleted of oxygen by the release of large volumes relatively inert gas. It is not unknown for laboratory workers to store blocks os solid carbon dioxide in cold-rooms, which generally have very little ventilation. This practice will very soon produce a suffocating atmosphere in the room.

(2) Liquefied gases and other very cold liquids must not be poured into unsuitable containers. The thermal shock produced may well be sufficient to shatter the container; many of the vacuum flasks produced for

domestic purposes, for example, are incapable of withstanding the very sudden lowering of their temperature when liquid nitrogen is poured into them.

(3) Liquefied gas must not be stored in containers or vessels that are not freely vented to the atmosphere. There is a danger that gas released by evaporation from the liquid will be unable to escape from the vessel at a sufficient rate to prevent the vessel becoming pressurized and subsequently exploding. This is particularly important with narrow-necked, metal, vacuum-insulated storage containers. In humid conditions, it is possible that ice may form at the mouth of the container and this would severely restrict the outflow of escaping gas.

Chemicals

There are many hazards associated with the use and handling of chemicals.

Chemicals are used by workers in many fields, some of whom may have had little or no training in chemistry. Many substances in common use are highly toxic and their use by inexperienced persons is carefully supervised.

Occupational Hygiene

In all laboratories in which hazardous (toxic or infectious) substances are used, a high standard of cleanliness and personal hygiene must be maintained.

Eating, drinking, smoking, the application of cosmetics, licking of labels, mouth pipetting, chewing of pencils, biting of fingernails, or any activity which could lead to the ingestion of toxic substances, is prohibited. Since chemicals may also enter the body by inhalation and by absorption through the skin and eyes, particular care is exercised when weighing or transferring toxic substances in dry powder form from one container to another.

The Laboratories in which toxic substances are handled are well ventilated and provided with sufficient properly designed properly designed and constructed fume hoods, suitable washing (eye, shower) facilities with hot and cold water, and an adequate supply of disposable paper towels.

For staff working with highly corrosive chemicals, it is necessary to wear goggles or face masks and rubber or plastic gloves. If the work being carried out involves the use of more than small amounts of corrosive substances, it is necessary to wear rubber or plastic aprons and boots. All staff is trained so that full use is made of the facilities provided for any such emergencies. The Safety Officer ensures that all spillages are effectively cleared up immediately after they occur and that a suitable standard of cleanliness is maintained at all times. Laboratory coats, are worn by all laboratory staff while working and they are removed before entering other rooms where food is consumed.

Dermatitis and Skin Reactions

Many substances, such as chromium salts, chlorinated hydrocarbons, phenolic compounds and animal hair and dust, will produce skin reactions and lesions which are not only of unpleasant appearance, but are often extremely painful and slow to heal. Sensitivity to these substances varies enormously between individuals. Many persons are liable to become so sensitized that after receiving a few fairly short initial exposures to the substance their response to a given dose or exposure becomes much greater and the result more painful. If they are isolated from the substance they will generally recover, but a subsequent brief exposure may well produce an immediate and severeresponse. At this stage, they may have to be removed permanently from the work that brings them into contact with the substance to which they have become sensitized.

Chromic acid which is widely used for cleaning laboratory glassware is still, regrettably, a common cause of contact dermatitis. Prolonged exposure of the hands and forearms to chromates will produce deep, sharply defined ulcers that are slow to heal. In our laboratories, chromic acid has now been replaced by modern powerful detergents specially formulated for cleaning glassware and their use has done much towards reducing the incidence of contact dermatitis. Because of the nature of their work, laboratory glassware cleaning personnel are especially protected from the effects of these harmful substances. If they are allowed to put their bare hands into hot water containing detergent, their skin may become defatted and thus be more easily penetrated by the causative agents. The Safety Officer ensures that the glassware cleaners wear rubber or plastic gloves and safety glasses when they are working and that they report any sign of skin irritation immediately.

Toxic Substances and Threshold Limit Values

Some countries, notably the UK and the USA, have introduced legislation or regulations (OSHA) that define the maximum concentration of a substance in air to which a person may be exposed whilst at work. Threshold limit values (TLVs) refer to a time-weighted concentration for a 7 or 8-hour working day or a 40-hour working week. TLVs are expressed as parts per million (ppm) or milligrams per cubic metre (mg/m^3). Time-weighted averages generally permit excursions for a limited period above the limit, provided that it is compensated for by excursions below the limit. Some substances have ceiling limits above which no excursion is permitted. The tables for TLVs are based on the best available information from industrial experience and from experimental human and animal studies.

The sense of smell is a useful, but not a very reliable, guide to the concentration of the substance present. It should be noted that it is possible for two substances of modest toxicity to combine chemically or react to produce an extremely toxic product, e.g. the TLV of chlorine is 0.1 and that of formaldehyde is 2.0. It is possible, but not very likely, that under certain conditions these two substances could react together to form the extremely carcinogenic substances bis-chloro-methyl-ether, which has a TLV of 0.001 ppm. Therefore, all OSHA noted substances are used with proper ventilation considerations.

Carcinogens

A number of substances have been associated with an increased risk of the development of neoplastic disease in both man and animals. More are suspected of carcinogenic action and many more remain as yet untested for this type of activity. A number of substances whose use has been suggesed as a safe substitute for known or suspected carcinogens have later been found to be almost as active in this respect as the original material.

With new substances being added almost daily to the list of compounds known to have, or suspected of having carcinogenic properties, it is imperative that all laboratory staff should be aware of the hazards and that adequate precautions are taken whenever these substances are used or handled in the laboratory.

It has been suggested by Howe (Laboratory Practice, 24, 457-567, 1975) that, as far as animal experiments are concerned, it is possible to grade the available evidence about carcinogens into three arbitrary categores:

(1) Potent carcinogens - strong, proven carcinogens associated with high incidence of cancer.

(2) Carcinogenic - proven carcinogens with moderate or weak activity.

(3) Suspect carcinogens - inconclusive evidence of carcinogenicity or untested compounds structurally related to known carcinogens.

Compounds falling within the first group require precautions at facilities that are unlikely to be available or possible in many laboratories. The manufacturer, importation and sometimes the use of these substances has been restricted or prohibited in many countries.

In general, the risk of developing neoplastic disease from working with carcinogenic substances is in proportion to (a) the length and frequency of exposure, and (b) the amount or concentration of the substance to which one is exposed.

Irrespective of the type and quantity of equipment that is provided for the safe handling of carcinogenic substances, and of the rigour with which the precautionary measure are enforced, a very high standard of occupational hygiene is maintained when and wherever they are used or handled.

Many codes of practice have been published for the safe use of carcinogens. We advise staff to avoid the use of these substances altogether and, if this is not possible or reasonably practicable, to substitute safer and less hazardous compounds whenever possible.

It is the duty of the Safety Officer to ensure that all dangerous substances arising from work in the laboratories are disposed of safely, and with due regard to any local or other legal requirement, such as manifests (RCRA), etc.

Response to Emergencies

Areas in the laboratory are designated for emergenced as required. An eyewash and shower are located in the sample preparation lab, with a full shower in close proximity.

A first aid station and fire blanket is centrally located in the sample preparation lab.

Any accidents should be reported immediately to the Safety Officer so that timely reponse can be achieved. The Safety Officer is fully versed in typical treatment for acid burns and similar laboratory type emergencies.

4.21 Technical Procedure Revision

Revision of any portion of technical procedures is allowed only after decision by the applicable Group Leader in concert with the Chief Chemist. In no instance should any analyst alter protocol without the approvals as noted above.

APPENDIX G
GEOLOGIC LOGGING PROTOCOLS
QA/QC

APPENDIX G

STANDARD POLICY FOR GEOLOGICALLY LOGGING FORMATIONS PENETRATED DURING WELL/TEST BORING

The standard geologic well/bore hole logging system utilized by YWC, Inc. for stratigraphic identification of formations penetrated is based upon the Wentworth Grain Size Classification System, as modified by the United States Geological Survey and Unified Soil Classification System (developed by the U.S. Army Corps of Engineers) as modified by YWC, Inc.

Basically, the purpose of a geologic log is to describe:

1) The grain sizes of the formations penetrated.

2) The approximate proportions of each grain size.

3) Identifying characteristics of the formation penetrated (i.e., color, thickness, lenses, odor, etc.).

4) Rock type and identifying characteristics.

5) The depth interval of each formation.

This information can, in turn, provide valuable qualitative information concerning relative precipitation percolation rates through overburden material, as well as a qualitative assessment of relative hydrogeologic characteristics of site aquifer materials and estimations of contaminant plume flow rates.

A standard YWC Well/Bore Hole Geologic Log is presented in Figure A.

Identification and description of formations penetrated during well/soil core bore hole advancement activities is generally somewhat subjective. Accurate formation identification and description in the past has been largely dependent upon the experience level of the person logging the collected samples and his or her educational background. To standardize geologic logging procedures followed by YWC, Inc. during acquisition of soil samples in the field, thereby improving the quality of

FIGURE A

OWNER: ____________________
ADDRESS: ____________________

BORING NO: _____ WELL NO: _____ SHEET __ OF __
DATE STARTED: _____ DATE COMPLETED _____

Location: ______
Drilling Company: ______
Driller: ______
Drilling Method: ______
Sampling Method: ______
Samples Examined By: ______
Reference Point: ______
Well Construction
Screen Type: ______
Diam: _____ Slot No: ______
Setting (BGL): ______
Setting (Elevation): ______
Riser Elevation: ______
Protector Elevation: ______
Gravel Pack Size: ______
Protector: ______
Static Water Level: ______
Riser Stick-Up (AGL) ______
Protector Stick-Up: ______

Sample Depths From/To	Type Of Sample	Blows Per 6" On Sampler From 0-6	To 6-12	12-18	Moisture Density Or Consist.	Strata Change Depth	SOIL IDENTIFICATION Remarks Include Soil Type, Grain Size, Color, Gradation, Rock Color, Type, Condition, Hardness, Seams, Degree of Fracturing

REMARKS:

SAMPLE TYPE

AR= Air Return
C = Cored
W = Washed
SS= Split Spoon
TP= Test Pit
A = Auger Flight

PROPORTIONS USED

Trace	0 To 10%
Little	10 To 20%
Some	20 To 35%
And	35 To 50%

SUMMARY

Earth Boring ____
Rock Coring ____
Samples ____

140 LB. WT. x 30" FALL ON 2" O.D. SAMPLER

Cohesionless Density		Cohesive Consistency	
0 - 10	Loose	0 - 4	Soft
10 - 30	Med. Dense	4 - 8	Med. Stiff
30 - 50	Dense	8 - 15	Stiff
50+	Very Dense	15 - 30	Very Stiff
		30+	Hard

DRILLING METHOD

HSA=Hollow Stem Auger
Cd = Casing Drive
Cs = Casing Spin
Ar = Air Rotary
Rb = Rotary Bit
Cb = Core Barrel

collected geologic/hydrogeologic data obtained, Standard Procedures for soils identification and boring log completion have been developed.

Definitions for those portions of the standard Well/Bore Hole Log which are not readily self-explanatory are provided below:

> Drilling Method - Includes abbreviations (as presented at the bottom of the YWC Well/Boring Log) for all drilling methods utilized during bore hole advancement.
>
> Reference Point - Point (surface) from which sampling/ boring depths are measured.
>
> Setting (Bgl) - Depth interval of well screen setting (bottom of screen to top of screen) below ground level.
>
> Setting (Elevation) - Elevation interval of well screen setting [relative to mean sea level (MSL)].
>
> Riser Elevation - Elevation of the top of the well riser pipe relative to MSL.
>
> Protector Elevation - Elevation of the top of the surface protective casing (steel, cast-iron, etc.) with the cap off. (Note: This may change due to accidents, vandalism, etc.).
>
> Gravel Pack Size - Median grain size used for filter pack in annular space between well screen and bore hole wall.
>
> Protector - Surface well protector material type and dimensions.
>
> Static Water Level - Measured water level in well/bore hole (after the water level has returned to equalibrium with natural formation water levels).
>
> Sample Depth
>
> - Split Spoon or Core Barrel: Measured depth from top to bottom of coring interval.

- Auger Flight (Grab): Estimated depth from which grab sample originated.

- Air Return/Washed: Sample is collected from recirculation water/air return at an estimated depth of drill string.

- Test Pit: Depth in test pit from which sample was collected.

Type of Sample - Abbreviation of sample type (as presented at the bottom of the YWC Well/Boring Log.

Blows Per 6" On Sampler - Number of (140 lb.) hammer drops over 30" run per 6" depth advancement of split tube sampler. (This section is left blank for other sampling methods).

Moisture, Density, or Consistency - Moisture content of collected sample (dry, moist, wet); density or consistency calculated from total number of hammer drops necessary to advance the split tube sampler 1.5 feet; estimated for other sampling methods according to drilling speeds observed at time of collection.

Strata Change Depth - Depth at which formation material characteristics (i.e., color, grain size, sorting, density, material type, etc.) display a marked change.

Unfortunately, documentation of soil sample identification in the field will always be somewhat subjective due to obvious limiting factors. However, to standardize identification of soils to the maximum degree possible, a standard soils identification criteria and format has been established. Completion of the "Soil Identification" section of the Well/Bore Hole Geologic Log shall proceed as follows:

1) The dominant material grain size range nomenclature (i.e., sand, gravel, silt, etc. as per the Wentworth Scale, Table A-1), shall be the first word entered in the soil sample identification, to be followed by the observed material size description, color and any other modifiers pertinent to material identification. Table A-2 presents a checklist of typical material modifiers terms.

TABLE A-1
WENTWORTH GRAIN-SIZE CLASSIFICATION SYSTEM
(AS MODIFIED BY USGS)

Classification	Size Range
Boulder	10.08 Inches and Above
Cobble	2.52 to 10.08 Inches
Very Coarse Gravel	1.26 to 2.52 Inches
Coarse Gravel	0.63 to 1.26 Inches
Medium Gravel	0.31 to 0.63 Inches
Fine Gravel	0.16 to 0.31 Inches
Very Fine Gravel	0.08 to 0.16 Inches
Very Coarse Sand	0.04 to 0.08 Inches
Coarse Sand	0.02 to 0.04 Inches
Medium Sand	0.01 to 0.02 Inches
Fine Sand	0.005 to 0.01 Inches
Very Fine Sand	0.002 to 0.005 Inches
Silt	0.0002 to 0.002 Inches
Clay	Below 0.0002 Inches

TABLE A-2
TYPICAL SOIL DESCRIPTION MODIFIERS

Checklist for Description of Fine-Grained and Partly-Organic Soils

1) **Typical Name:**

Sandy Silt	Silt	Clayey Silt	Sandy Clay
Silty Clay	Clay	Organic Silt	Organic Clay

2) **Color:** Use Munsell notation, if possible. Note presence of mottling or banding.

3) **Odor:** None, Earthy, Organic

   May be neglected except for dark-colored soils.

4) **Consistency:** Soft, Medium Stiff, Very Stiff, Hard

5) **Structure:** Stratified, Laminated (Varved), Fissured, Slickensided, Blocky, Lensed, Homogeneous (Non-Stratified).

6) Local or Geologic Name (if known).

Checklist for Description of Coarse-Grained Soils

1) **Typical Name:** Boulders, Cobbles, Gravel, Sand.

   Add descriptive adjectives for minor constituents.

2) **Gradation:** Well Graded, Poorly Graded (Uniformly Graded or Gap-Graded).

   Describe range of particle sizes or predominant size or sizes as coarse, medium, or fine sand or gravel.

3) **Grain Shape:** Angular, Sub-Angular, Sub-Rounded, Rounded.

4) **Mineralogy:** Rock type for gravel, predominant minerals in sand, if known.

5) **Color:** Use Munsell notation, if possible.

6) **Odor:** None, Earthy, Organic.

   May be neglected except for dark colored soils.

7) **Natural Density:** Loose, Medium Dense, Dense, Very Dense.

8) **Structure:** Stratified, Lensed, Non-Stratified.

9) Local or Geologic Name (if known).

Example: Sand, fine to medium, tan-brown, with mica flakes.

2) Other sample constituents shall be listed after the dominant material description, according to decreasing proportion of total sample, using the following guidelines (as listed at the bottom of the Well/Bore Hole Log):

a) 0 - 10% - Trace
b) 10 - 20% - Little
c) 20 - 35% - Some
d) 35 - 50% - And

Examples based upon estimated percentages are presented below:

a) Medium Sand - 45 Percent
Organic Silt - 40 Percent
Very Fine Gravel - 10 Percent
Wood Fibers - 5 Percent

Should read: Sand, medium, brown and silt; ~~trace~~ gravel, very fine, rounded; trace wood fiber.

b) Medium Sand - 15 Percent
Organic Silt - 50 Percent
Very Fine Gravel - 30 Percent
Wood Fiber - 5 Percent

Should read: Organic silt, dark gray; some gravel, very fine, rounded; little sand medium; trace wood fiber.

c) Medium Sand - 5 Percent
Organic Silt - 25 Percent
Very Fine Gravel - 70 Percent
Wood Fiber - 0 Percent

Should read: Gravel, very fine, rounded; some organic silt, dark gray; trace sand, medium.

Note: As shown above, only the color of the material grain size which imparts the overall sample color is noted (unless other colors are clearly evident).

3) Any material which constitutes less than 35% of the total sample is separated from the preceding material description by a semi colon.

4) When gravel is present, the degree of rounding or angularity should be specied as follows:

   a) <u>Angular</u> gravel has sharp edges and relatively plane sides.

   b) <u>Sub-Angular</u> gravel is similar to angular but has somewhat rounded edges.

   c) <u>Sub-Rounded</u> gravel exhibits nearly plane sides but has well rounded edges.

   d) <u>Rounded</u> gravel has smooth curved sides and no edges.

5) Any material larger than coarse gravel must be logged on the basis of drilling penetration speed, drill cuttings (wash), core barrel retrieval, or driller/logger experience, since split tube samples will be impossible to obtain.

6) When layering is observed in the split tube sampler, layer thickness and location within the split tube shall be described.

   Examples: Sand, medium, brown with 1/4" to 1/2" layers of silt (bottom 6 inches of tube).

   Silt, red brown (bottom 12" of tube and sand, fine to medium, brown (upper 6" of tube).

7) Strictly geologic terms (aphanitic, metaquartzite, rhyolite, etc.) should be avoided unless the well logger has a geology background and/or if such descriptions are significant to a particular job.

8) Any unusual odors, colors, or drilling and sampling conditions should be noted at the end of the sample description.

Example: Sand, very coarse, tan brown; trace silt; trace gravel, very fine, rounded; hydrocarbons? Odor noted.

9) The last log entry shall indicate the bore hole termination depth and reason for termination.

Examples:	17'	Desired Depth Reached
	42.5'	Auger Refusal (Bedrock?)
	6'	Auger Refusal-Boulder Encountered - Relocated Hole

Most Important: Be Consistent!!

10) Lithologic identification of collected rock core samples should be performed at the office by the project geologist unless the well/bore hole logger is a geologist or has considerable geologic background.

11) Differentiation between silt and clay size particles for field logging purposes will be performed by smearing a small portion of a moistened sample between the finger tips and observing the degree of "shine" on the smeared surface. Identification will be as follows:

- Readily visible shine (no "gritty" feel) - Clay.
- Dull shine (with slight "gritty" feel - Silty clay.
- No shine (with "gritty" feel) - Silt.

Further differentiation shall be performed in the laboratory, if necessary.