

Rec'd 12/15/86

Site: WELLS G&H
Break: 11.9
Other: 553101

NUTTER, McCLENNEN & FISH

FEDERAL RESERVE PLAZA
600 ATLANTIC AVENUE
BOSTON, MASSACHUSETTS 02210



SDMS DocID 553101

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December 12, 1986

Ms. Barbara Newman or Ms. Gwen Ruda
Project Officer, Waste Management Division
HRS-1903
U.S. Environmental Protection Agency
J.F.K. Federal Building
Boston, MA 02203

Re: Request for Information to John J. Riley
Pertaining to the Wells G&H Superfund
Site, Woburn, MA

Dear Ms. Newman:

The following is the response of John J. Riley, Jr. to a letter dated November 20, 1986 from Merrill S. Hohman. Mr. Riley objects to this information request on the ground that he is not a "person who generates, stores, treats, transports, disposes of, or otherwise handles or has handled hazardous wastes," within the meaning of §3007(a) of the Resource Conservation and Recovery Act of 1976 ("RCRA"), 42 U.S.C. §6927(a). Mr. Riley personally did not undertake any of these activities, nor did any of his actions as an officer or director of the John J. Riley Company, the John J. Riley Company division of Beatrice Foods Company, or the John J. Riley Company, Inc. render him a "person" within the meaning of the above-quoted provision.

Mr. Riley also objects to this information request on the grounds the Environmental Protection Agency ("EPA") has no "reasonable basis to believe there may be a release or threat of release of a hazardous substance or pollutant or contaminant" from the subject property. Comprehensive Environmental Response, Compensation and Liability Act of 1980 ("CERCLA"), 42 U.S.C. 9604(e)(1), as amended by the Superfund Amendments and Reauthorization Act of 1986.

Notwithstanding the foregoing objections and without waiver of the same, Mr. Riley responds to the specific requests set forth therein insofar as the requests are within the statutory authority of the EPA, namely, RCRA §3007(a) and CERCLA §104(e), as amended. Mr. Riley objects to all other instructions or questions which are irrelevant to the EPA statutory authority, including, without limitation, the verification and affidavit instructions, as there is no statutory or regulatory basis for such a requirement, and any instruction which might require production of documents protected by the attorney client or work product privilege.

Although Mr. Riley believes that there is a valid claim of work product privilege with respect to the so-called "21E" report, he does not press that objection.

This response is made without any acknowledgement that Mr. Riley is a "responsible party" within the meaning of the CERCLA in connection with the above-referenced site, and without admitting any liability or responsibility under CERCLA, RCRA or any other statute. Mr. Riley's response is based upon all information currently available to him, after a diligent search.

Requests Nos. 1 & 2

1. Identify all documents that contain information pertaining to any property inspection, soil or groundwater sampling for chemical analysis, and environmental quality monitoring performed on the John J. Riley Company property located at 228 Salem Street in Woburn, Massachusetts; Block 21000, lot 37 and lot 96, on the Assessor's Map #21 of Woburn Massachusetts [herein, "the subject property"]. This includes but is not limited to the M.G.L. 21E inspection done for the same property.
2. Provide copies to EPA of all documents identified in request # 1, above, that contain information collected by parties other than the U.S. EPA or contractors for the U.S. EPA.

Response Nos. 1 & 2.

Mr. Riley objects to the terms "property inspection" and "environmental quality monitoring" as vague and ambiguous. To the extent that the term "property inspection" refers to an evaluation of the property for purposes of determining "the

Ms. Barbara Newman/Ms. Gwen Ruda
December 12, 1986
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nature or content of a release or threatened release of a hazardous substance or pollutant or contaminant . . . from . . . a facility", CERCLA §104(e)(1), as amended, please see Exhibit 1 and 2 to this response; to the extent that "environmental quality monitoring" refers to air monitoring, Mr. Riley knows of no air monitoring tests on the subject property.

Attached hereto as Exhibits 1-8 and incorporated herein by reference are copies of documents responsive to EPA's requests for information nos. 1 and 2, in addition to the report previously sent to you with my letter of October 14, 1986. References to Well No. 1 in these exhibits are references to the production well located on the subject premises. To the extent that such documents contain information that is not the subject of the November 20 information request, and which does not relate to the subject property, such information has been redacted. In addition to the ground water analyses described in the exhibits, in 1977 a chemical analysis of well water from Production Well No.1 was performed by the Tanner's Council of America for inorganics only. These results showed .005 ppm total chromium, .0136 ppm lead, 298.3 ppm chloride, 900 dissolved solids and 218.7 pH.

Request No. 3

Identify the person(s) responding to this information request.

Response No. 3

This response is by Mary K. Ryan, as attorney for John J. Riley, Jr.

Request No. 4

Identify all persons consulted in the preparation of the answers to these requests.

Response No. 4

No response to this paragraph is required as it exceeds EPA's statutory authority and the information is also protected under attorney-client and work product privileges. Notwithstanding the foregoing objection, and without waiver of the same, Mr. Riley states that the Riley Leather Company, 228 Salem Street, Woburn, Massachusetts, was consulted with respect to this response.

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Request No. 5

Identify all documents consulted, examined, or referred to in the preparation of the answers to these requests. If any of these requests cannot be answered in full, then answer to the extent possible, and specify each reason for your inability to answer the remainder, and state whatever information or knowledge you have concerning the unanswered portion.

Response No. 5

See response to Request No. 4 above, and Exhibits 1-8.

Request No. 6

Identify any documents requested above that have been transferred voluntarily or involuntarily to others or have been otherwise disposed. For each document transferred, identify each such document, identify the person to whom it was transferred, describe the circumstances surrounding such transfer or other disposition, and state the date or approximate date of such transfer or other disposition.

Response No. 6

Mr. Riley believes that some or all of Exhibits 3-8 may be copies of documents which were transferred to the Riley Leather Company in connection with the sale of the tannery business in May 1985. To the best of his knowledge and belief, Riley Leather Company has no additional information responsive to these requests.

If you require further information or assistance, please conduct the undersigned.

JOHN J. RILEY, JR.

By his attorneys,



Mary K. Ryan
Nutter, McClennen & Fish
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600 Atlantic Avenue
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Wells 6+H
11.8.
11.82

21E ASSESSMENT OF
J. J. RILEY PROPERTY
228 SALEM STREET
WOBURN, MASSACHUSETTS

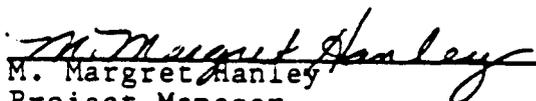
April 19, 1985

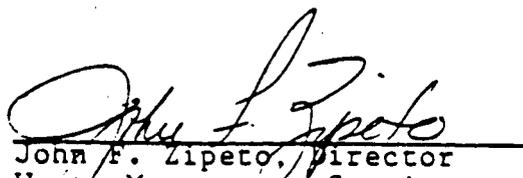
Submitted to
Nutter, McClennen & Fish
Boston, Massachusetts

by

Geotechnical Engineers Inc.
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Project 84442


M. Margaret Hanley
Project Manager


John F. Zepeto, Director
Waste Management Services

EXECUTIVE SUMMARY

The objective of this assessment is to provide data for the evaluation of the John J. Riley Co., Inc. property at 228 Salem Street in Woburn, Massachusetts in regards to Massachusetts General Law, Chapter 21E. Information obtained during this assessment has been used to evaluate the site for the presence or absence of hazardous materials. This assessment includes a review of the site history, the hydrologic and geologic setting, identification of the manufacturing process employed at the site, summary of the materials used and the waste generated at the facility, and a summary of the chemical analysis performed on waste and groundwater during previous investigations. No chemical analysis was performed during the present investigation.

Geotechnical Engineers Inc. (GEI) determined that while the John J. Riley Co., Inc. currently uses and has in the past used chemicals which are hazardous, the company does not generate hazardous waste. Additionally, a review of the operating history of the John J. Riley Co., Inc. suggests that only small quantities of hazardous materials used at the site have been discharged to the environment. Finally, previous environmental sampling of soil and groundwater at the site suggests that there is no threat to human health or the environment due to the presence of hazardous material or oil. It is GEI's professional opinion, based on data presented in this report, that environmental conditions at the John J. Riley Co., Inc. site do not warrant further investigative action by the Massachusetts Department of Environmental Quality Engineering.

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1. OBJECTIVE

The objective of this assessment is to provide data for the evaluation of the John J. Riley Co., Inc. property at 228 Salem Street in Woburn, Massachusetts in regards to Massachusetts General Law, Chapter 21E. Information obtained during this assessment has been used to evaluate the site for the presence or absence of hazardous materials. This assessment includes a review of the site history, the hydrologic and geologic setting, identification of the manufacturing process employed at the site, summary of the materials used and the waste generated at the facility, and a summary of the chemical analysis performed on waste and groundwater during previous investigations.

2. SITE LOCATION/DESCRIPTION

The John J. Riley Co., Inc. is located at 228 Salem Street, Woburn, Massachusetts. The site location is shown in Fig. 1, and a plan of the site is shown in Fig. 2. The property is approximately 15.8 acres and is bounded by the following:

- ° Property occupied by Bio Assay Inc. to the north.
- ° The Boston and Maine Railroad right-of-way to the east.
- ° Salem Street to the south.
- ° Wildwood Street to the west.

The base plan for Fig. 2 is from city of Woburn topographic maps. The topographic maps were prepared in 1966 and may therefore be incorrect where excavation and/or filling has been performed. Wildwood Street was added to the map by GEI.

The tannery has been in operation at this location since 1915.

The tanning operation takes place in two large gray, wood-framed buildings (Buildings 1 and 2). Two wood-framed office buildings abut Salem Street south of the tannery buildings. There are several areas and structures which are associated with the tanning operation as follows (refer to Fig. 2):

- ° A hide storage area approximately 170 ft by 300 ft. Hides are stacked on pallets in this area after arriving at the site by truck. The hides have been salt cured before storage in this area. This area is paved.
- ° A drum storage area where empty drums which contained chemicals used in the tanning process are stored awaiting pick-up by a barrel recovery firm. This area is paved. *Whitney?*
- ° A bag house north of Building No. 1 where dust from the buffing of hides is collected. This dust is transferred to a small lagoon just north of the bag house.
- ° A catch basin north of Building 2. Effluent from the tanning operation, containing solid and liquid wastes, enters the catch basin. Solids settle out and the

liquid effluent enters the city of Woburn sewer which connects with the MDC Wilmington trunk sewer main. The sewer runs north from Salem Street between the hide storage area and the catch basin and then northeast under the B&M Railroad.

Was this ever tested for EP, PH?

- ° An area north of the hide storage area and adjacent to Wildwood Street which has been used in the past to landfill sludge from the catch basin. Sludge was land-filled in this area up until 1975 and was recently excavated and stockpiled nearby awaiting removal from the site. Sludge from the catch basin is now disposed of on the slope between the catch basin and the pump house for Production Wells #1 (PW #1).
- ° An oil-fired power plant north of Building 1. Three 15,000 gallon underground storage tanks are located adjacent to the power plant.
- ° A pump house for Production Well #1 (PW #1) is approximately 300 ft northeast of the catch basin adjacent to the B&M Railroad tracks. PW #1 is operational but is seldom used. A second well, currently used for production water, is located on property owned by Wildwood Conservation Trust approximately 400 ft northeast of PW #1. The second well is called Production Well #2 (PW #2.)

The site is intersected by a Woburn City Sewer easement which extends approximately 600 feet north from Salem Street, and then northeast towards the B&M Railroad easement, where the Woburn City Sewer discharges to the Metropolitan District Commission Wilmington trunk sewer main. The Riley tannery has been discharging effluent into the Woburn City Sewer since approximately 1925.

The land east and north of the John J. Riley Co., Inc. property is zoned for industrial use, and there are numerous small businesses in this area. The properties abutting or close to the Riley property are described below. Previous use of the property is noted where information was available.

Murphy's Waste Oil Service

This property is located east of the Riley property and the B&M Railroad and fronts on Salem Street (No. 252). The primary activity on this property is the collection and storage of waste oil before disposal.

Whitney Barrel Company

This property is located east of Murphy's Waste Oil Service along Salem Street (No. 256). The primary activity on this property is the reclamation of chemical storage drums.

Beatrice Foods Co. (now Wildwood Conservation Land)

This property is located north of Murphy's Waste Oil Service and Whitney Barrel Co., beside B&M Railroad right-of-way. This land is unused except for a water supply well used by the John J. Riley Co., Inc.

Bio Assay, Inc.

This property is located north of the Riley property along Wildwood Street. The primary activity on this property is research and testing concerning animal toxicology.

Lechmere Warehouse

This property is located north of the Bio Assay property, between Wildwood Street and the B&M Railroad right-of-way. The primary activity on this property is the storage of merchandise prior to distribution.

Johnson's Roses

This property is located west of the Riley property and Wildwood Street. The primary activity on this property is the growing of roses.

215 Salem Street

This property is located at the intersection of Wildwood and Salem Streets, south of Salem Street. An office building is located at the rear of the property. This property is the former site of the Murray Leather Co., a leather tannery.

219 Salem Street

This property is located directly across Salem Street from the Riley property. The primary site activity is the storage and sale of concrete forming supplies.

235 Salem Street

This property is located directly across Salem Street from the Riley property. The primary site activity is the sale of banding saws and knives.

The area west of Johnson's Roses is zoned for residential use to the border with the town of Burlington.

3. ENVIRONMENTAL SETTING

The John J. Riley Co., Inc. site is located west and adjacent to the Aberjona River, which has been the subject of investigations performed by or at the direction of the United States Geologic Survey (USGS), the United States Environmental Protection Agency (US EPA), and private property owners. Information regarding the geologic and hydrologic setting of the site presented here is based on information developed during these investigations. A list of the references used during this assessment is presented in Section 8.

3.1 Topography

The topography of the Riley site is generally level over the southern half but slopes gradually to the north to a drainage swale. In the northern half of the site the topography varies. There is a small hill adjacent to the northerly property line which rises to El 113 ft (NGVD). From the vicinity of the catch basin ground surface drops from about El 80 down to about El 55 at PW #1. East of Building 2 ground surface drops from about El 80 adjacent to the building down to El 50 along the B&M Railroad right-of-way. In general, the topography of the site decreases from west to east.

Geology/Hydrology

Surface runoff on the site generally drains to the east. Runoff from the north and south halves of the site drains to the swale which cuts across the site from west to east. It is reported by Mr. John Riley that a stream flows intermittently in the swale.

The Riley site is located approximately one quarter of a mile west of the Aberjona River which is within the Mystic River Drainage Basin. A USGS study (Ref. 8) reports expected well yields of 300 gpm in the area of the site. The aquifer consists of sands and gravels overlying bedrock. Borings performed during YE²ARS investigation in 1983 (Ref. 7) indicate that the subsoils consist of coarse sand, gravel and boulders overlying bedrock. (The location of monitoring wells installed by YE²ARS are identified in Fig. 2.) Based on water levels measured in observation wells installed on the site during YE²ARS investigation, it appears that groundwater flows from west to east over the site. The groundwater level measurements were taken while only Well PW #2 was operating.

The YE²ARS report concluded, however, that based on the results of measurements of drawdown in PW #1 while pumping PW #2, the direction of groundwater flow on the site is not significantly affected by pumping at PW #2. In our opinion, the conclusion appears reasonable based on the available data.

The city of Woburn obtains its drinking water supply from the Metropolitan District Commission (MDC) and Spot Pond. The Aberjona River Valley proximate to the Riley site is designated as a water resource area within the city of Woburn and two high yield production wells (Wells G and H) are situated northeast of the site. Existing information indicates that these wells are located upgradient of the Riley site. The wells were closed in 1978 when volatile organic compounds were detected in water from the wells. The source of the contamination affecting the wells is currently under investigation by the USEPA and their consultant, NUS Corporation.

Groundwater from the Riley Production Well No. 2 (PW #2), which is situated on property owned by the Wildwood Conservation Corporation, is known to contain significant levels of chlorinated volatile organic compounds, many of which have been detected in Woburn Supply Wells located northeast of the Riley tanning site. Groundwater from Production Well No. 1 has exhibited (based on chemical testing completed in 1983) only trace levels of chlorinated volatile organic compounds. The source of the contamination in the Riley wells is unknown. Samples collected by NUS Corporation and Beatrice Foods Corp. during a hydrogeologic investigation of the Wildwood property indicate that soil and groundwater northwest and south of Production Well #2 is contaminated.

Additionally, information obtained by YE²ARS during a hydrogeologic assessment of the Riley site indicates that groundwater migrating west to east from the Riley site contains only trace levels of VOC's and, accordingly, even if drawn toward PW #2 is not a probable source of contamination in PW #2.

4. MATERIALS/WASTE ASSOCIATED WITH TANNING PROCESS

The John J. Riley Co., Inc. is a medium-sized, chrome cowhide leather tannery. The principal product is leather for footwear.

The John J. Riley Co., Inc. is not an EPA generator of hazardous material nor does the facility require a Resource Conservation Recovery Act (RCRA) permit for the storage or handling of hazardous material. The facility does use small quantities of materials which are considered hazardous by US EPA and DEQE, however. The materials include:

Chromium: The tannery uses a chromium tanning process. This involves converting hexavalent chromium (Cr^{+6}) which is an EPA hazardous substance into trivalent chromium (Cr^{+3}) which is not a hazardous material. Only the trivalent chromium is introduced into the actual tanning process. Waste streams generated during the tanning process do not, therefore, contain Cr^{+6} and are not considered hazardous by US EPA or DEQE.

Solvents: Solvents are used at the facility in the application of lacquers and finish coatings to the tanned hides. These solvents include:

- Butyl Acetate
- Butoxyethanol
- Diisobutyl ketone
- Methoxyethanol

The solvents are used as a carrying medium for lacquers and finishes which are applied directly to finished hides. Waste solvent is not generated during this process since residual solvents will vaporize upon application. Of the solvents listed above, only butyl acetate is identified as an EPA hazardous substance. This designation is due to the flammability of the solvent. No water quality standard for butyl acetate has been established, and the compound is not an EPA hazardous waste.

Finally, small quantities (less than 1 gallon/year) of the chlorinated solvent 1,1,1-trichloroethane were used at the facility prior to 1979 to clean one embossing plate.

Benzidine Dye: Benzidine based dyes were used by the John J. Riley Co., Inc. until the mid-1960's. Water used to wash dyed hides was discharged to the catch basin. Solids, which settled out of the wash water, were piped to lagoons at the northwest portion of the site and the effluent was

discharged to the sewer. It is expected, therefore, that trace concentrations of benzidine dye were present in sewer effluent and may be present in solids which were landfilled on the site.

Disinfectants: According to employees at the Riley facility, the commercial product Dizene™, which contains orthodichlorobenzene, was used as a disinfectant in the hide wash water from about 1972 to 1982. Dizene™ which is an antiseptic/disinfectant, was used on weekends and during plant shutdowns when the hides would be soaked over a longer period of time. Dizene™ diluted with water was also used as a disinfectant and deodorizer in the floor drains. It is estimated that 1100-2200 lbs of Dizene™ were used annually between 1979 and 1982 at the Riley facility. Dizene™ introduced to the washwater and flow drains is expected to have discharged to the sanitary sewer. Sediments settled from wash water and landfilled at the northwest corner of the site may contain trace concentrations of Dizene™, or the constituents of Dizene™, including orthodichlorobenzene. Orthodichlorobenzene is an EPA hazardous substance.

Fuel Oil: The Riley tannery maintains a power plant which consists of two boilers with a maximum output potential of 25,000 lbs of steam per hour. The boilers are fueled by No. 3 Bunker C. fuel oil, which is stored in three 15,000 gallon underground storage tanks situated north of the machine shop and west of the boiler room. These tanks were installed in 1981, to replace the original tanks used at the facility. Oil is considered a regulated material according to Massachusetts General Law, Chapter 21E.

In addition to the material described above, the John J. Riley Co., Inc. generates solid and liquid waste which is not considered a hazardous material. These wastes include:

Process Effluent: The tannery process may generate 350,000 - 400,000 gallons of waste water per day. Waste water is discharged to a catch basin located north of Building No. 2. Solids are permitted to settle out of the waste water and the liquid fraction is discharged to the Woburn City Sewer System.

Effluent which is discharged to the sewer system is monitored by the Metropolitan District Commission. The John J. Riley tannery is currently operating under a voluntary consent decree with the MDC to upgrade the waste treatment system at the facility.

Sewage Sludge: Solids which accumulate in the catch basin are dredged periodically and landfilled on site. This

landfilling activity has been observed by DEQE. Currently, sludge which is disposed of on the slope between the settling basin consists of soluble and insoluble hide material, hair, blood, dirt, manure, salt, lime, chromium hydroxide, and ferrous hydroxide. Representative samples of sludge which has been landfilled on the site have been analyzed using the EPA EP toxicity test. The sludge was determined to contain acceptable limits of hexavalent and total chromium, as established by EPA and DEQE. The sludge is not identified by EPA or DEQE as a hazardous waste.

Buffing Dust: Dust from the buffing room is collected in a bag house located adjacent to Building No. 1 and is disposed of in a small lagoon situated next to the bag house. Buffing dust is a particulate waste composed of fine shavings from the finished hides. According to EPA and DEQE, it is not a hazardous waste.

Steel Drums: Some of the raw material used at the tannery is delivered in 55-gallon steel drums. Empty drums are stored on site for short periods of the time until they are sent to the barrel reclamation firm in Woburn.

Leather Trimmings: Scrap leather is sold to other manufacturing companies.

Miscellaneous Trash: Trash generated at the John J. Riley Co., Inc. is either incinerated on site or removed from the site by a private trash collecting company.

Scrap Metal: Scrap metal is sent to the Stoneham Trading Company for reclamation.

5. SUMMARY OF PREVIOUS CHEMICAL ANALYSIS

5.1 Description of Chemicals Potentially Present On Site

Based on information presented in Section 4, hazardous chemicals or waste which are potentially present on the site as a result of waste management practices employed by the John J. Riley Co., Inc. include:

Benzidine: Residual benzidine dye may potentially be present in sewage sludges landfilled at various locations on the site. The benzidine would originate from solids precipitated out of wash water used to rinse dyed hides. Benzidine is a base/neutral organic compound and is a recognized human carcinogen. It is identified by EPA as a hazardous waste and priority toxic pollutant. No regulatory standards exist for permissible concentrations of benzidine in soil. The EPA Recommended concentrations in water to protect human health is zero. The criteria for an increased cancer risk of one in 100,000 is 1.2 nanograms per liter (ng/l) (USEPA, Benzidine: Ambient Water Quality Criteria, Washington, DC, 1980).

Orthodichlorobenzene: Orthodichlorobenzene is an active ingredient of the disinfectant "Dizene", which was used in rinse water at the tannery. Although it is likely that the orthodichlorobenzene, which is relatively soluble, remained in the rinse water and was carried from the facility in wash water, it is possible that trace concentrations of orthodichlorobenzene adsorbed to solids in the catch basin and is present in sludges which were landfilled on the site. Dichlorobenzene is considered an EPA Hazardous Substance, Hazardous Waste and Priority Pollutant. The EPA Health Advisory for chronic exposure of dichlorobenzene in drinking water is 134 micrograms per liter (ug/l) or parts per billion (ppb).

5.2 Groundwater Analysis Performed on and Adjacent to the Riley Tanning Site

5.2.1 Groundwater Samples

As part of the US EPA investigation of groundwater contamination in Woburn, samples of groundwater from Riley Production Well No. 1 (PW #1) were obtained and tested for priority pollutants which included volatile organics and base/neutral organic compounds. In addition, groundwater samples were obtained from four monitoring wells and PW #1 during YE²ARS investigation in October, 1983. These samples were analyzed only for the presence of volatile organics according to EPA Method

601. The results of the analyses of groundwater samples obtained on the Riley property are summarized in Table 2. The results are also summarized on Fig. 3 at the locations where the samples were obtained.

Volatile organic contaminants were detected in four of the five groundwater samples analysis reported in Table 1. The most significant levels of volatile organic contaminants were detected at PW #1 in 1980.

The contaminants detected at PW #1 have also been detected at Riley PW #2, which is situated approximately 400 feet northeast of PW #1. The relationship between contaminants detected in both the Riley Production Wells and the contaminants detected in Woburn Wells G and H is currently under investigation by US EPA's subcontractor NUS Corporation.

The most recent analysis of water from PW #1 (October, 1983) indicated the presence of only two volatile organic compounds: 1,2 transdichloroethene and trichloroethene, at concentrations less than 1 ppb, which is below the reporting limit for the analysis performed. Neither of these compounds are reported to have been used or disposed of on the Riley site.

Three volatile organic compounds were reported to be present in three of the four monitoring wells installed on the Riley tanning site by YE²ARS.

Chloroform was detected in B-4 and B-5, the locations of which are shown in Figs. 2 and 3. Chloroform, which is a trihalo methane, is a common contaminant in drinking water supplies as a result of chlorination. The DEQE has set a Regulatory Standard for permissible concentrations of trihalomethanes of 100 ug/l (ppb). The concentration of chloroform in water sampled at the Riley site ranged between .8 and 1.7 ppb which is below the DEQE's drinking water standard for that class of chemical contaminants.

Chlorobenzene was detected in water sampled from B-2 at a concentration of 2.3 ppb and at B-4 at 20 ppb. The source of the chlorobenzene is not known. It is possible, however, that chlorobenzene is occurring as a degradation product of orthodichlorobenzene or was present as a contaminant in the orthodichlorobenzene products used at the site. The maximum concentration of chlorobenzene detected is below the recommended permissible concentration in water to protect human health,

which is 488 ug/l (ppb). Groundwater contour elevations for the site indicate that B-4 is the most upgradient well at the site. This suggests that contaminants present at B-4 may result from contamination migrating on to the site from west of Wildwood Street. Existing data are insufficient to demonstrate this however. Chlorobenzene was not detected in B-1 or PW #1 when sampled by YE²ARS in 1983. The absence of the contaminants in these wells, which are downgradient from B-4 and B-2, suggests that chlorobenzene is not migrating off of the Riley property.

1,2 trans dichloroethene (Also referred to as 1,2 dichloroethylene) was detected in groundwater in trace concentrations (.7 ppb) at B-2. The source of the contaminant, which is an EPA priority toxic pollutant, is unknown. An EPA Health Advisory for 1,2 trans dichloroethene in water to protect human health has not been established due to insufficient data. 1,2 trans dichloroethene was also detected in trace concentrations (.4 ppb) in water from PW#1.

A complete analysis for EPA Priority Pollutants was performed on water from PW #1 by Ecology & Environment (E&E) in 1980. This is the only analysis performed which would detect benzidine in water at or adjacent to the Riley site. The compound was not detected in the sample collected by E&E. Since PW #1 is downgradient of the Riley site, it is probable that contaminants migrating from the Riley site would be detected in this well. The lack of benzidine in groundwater at this location suggests that benzidine is not present as a contaminant at this time in groundwater migrating from the Riley tanning site to the Aberjona River Valley.

5.2.2 Sludge Samples

EP toxicity analyses of the sludge landfilled on the Riley property, were performed during YE²ARS investigation in July 1983. The results of the EP toxicity tests are summarized in Table 2. In May 1982, samples of the landfilled sludge were obtained by personnel from the John J. Riley Co., Inc., sent to a DEQE approved laboratory, and analyzed for volatile organic chemicals. The results are summarized in Table 3.

The results of EP toxicity tests and volatile organic analysis, reported in Tables 2 and 3, indicate that sludges landfilled at the site do not exhibit characteristics which would cause the waste to be identified

as a hazardous waste. The analysis would not detect benzidine in the sludges. However, no regulatory standard for permissible concentrations of benzidine have been established by DEQE or EPA.

6. CONCLUSIONS

In our professional opinion, based on our review of the available information and data presented in this report, we make the following conclusions regarding the 21E assessment of the John J. Riley Co., Inc. property:

1. The John J. Riley Co., Inc. site is occupied by a chrome tanning facility which uses or has used hazardous material and/or potentially hazardous material and oil in a tanning process. These materials include hexavalent chrome, nonchlorinated polar solvents, benzidine-based dyes, and disinfectant which contained orthodichlorobenzene. The J. J. Riley Tanning company is not a generator of hazardous waste, however, according to US EPA and DEQE.
2. Evaluation of waste management practices employed at the John J. Riley Co., Inc. suggests that trace concentrations of benzidine and orthodichlorobenzene may have been introduced to the environment via the land-filling of sewage sludges on the site.
3. Groundwater sampling from wells installed on the Riley tanning site by YE²ARS in 1983 revealed trace concentrations (less than 20 ppb) of volatile organic compounds. The source of these contaminants is unknown. It is possible, however, that one of the compounds, chlorobenzene, is present as a result of the degradation of orthodichlorobenzene, which was present in a disinfectant used at the tannery.
4. The concentrations of volatile organic compounds detected are small and are below the recommended permissible concentration in water to protect human health or current EPA Health Advisories for all of the compounds except 1,2,trans dichloroethene. No permissible concentration or SNARL has been set by EPA or DEQE for 1,2,trans dichloroethene due to insufficient data.
5. The most recent analysis of water from Riley PW #1 indicates that groundwater at that

location contains only trace concentrations (less than 1 ppb) of two volatile organic compounds. One of these compounds, 1,2,trans dichloroethene, has been detected on the Riley site at a concentration of less than 1 ppb.

6. Riley Production Well #1 was sampled for US EPA priority toxic pollutants by Ecology & Environment Inc. (E&E) 1980. US EPA priority toxic pollutants include benzidine, which may be present in sludges landfilled at the site. Benzidine was not detected in groundwater from PW #1, sampled by E&E.
7. Groundwater contours measured by YE²ARS in 1983 indicate that groundwater on the Riley site flows west to east toward the Aberjona River. Therefore, PW #1 and B-1 represent the most downgradient wells on the Riley site. The absence of chlorinated volatile organic compounds in B-1, the presence of only trace concentrations of chlorinated organics, and the absence of benzidine in PW #1 suggests that groundwater migrating from the John J. Riley Co., Inc. site is not a probable source of the groundwater contamination present within the Aberjona River Valley.
8. Sampling of landfilled sludge at the Riley tanning site for EP toxicity characteristics and volatile organics indicate that sludge at the site does not exhibit those characteristics of hazardous waste, according to US EPA and DEQE. Although the sludge has not been analyzed specifically for nonvolatile organic compounds, including benzidine, we note that no standards or permissible concentration for solid waste have been established.
9. Significant levels of volatile organic contamination have been detected in groundwater on land east of the Riley tanning site, including land presently owned by Wildwood Conservation Corporation and in the City of Woburn Supply Wells G and H, situated northeast of the site. Data developed during previous investigations at the J. J. Riley Tanning site (YE²ARS, 1983) and by EPA and

DEQE indicate that the John J. Riley Co., Inc. site is not a probable source of the contamination detected east of the site. Additionally, Wells G and H, which are currently under investigation by EPA's consultant, NUS Corporation, are known to be located upgradient of the Riley tanning site.

10. As in all 21E site assessments, the information presented in this report is not sufficient to guarantee the presence or absence of hazardous waste or oil at the John J. Riley Co., Inc. Based on our analysis of the data presented in this report, however, it is GEI's opinion that conditions at the site do not suggest that a threat to human health or the environment currently exists at the site, nor does it indicate the need for further investigative action by DEQE.

7. LIMITATIONS

The conclusions contained in this report are based on the information described in this report. Information concerning chemicals used by the John J. Riley Co., Inc. was provided by personnel at the John J. Riley Co., Inc.. No new chemical laboratory testing was performed as part of this study. The conclusions provided by GEI in this report are based solely on the information reported in this document. Should additional chemical testing information become available, GEI will review it to confirm or modify conclusions presented in this report.

This environmental assessment and report was prepared by GEI for the use of the law firm of Nutter, McClennen and Fish, exclusively. However, if authorized by Nutter, McClennen & Fish, GEI acknowledges and agrees that this report may be used by said firm in the course of its representation of John J. Riley Co., Inc. and may be delivered to potential lenders, title insurers, purchasers and tenants.

This report has been prepared in accordance with generally accepted engineering practices as stated in our Standard Conditions for Engagement dated July 1, 1984 contained in Appendix A. No other warranty, expressed or implied, is made.

8. LIST OF REFERENCES

1. "Site Inspection Report of John J. Riley Company, December 1, 1980," Ecology and Environment.
2. "Inventory and Analysis of Existing Well Data for East and North Woburn, MA, January 9, 1981," Ecology and Environment, Inc.
3. "Interim Report on the Geology and Groundwater of North and East Woburn, April 3, 1981," Ecology and Environment, Inc.
4. "Interim Report on the Groundwater Quality of East and North Woburn, MA, May 6, 1981," Ecology and Environment, Inc.
5. "Chlorinated Solvent Contamination of the Groundwater, East Central Woburn, MA, March 8, 1982," Ecology and Environment, Inc.
6. "Evaluation of the Hydrogeology and Groundwater Quality of East and North Woburn, MA, Volume I, Final Report, June 25, 1982," Ecology and Environment, Inc.
7. "Hydrogeologic Investigation of the John J. Riley Tanning Co., Inc., 1983," Yankee Environmental Engineering and Research Services, Inc.
8. "Hydrology and Water Resources of the Coastal Drainage Basins of Northeastern, Massachusetts, from Castle Neck River, Ipswich, to Mystic River, Boston, 1980," Department of the Interior, United States Geological Survey.

TABLE 1 - CONTAMINANTS FOUND IN GROUNDWATER
 SAMPLES FROM J.J. RILEY TANNING CO. PROPERTY
 21E ASSESSMENT
 J.J. RILEY TANNING CO.

Compound	Concentration, ppb					
	PW #1		B-1	B-2	B-4	B-5
	A	D	D	D	D	D
1,1,1 trichloroethane	28	ND	ND	ND	ND	ND
1,2 trans dichloroethene	12	0.4	ND	0.7	ND	ND
trichloroethene	53	0.4	ND	ND	ND	ND
chlorobenzene	10	ND	ND	2.3	20	ND
chloroform	ND	ND	ND	ND	1.7	0.8

Notes:

1. Key to sampling:

- A. Samples collected by Ecology and Environment, Inc. between November 12, 1980 and March 2, 1980. ND indicates compound not present at or above the unspecified method detection limit.
- D. Samples collected by YE²ARS on October 12, 1983. ND indicates compound not present at or above the method detection limit of 0.1 ppb.

Geotechnical Engineers Inc.

Project 84442
 April 19, 1985

TABLE 2 - RESULTS OF EP TOXICITY ANALYSES ON
 SAMPLES OF LANDFILLED SLUDGE
 21E ASSESSMENT
 J.J. RILEY TANNING CO.

<u>Constituent</u>	<u>Concentration in ppm</u>				<u>Detection Limit</u>
	<u>Sample 0</u>	<u>Sample N(2)</u>	<u>Sample B</u>		
METALS					
As	ND	ND	ND	ND	0.005
Ba	ND	ND	ND	ND	0.1
Cd	ND	0.008	ND	ND	0.005
Cr (total)	0.35	ND	0.27	ND	0.1
Cr (hexavalent)	0.17	ND	ND	ND	0.1
Pb	0.10	0.11	.11	1.2	(5)
Hg	ND	ND	ND	ND	0.002
Se	ND	ND	ND	ND	0.005
Ag	ND	ND	ND	ND	0.01
Cyanide (ppm, wet weight)	0.66	6.5	--	--	(5)
Sulfide (ppm, wet weight)	ND	ND	--	--	5

NOTES:

- 1) Results reported in YE²ARS Report (Ref. 7)
- 2) Duplicate analyses
- 3) Sample locations as follows:
 O Old Lagoons
 N Slope northeast of Catch Basin
 B Buff Dust Lagoon
- 4) ND indicates not present at or above the method detection limit.
- 5) Detection limit not specified in referenced report.

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TABLE 3 - RESULTS OF ORGANIC ANALYSES OF
 LANDFILLED SLUDGE
 21E ASSESSMENT
 J.J. RILEY TANNING CO.

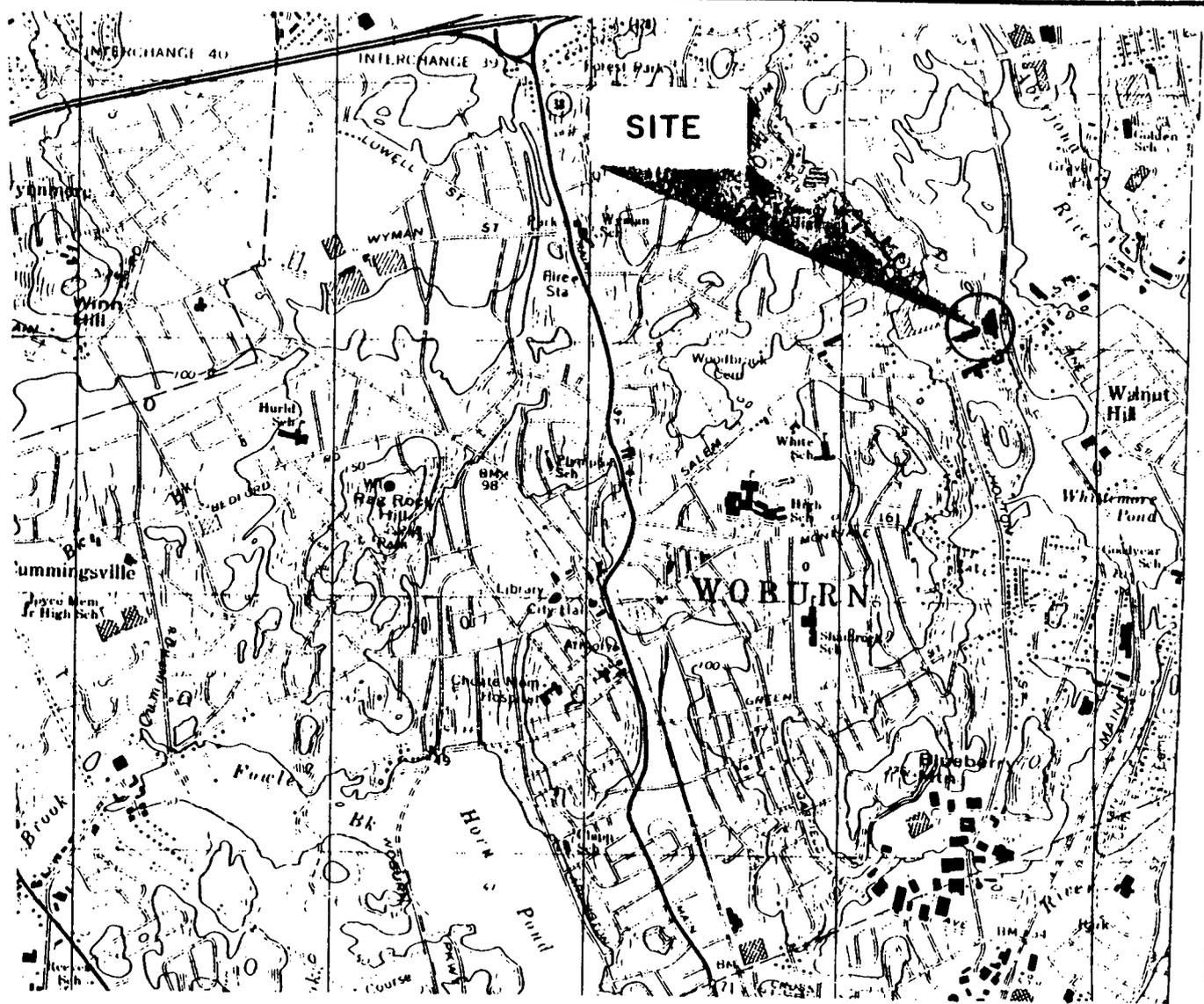
<u>Organic Chemical</u>	<u>Concentration (ppm)</u>		<u>Detection Limit</u>
	<u>Old Lagoons</u>	<u>Sample from Slope North of Catch Basin</u>	
Chloroform	ND	ND	0.05
Trichloroethane	ND	ND	0.005
Dichloroethylene	ND	ND	0.5
Trichloroethylene	ND	ND	0.01
Tetrachloroethylene	ND	ND	0.005
Benzene	ND	ND	0.1

NOTES:

1. Samples obtained May 27, 1982 by J.J. Riley Tanning Co. personnel. ND indicates compound not present at or above the method detection limit.

Geotechnical Engineers Inc.

Project 84442
 April 19, 1985



<p>J.J. Riley Tanning Co. Woburn, Massachusetts</p>	<p>21E Assessment 228 Salem Street Woburn, Massachusetts</p>	<p>SITE LOCATION</p>
<p> GEOTECHNICAL ENGINEERS INC. WINCHESTER • MASSACHUSETTS</p>	<p>Project 84442</p>	<p>March 22, 1985 Fig. 1</p>



SCALE: 1"=100'

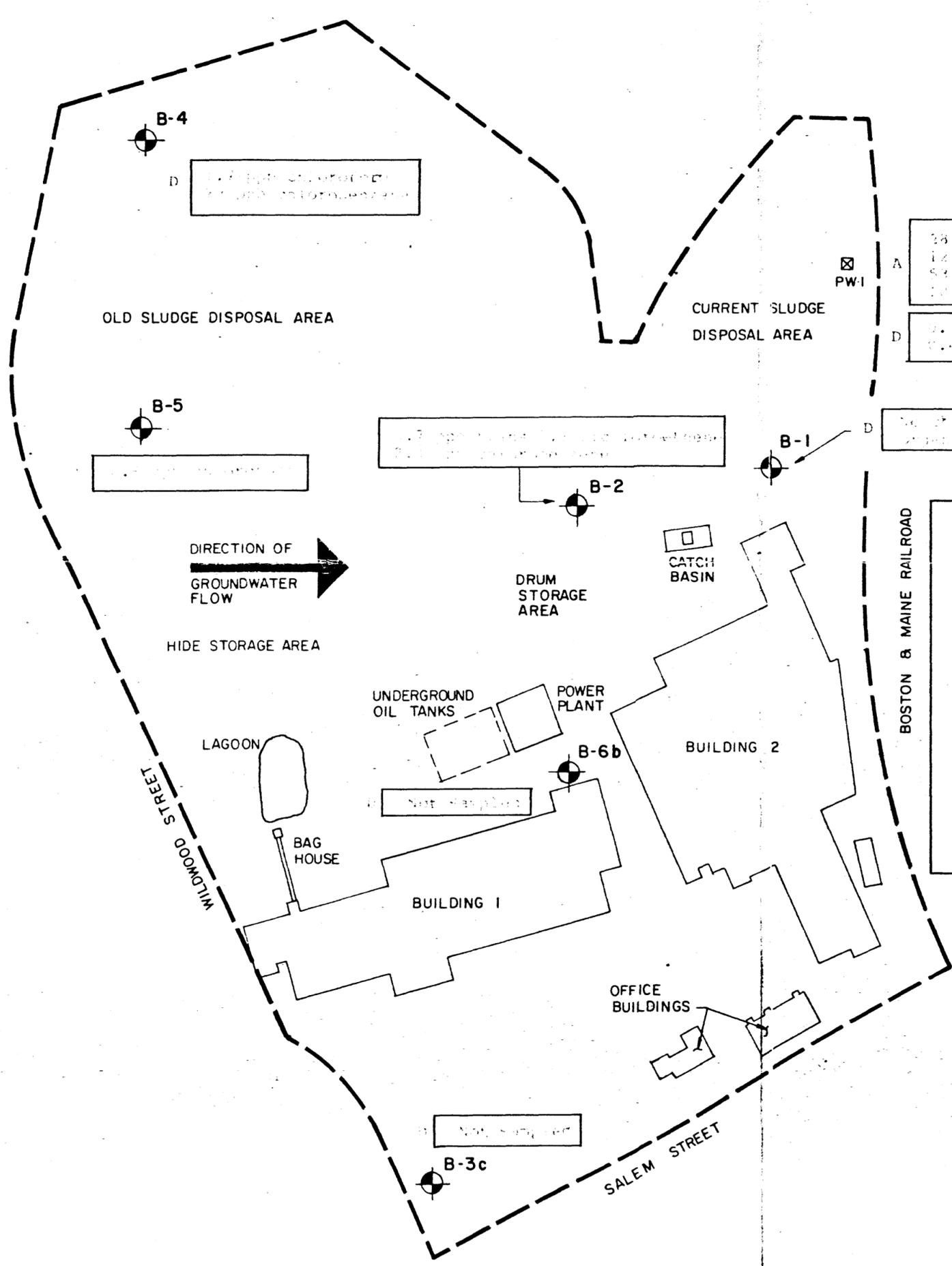
LEGEND

- B-1 Boring performed by Geometrics for YEARS investigation. Monitoring well installed.
- Property Line - J. J. RILEY TANNING CO.

NOTES

1. Base plan is from the city of Woburn topographic maps, dated 1966 and may not represent current conditions.
2. Boring locations and other information traced from YEARS report, Figure 5.

J. J. Riley Tanning Co. Woburn, Massachusetts	21E Assessment 228 Salem Street Woburn, Massachusetts	SITE PLAN
GEOTECHNICAL ENGINEERS, INC. WILMINGTON, MASSACHUSETTS	Project 84442	March 22, 1985 Fig. 2



A
 28 ppb vinyl trichloroethene
 12 ppb trans 1,2-dichloroethene
 53 ppb trichloroethene
 20 ppb chloroform

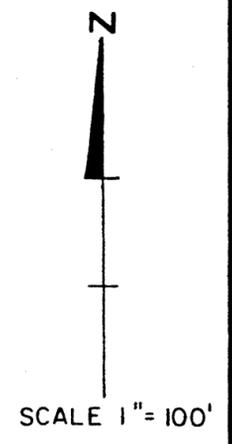
D
 0.1 ppb benzene, 0.001 ppb toluene
 0.1 ppb chloroform

0.7 ppb toluene, 0.001 ppb benzene
 0.1 ppb chloroform

0.1 ppb benzene, 0.001 ppb toluene
 0.1 ppb chloroform

LEGEND

	Monitoring wells installed in 1983 and 1984. Locations are shown on this map.
	Wellhead for monitoring well.
	Boxed areas indicate analytical results for monitoring wells. Analytical results are listed as follows:
A	Large analytical results by Analytical Laboratories, Inc. between November 12, 1983 and March 2, 1984 (Ref. 5).
D	Samples collected by YP&AW between 12/1/83 (Ref. 7).



J.J. Riley Tanning Co. Woburn, Massachusetts	21E Assessment 228 Salem Street Woburn, Massachusetts	CONTAMINANTS HISTORICALLY FOUND ON RILEY PROPERTY
GEOTECHNICAL ENGINEERING A COMMITMENT TO EXCELLENCE	Project 84442	March 21, 1985 Fig. 3

HYDROGEOLOGIC INVESTIGATION
of the
JOHN J. RILEY TANNING COMPANY INC.
228 SALEM STREET
WOBURN, MASSACHUSETTS

date ?

YE²ARS

YANKEE ENVIRONMENTAL ENGINEERING AND RESEARCH SERVICES, INC.
27 SALEM STREET
WOBURN, MASSACHUSETTS 01801
(617) 935-8700



ENVIRONMENTAL CONSULTANTS

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Where are plates?

1.0 Statement of Problem/Objective of Investigation

The John J. Riley Tanning Company is located in East Woburn approximately one mile west of the Aberjona River, north of and adjacent to Salem Street. The Boston and Maine (B&M) Railroad easement and tracks abut the Riley property to the east (Figure 1). Two production wells are located northeast of and are utilized by the tanning facility. Production Well #1, which is located west of the B&M Railroad easement on Riley property is not presently in use and is reported to be in poor condition (Riley, 1980). Production Well #2, which is located east of the B&M Railroad easement, is located on property owned by Beatrice Foods Company. The John J. Riley Company, Inc. maintains the water rights to Production Well #2, which provides up to 400,000 gallons of water for the tannery process daily.

Groundwater samples collected from Production Well #2 (PW#2) have been shown to contain significant levels of chlorinated volatile organic compounds. Groundwater collected from Production Well #1 (PW#1) has also exhibited chlorinated volatile organic contamination, although to a lesser extent. The source of the contaminant found in these wells is unknown. It has been suggested, however, that the source of contamination may be located on the John J. Riley property, which appears to be upgradient from both Production Wells (EPA, 1981).

The objective of this investigation is to determine the direction of groundwater flow on the John J. Riley property under typical pumping conditions at PW#2 and determine if groundwater contamination, if present, on the Riley property is contributing to the contamination of Production Wells #1 and #2.

The John J. Riley Tanning Company, Inc. property, which is the subject of this investigation, is situated on approximately 31 acres of land, bordered to the east by the Boston and Maine Railroad easement, to the west by Wildwood Street, to the north by property owned by Bioassay Systems, Inc., and to the south by Salem Street (Figure 1).

Topographic elevations at the Riley Site range between 113.1 National Geodetic Vertical Datum (NGVD) at the crest of a small drumlin north of Building #2 and along the northeastern edge of the property, and 48 NGVD at the well house for PW#1. Generally, topographic elevation declines from west to east. Surface drainage from the site is via an intermittent stream which flows from Wildwood Street east toward PW#1. Land elevations east of the Riley property and north of Salem Street is low, generally within the 100 year floodplain of the Aberjona River, and is under the protection of the Massachusetts Wetlands Protection Act, Chapter 131, Section 40 (Brady, 1983).

The Riley facility consists of a medium sized chrome-cowhide leather tannery of which the principle product is leather for footwear.

Two large buildings, which house the tannery, are located within the study area (Figure 1). A gray, one-story building (Building #1) which abuts Wildwood Street and the main parking lot, is used for washing tanned hides, streaking and buffing. The Machine Shop is also located at the northeast corner of Building #1. A second, two-story building (Building #2) encloses the beam house, tan coloring and finishing rooms, and a material storage area. A power plant, which houses two boilers, with a maximum output potential of 25,000 lbs. of steam per hour, is located north of the Machine Shop in Building #1. Three 15,000 gallon underground storage tanks are located west of and adjacent to the power plant. Administration and business offices are located in two woodframe buildings located at the southernmost end of the property along Salem Street. Finally, the brick pump house for PW#1 is located at the base of the slope at the eastern edge of the Riley property.

The Pump House for Riley's PW#2, which is located on property owned by Beatrice Foods, Inc. is located approximately 400' northeast of PW#1.

The Riley property is intersected by a Woburn City Sewer easement which extends approximately 600' north from Salem Street, and then northeast towards the B&M Railroad easement, where the Woburn City Sewer discharges to the Metropolitan District Commission Wilmington Trunk Sewer Main. The Riley Tannery has been discharging effluent into the Woburn City Sewer since approximately 1940 (Riley, 1983).

The northernmost portion of the Riley property, west of the gravelly drumlin identified in Figure 1 is presently grassland. This area, which was previously a sand and gravel pit, was excavated and filled with sewage sludge from the Riley Tanning process prior to 1975 (Riley, 1983). A semi-paved lot north of Building #1 and south of the grassland area is used for raw hide material and refuse storage. An empty barrel and pallet storage area is situated on a paved area northeast of the Power Plant (Figure 1).

A catch basin which receives all liquid and semi-liquid waste generated during the tanning process is located north of Building #2. Solids are permitted to settle out of the waste stream and the liquid fraction is discharged to the Woburn City Sewer System.

Effluent which is discharged to the Sewer System has been analyzed for parameters selected by the Metropolitan District Commission (MDC) (Appendix A). Solids which accumulate in the catch basin are dredged on a regular basis and landfilled on site. Currently, sludge is disposed of on the slope between the settling basin and the pump house for PW#1. Solids from the settling basin consist of soluble and insoluble hide material, hair, blood, dirt, manure, salt, lime, and miscellaneous salts which are precipitated out of the waste stream by high alkalinity (chrome hydroxide and ferrous hydroxide). Representative samples of landfilled sludge from the settling basin have been collected and submitted for an EPA EP toxicity test. Sewage sludge on the Riley site was determined to contain acceptable limits of hexavalent and total chromium, as established by the Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Quality Engineering (DEQE) (Appendix A).

Dust from the buffing room, which is located in Building #1, is collected in a bag house and disposed of in a small lagoon located north of Building #1 and approximately 100' east of Wildwood Street (Figure 1).

Other solid wastes generated during the tanning process includes steel drums, which are sent to a barrel reclamation firm in Woburn, general trash, which is incinerated or removed from the site by a private trash collecting company, scrap metal, which is sent to the Stoneham Trading Company, and leather trimmings and shavings, which are sold to other manufacturing companies (Riley, 1983).

Sampling conducted by EPA between November 1980 and March 1981, and more recent sampling by John J. Riley personnel has shown that groundwater from PW#2 is contaminated with chlorinated volatile organic compounds. Levels of contaminants in water from PW#2 has on occasion exceeded 1000 ppb. In addition, lesser quantities of several chlorinated volatile organic compounds have been detected in PW#1 (Table 1).

The source of the contamination is unknown. Some of the contaminants present in PW#1 and PW#2 are also present in the City of Woburn's Municipal Production Wells G and H, which are located approximately 2000' northeast of Riley Production Well #2, and east of the Aberjona River (EPA, 1981).

This report will address, in part, the effect that groundwater quality at the Riley site may have on Production Well #2. It does not, however, address the relationship between contaminants in groundwater at Woburn Production Wells G and H and Riley Production Well #2.

TABLE 1
 CONTAMINANTS DETECTED IN PRODUCTION WELL #1 and #2
 1980 - 1983

Compound	Contaminants Detected (in parts per billion (ppb))			
	PW#2			PW#1
	A	B	C	A
1,1,1 trichloroethane	133	ND	6.6-9.4	28
1,2 trans dichloroethene	116	10	15-25	12
tetrachloroethylene	28	240	3.1-6.8	ND
trichloroethene	1372	5	358-540	53
benzene	ND	ND	----- ¹	ND
chlorobenzene	ND	ND	ND	10
chloroform	ND	20	2.8-3.7	ND
toluene	ND	ND	----- ¹	ND

¹Sample not analyzed for compound

KEY

- A - Samples collected by Ecology and Environment, Inc. of Buffalo, NY between November 12, 1980 and March 2, 1981 for U.S. EPA Investigation of East and North Woburn. From the Report of Chlorinated Solvent Contamination of the Groundwater, East Central Woburn, Massachusetts. Final Report, March, 1982. U. S. EPA.
- B - Samples collected by Ecology and Environment, Inc. on November 4 and 5, 1981 for U.S. EPA Investigation of Groundwater Contamination in Woburn, Massachusetts.
- C - Samples collected by employees of John J. Riley Company during modified pump test of PW#2. August 8, 1983.

2.0 Method/Results of Investigation

In order to address the objectives of the study, Yankee Environmental Engineering and Research Services (YE²ARS), Inc. implemented a phased investigation of the John J. Riley Company, Inc. Tannery. This section describes tasks of each phase of the investigation, the purpose of the tasks and summarizes the data obtained.

2.1 Review of Existing Data

The John J. Riley Tannery is located west of and adjacent to the Aberjona River Valley, which has been the subject of numerous hydrogeologic and environmental investigations. As a result, some limited data in groundwater quality, geology and land use data has been developed for the Riley property. In order to avoid the duplication of existing data during this study and to assist in the development of a hydrogeologic investigation of the site, YE²ARS evaluated numerous documents. References reviewed, which are summarized in Table 2, provided seismic data, groundwater flow conditions east of the site, and groundwater quality data. In addition, a topographic base map of the study area was obtained from the City of Woburn Engineering Department. This map, which was completed by Harry Feldman Inc. in 1966 for the City of Woburn, with a scale of 1" = 100', will be used as a base map for this investigation.

2.2 Excavation of Test Pits

In order to assess surficial geologic conditions, the presence or absence of subsurface waste, and to determine depth to the water table, YE²ARS excavated nine test pits on the Riley property. Test pit locations 1 - 9 are shown on Figure 2. Table 3 summarizes data obtained during the excavation of test pits. All test pits were excavated on August 23 by Arthur Pyburn & Sons Inc., General Contractors, under the supervision of YE²ARS geologist. No soil samples were collected for chemical analysis during test pit excavation. }

TABLE 2
REPORTS REVIEWED FOR
HYDROGEOLOGIC INVESTIGATION OF
JOHN J. RILEY TANNING COMPANY SITE

Ecology and Environment, Inc., May 6, 1981. Interim Report on the Geology and Groundwater of North and East Woburn, Massachusetts.
EPA FIT Project.

Ecology and Environment, Inc., April 3, 1981. Interim Report on the Geology and Groundwater of North and East Woburn, Massachusetts.
EPA, FIT Project.

Cook, D. K., 20 November - 17 December 1980. Site Inspection Reports for Severence Trucking Company, Inc., Aberjona Auto Parts, John J. Riley Company, Whitney Barrel Company, Atlantic Gelatin and Independant Tallow Company. EPA FIT Project.

U. S. Geologic Survey,, 1979 Photo Revisions. 1:25000 Topographic Sheets for the Boston North, Wilmington, Reading, and Lexington, Massachusetts Quadrangles.

Delaney, F. D., and Gay, F. B. Hydrogeology and Water Resources of the Coastal Drainage Basins of Northeastern Massachusetts from Castle Neck River, Ipswich to Mystic River, Boston. U. G. Geologic Survey Hydrologic Investigation Atlas No. 589 (1980).

Ecology and Environment, Inc., October 13, 1981. Report on the Groundwater Contamination by Trichlorethylene, East Woburn, Massachusetts.
Interim Report. EPA FIT Project.

TABLE 3
 DATA OBTAINED DURING EXCAVATION OF TEST PITS
 AUGUST 23, 1983
 (LOCATIONS OF TEST PITS ILLUSTRATED IN FIGURE 2)

<u>TEST PIT NO.</u>	<u>LOCATION</u>	<u>STRATIGRAPHY</u>	<u>COMMENTS</u>
1	North end of Site, South of Chain Length Fence, NW Edge of Drumlin	0-2' topsoil 2-9' gravel, large boulders 9'11" fine grey silt, sand, with gravel 11' compact silt and sand 11'3" bottom of excavation	Hole was dry.
2	Approximately 100' East of Wildwood, At Northern End of Site	0-1' topsoil 1-2" brown-beige fine sand 2-4' coarse sand, gravel 4-6' gravel and boulders 6-9' grey silt, sand, some cobble 9-11' clean grey-brown medium sand 11'8" grey sand, cobbles (till) (bottom of excavation)	Hole was dry.
3	Approximately 200' Southeast of TP#2	0-4' brown, medium sand 4-7' medium sand mixed with black peat-like sludge 7-9' wet sludge, some gravel. 10'7" bottom of excavation	Area was identified as an abandoned sand and gravel pit, which was used for tannery waste disposal. Water at 9'7".

TABLE 3 continued
 DATA OBTAINED DURING EXCAVATION OF TEST PITS
 AUGUST 23, 1983
 (LOCATIONS OF TEST PITS ILLUSTRATED IN FIGURE 2)

<u>TEST PIT NO.</u>	<u>LOCATION</u>	<u>STRATIGRAPHY</u>	<u>COMMENTS</u>
4	Excavated Area Approximately 150' East of Wildwood Street	0-3' topsoil, sand, gravel 3-7' black sludge 7-8 1/2" gravel, sharp stones, mixed with sludge 8 1/2" refusal	Water at 5 feet.
5	Stream Bed. North of Storage Area	0-3 1/2' loam, topsoil 3 1/2-4' sandy loam 4' refusal, very large boulders	Stream bed is dry. Area is being used as a vegetable garden.
6	Northern Edge of Hide Storage Area	0-10 1/2' misc. fill. includes sand, gravel, asphalt, chared timbers, brick, plastic, leather scraps, small amounts of tannery sludge. Woburn storm drain encountered at 5'. Excavation widened to complete hole.	Hole is dry.

TABLE 3 continued
 DATA OBTAINED DURING EXCAVATION OF TEST PITS
 AUGUST 23, 1983
 (LOCATIONS OF TEST PITS ILLUSTRATED IN FIGURE 2)

<u>TEST PIT NO.</u>	<u>LOCATION</u>	<u>STRATIGRAPHY</u>	<u>COMMENTS</u>
7	North of Power Plant adjacent to Paved Area	0-2' orange-brown sand 2-9'4" very large cobbles and boulders in fine sand	Hole is dry. Difficult to excavate.
8	East of Bag house	0-6'6" very large cobbles, and boulder in fine sand	Hole is dry.
9	East of Catch Basin, Southwest of PW#1	0-7' clean sand with coarse gravel, large cobbles	Hole is dry.

2.3 Installation of Monitoring Wells

Although hydrologic data is available for land located east of the Riley property and west of the Aberjona River, no hydrologic data has been developed for the site to date. In order to determine the direction of groundwater flow, depth to bedrock, subsurface geologic conditions, and provide groundwater quality monitoring locations, YE²ARS installed six monitoring wells on the John J. Riley property. Monitoring well locations are identified in Figure 2. Wells were installed between September 12 and October 17, 1983 by Geo-Metrics, Inc. under the supervision of YE²ARS geologist.

All wells were constructed with a 2" nominal PVC casing and screened over the entire length of the saturated thickness of soils penetrated. With the exception of B-6b, all wells were installed to bedrock. Depth to bedrock was confirmed by coring and sampling two to five feet of bedrock material. Detailed logs of subsurface soils were recorded during monitoring well installation. Soil samples were collected with a split-barrel sampler every five feet unless otherwise noted. The well specifications and drilling methods utilized during the investigation is presented in Appendix B. Well logs for each well are included in Appendix C.

Finally, YE²ARS monitored ambient air and soil samples during the installation of B-1 and B-2 with an HNU Systems Organic Vapor Analyzer (OVA). No significant concentrations (greater than 20 ppm) of volatile organic vapors were detected during the installation of these wells. ✓

2.4 Topographic Survey of Locations of Monitoring Wells, Test Pits and Other Locations

In order to construct an accurate groundwater contour map and bedrock elevation map of the site, YE²ARS contracted Dana Perkins Associates of Reading, Massachusetts to survey elevations and distances between selected monitoring wells, test pits and other features.

Approximately 20 points were surveyed and plotted on an overlay to the topographic base map of the site. Surveyed elevations are identified in Figure 2. A description of the work completed by Dana Perkins Associates at the John J. Riley Tannery is presented in Appendix D.

Although elevations and distances between test pits, monitoring wells and other features are accurate, many of the features depicted in Figures 1 and 2 (such as the location of Wildwood Avenue) are approximate and based on property maps obtained at the City of Woburn Engineering Department.

2.5 Measurement of Water Level Elevations in Monitoring Wells and Test Pits

In order to map groundwater contour elevations at the Riley site, YE2ARS collected depth to groundwater measurements from all monitoring wells and test pits located on site. Water level measurements from monitoring wells B-1, B-2, B-3c, B-4 and B-5 were collected with a Soil Test Automatic Water Level Indicator on both October 11 and 12, 1983. Water level measurements which were taken on October 11, 1983 were taken approximately five hours after PW#2 was shut down. Water level measurements taken on October 12, 1983 were taken while PW#2 was pumping at a typical rate (averaging 400,000 gallons per day). A water level measurement from B-6b was collected on October 23, 1983 with an Interface Probe manufactured by Oil Recovery Systems, also during normal pumping at PW#2. Water level measurements from test pits were collected during excavation of test pits on August 23, 1983. Table 4 summarizes water table elevations recorded for all monitoring points.

2.6 Groundwater Sampling

To determine if groundwater quality on the Riley property is contributing to the contamination of PW#2, it was necessary to determine if chlorinated volatile organics, such as those present in PW#2, are present in groundwater at the Riley site. YE2ARS collected groundwater

TABLE 4
 SUMMARY OF WATER LEVEL MEASUREMENTS
 FROM
 MONITORING WELLS AND OTHER LOCATIONS

Well Location	Ground. Surface Elevation (NGVD)	Depth to Groundwater				Groundwater Elevation (NGVD)
		10/11/83	10/12/83	10/23/83	8/23/83	
B-1	69.6	52' 10 5/8"	25' 10 5/8"			43.77
B-2	79.1	29' 11"	29' 8"			49.44
B-3c	90.8	37' 2 1/2"	37' 2 1/2"			53.6
B-4	86.7	18' 7 3/4"	18' 7 3/4"			68.06
B-5	73.6	3' 9 1/2"	3' 10"			69.7
B-6b	90 ¹			40' 7"		49.52
PW#1	55.4 (From top of Well House)	11.49 (From top of Well House)	11.91 (From top of Well House)			43.49
Test Pit #3	78 ¹				9' 7"	68.42

¹ Ground Surface Elevation Approximate

samples at B-1, B-2, B-4, B-5, and PW#1 for chemical analysis. Prior to sampling each well, YE²ARS calculated the approximate volume of water present in each well column, and bailed the equivalent of three well volumes of water from each well. Wells were permitted to equilibrate after bailing. A sample from PW#1 was collected from a discharge pipe located on the east side of the pump house, after water from PW#1 was pumped for five minutes (until clear).

Samples were collected in 40 ml vials with septum and delivered to Cambridge Analytical Associates in Watertown, Massachusetts for chlorinated volatile organic analysis. For a more complete description of sampling procedures utilized and Cambridge Analytical Associates (CAA) report on the sample analysis, see Appendix E. Table 5 summarizes the results of the analysis of water collected on the Riley site.

3.0 Evaluation of Results

3.1 Geology

Observations made during the excavation of test pits and the installation of monitoring wells indicate that unconsolidated glacial deposits between 10 and 60 feet thick, mantle a crystalline bedrock surface at the Riley site. Glacial deposits consist of a layer of poorly sorted coarse sand, gravel, cobbles and boulders with very little silt, ranging between 8 feet thick at Well B-5 and 34 feet at B-1, overlying a sequence of more uniform sand and gravel, in some instances exhibiting clay and silt varves with some occasional boulders.

As described in Section 2, tannery sludge has been mixed with soil and landfilled at the northwest portion of the site. A black, sludge resembling peat, with occasional ripraf, and hair was observed during the excavation of test pits 2, 3, 4, and 6. Samples collected during the installation of Wells B-4 and B-5 also include some tannery sludge in samples collected up to 17 feet deep.

Glacial sediment appear to thicken uniformly from west to east, as illustrated in Figure 3.

TABLE 5
 CHLORINATED VOLATILE ORGANIC ANALYSIS OF GROUNDWATER SAMPLES¹
 COLLECTED FROM WELLS ON JOHN J. RILEY TANNING COMPANY SITE
 WOBURN, MASSACHUSETTS³
 OCTOBER 12, 1983

	concentration ug/l (ppb) ²				
	<u>PW#1</u>	<u>B-1</u>	<u>B-2</u>	<u>B-4</u>	<u>B-5</u>
trans, 1,2-dichloroethene	.4	ND	.7	ND	ND
chloroform	ND	ND	ND	1.7	.8
trichloroethene	.4	ND	ND	ND	ND
chlorobenzene	ND	ND	.7	20	ND

¹ EPA Method 601. Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater EPA 600/3-82-057. EPA/EMSL, Cincinnati, Ohio.

² Concentrations less than 0.1 ug/l (ppb) are not detected.

³ Analysis completed by Cambridge Analytical Associates, Watertown, Massachusetts.

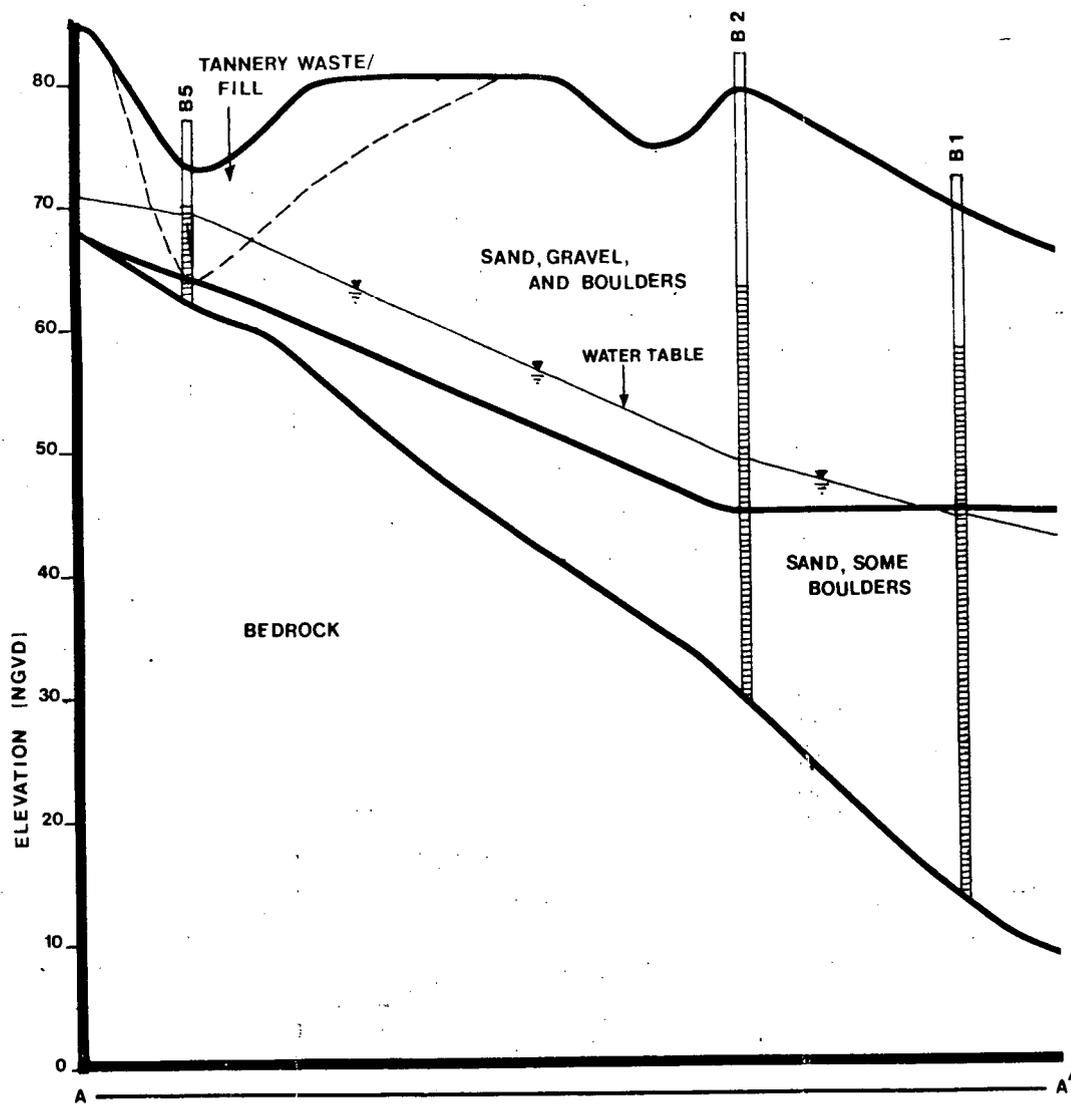


FIGURE 3. IDEALIZED GEOLOGIC CROSS SECTION VERTICAL SCALE EXAGGERATED (SEE FIGURE 4)

SCALE: 1' = 100'	APPROVED BY	DRAWN BY MH
DATE: 11/8/83		
JOHN J. RILEY TANNING COMPANY INC. 228 SALEM STREET, WOBURN, MASSACHUSETTS		
HYDROGEOLOGIC INVESTIGATION		DRAWING NUMBER 3

Depth to bedrock ranges from 62.6 feet above the NGVD at Well B-5 to approximately 10 feet above MGVD at PW#1. A contour diagram of the bedrock surface underlying the Riley site (Figure 4) suggests that the study area is located within a shallow buried glacial stream valley which discharged to the east.

3.2 Hydrology

Soil samples collected during monitoring well construction and observation made during excavation of test pits indicate that glacial soils present at the Riley site are moderately to highly permeable.

Surficial sediments consisting of poorly sorted coarse sand, gravel and boulder material which overly most of the site can be expected to exhibit permeabilities ranging between 10^4 and 10^2 ft³/ft²/day (ft/day) (USDI, 1981). This material was observed to be well drained in areas not used for sludge disposal. The more uniform sand and gravels observed at depth and in contact with bedrock were found to be saturated throughout the site, but appear to be more compact and slightly less permeable than the overlying sediments. Some compact silt and clay lenses, observed in samples of the uniform sand and gravel taken at B-3c, suggest that low to moderately permeable soils are present at depth on the Riley site.

Finally, sand and gravels mixed with tannery sludge were found to be generally saturated. Although no permeability tests were conducted during this investigation, permeabilities of the tannery sludge refuse are expected to be similar to naturally occurring peat and organic matter (10^{-2} to 10^{-3} ft³/ft²/day) (ft/day).

Based on groundwater elevation and surface elevations measured, YE²ARS constructed a groundwater contour elevation map of the Riley site (Figure 5). Groundwater elevation measurements are summarized in Table 4. Groundwater contour elevations indicate that groundwater flow direction is generally west to east across the site under typical

pumping conditions. The direction of local groundwater flow will, however, be effected by changes in surface topography and the configuration of the bedrock surface.

For example, the bedrock surface contour map (Figure 4) shows a slight trough which slopes from B-4 towards B-2. Groundwater migrating along the bedrock surface may be expected to travel from B-4 in the direction of B-2. Similarly, shallow groundwater may be expected to flow radially away from the drumlin identified in Figure 1.

Additionally, drawdown data previously collected by Riley personnel indicate that the total drawdown at PW#1 when pumping PW#2 at a rate of 530/gallons/minute is approximately 1 1/2 feet over a 24 hour period, indicating that flow conditions at PW#1 are influenced by pumping at PW#2 (Hanley, 1983). It is not known if flow at other monitoring wells installed by YE²ARS are influenced by pumping at PW#2. Groundwater contour elevations, which were measured under typical pumping conditions, do not suggest however that the predominant direction of groundwater flow on the Riley site is effected significantly by pumping at PW#2.

3.3 Groundwater Contamination

A total of four chlorinated organic compounds were identified in samples collected from monitoring wells located on the Riley property.

Trichloroethene (trichloroethylene), trans 1,2 dichloroethene (1,2 trans dichloroethylene) and chloroform, contaminants which are present in PW#2 (See Table 1), were identified in samples collected by YE²ARS at the Riley site. In addition, chlorobenzene was detected in two wells on the Riley property, but has not been found in groundwater sampled at PW#2.

Two contaminants detected in samples collected at PW#2 are present in groundwater from PW#1, located on Riley property. One of these contaminants, trans 1,2 dichloroethene is also present in another upgradient on-site monitoring well, B-2, but is not present in water sampled from wells upgradient of B-2, suggesting that the Riley property is the probable source of that contamination at PW#1. Trichloroethene, which is a major contaminant at PW#2 is also present in trace quantities (0.4 ppb) at PW#1. The absence of trichloroethene in all other wells sampled on the Riley property suggest, however, that the source of that contaminant is not the Riley property. Historical pumping of PW#1, or pumping during sampling may have induced contaminants from the vicinity of PW#2 towards PW#1.

Chlorobenzene was detected in groundwater samples collected from B-4 and B-2. Chlorobenzene has been detected historically in PW#1 in trace quantities (less than 10 ppb) (Table 1). Groundwater flow directions and sampling data indicate that the Riley property or an upgradient area northwest of B-4 is the source of chlorobenzene detected in B-4, B-2 and PW#1. Historical sampling data shows that PW#2 has not been contaminated with chlorobenzene, which may indicate that groundwater quality at PW#2 may not be affected by groundwater quality at PW#1 under typical pumping conditions.

The volatile organic compound chloroform was detected in the two most upgradient wells at the Riley site, B-4 and B-5 in concentrations less than 2 ppb. Chloroform was not detected in any of the downgradient wells located on site (B-1, B-2 and PW#1). Although chloroform has been detected in trace quantities at PW#2 (2.8 - 3.7 ppb), the absence of the compound in wells located downgradient of B-4 and B-5 suggest that the Riley site is not the source of chloroform detected at PW#2.

Groundwater flow at the Riley site under normal pumping conditions has been shown to flow west to east. Water level measurements taken at PW#1 during pumping and nonpumping conditions indicate that PW#1 is within the pumping of influence of PW#2. Chlorinated volatile organic compounds present at PW#1 could, therefore, contribute to the contamination at PW#2 under pumping conditions. Levels of trichloro-

ethene and trans 1,2 dichloroethene detected at PW-1 are however significantly less than those detected at PW#2. If chlorinated contaminants at PW#2 were the result of contamination at the Riley site, a significant concentration of those substances would be expected at PW#1, which is the most downgradient well on the Riley site and most proximate to PW#2.

The absence of significant concentrations of any of the compounds contaminating PW#2 in groundwater from PW#1 or from any other well on the Riley site indicates that the Riley site is not the principal source of contaminants detected at PW#2.

4.0 Summary/Conclusions

1. The geology of the Riley site is characterized by moderate to highly permeable glacial sediments, ranging between 11' and 60' thick overlying a crystalline bedrock surface which slopes from the west to the east. Landfilling of tannery waste has occurred on portions of the site north of the semi-paved storage area, and northeast of the catch basin, along a slope southwest of PW#1.
2. Existing data indicates that groundwater flow at PW#1 is influenced by pumping at PW#2. Contaminants present at PW#1 may therefore contribute to the contamination of PW#2 under pumping conditions. Groundwater contours illustrated in Figure 5, which represent groundwater elevations under typical pumping conditions of PW#2 do not indicate that groundwater upgradient of PW#1 is influenced toward PW#2. Flow direction appears to be west to east over the entirety of the study area.
3. Chlorinated volatile organic compounds were detected in monitoring wells installed by YE²ARS on the Riley site. B-1 which is located southwest of PW#1 was found to be free of chlorinated volatile organic contamination. PW#1, B-2, B-4 and B-5 contained trace amounts of four different compounds, three of which have been identified in samples collected at PW#2. None of the wells exhibited more than two contaminants .

Analysis of groundwater flow and contaminant distribution on the Riley site suggests that contaminants present on the Riley site would be detected at PW#1, and probably Wells B-1 or B-2 prior to entering the influence of pumping well PW#2.

Only two substances were identified in PW#1, both of which are present in PW#2; Trichloroethene (trichloroethylene) and trans 1,2 dichloroethene (trans 1,2 dichloroethylene) were present in concentrations of less than 1 ppb. Concentrations of these contaminants in PW#1 are significantly less than those detected in PW#2, suggesting that groundwater contamination at the Riley site is not contributing significantly to the contamination of PW#2.

In addition, only one of these substances, trans 1,2 dichloroethene was shown to be present at monitoring locations other than PW#1. It is possible, therefore, that a portion of the contaminants present at PW#1 are due to contamination downgradient of the well, which may be influenced toward PW#1 during pumping of that well prior to sample collection.

5.0 REFERENCES

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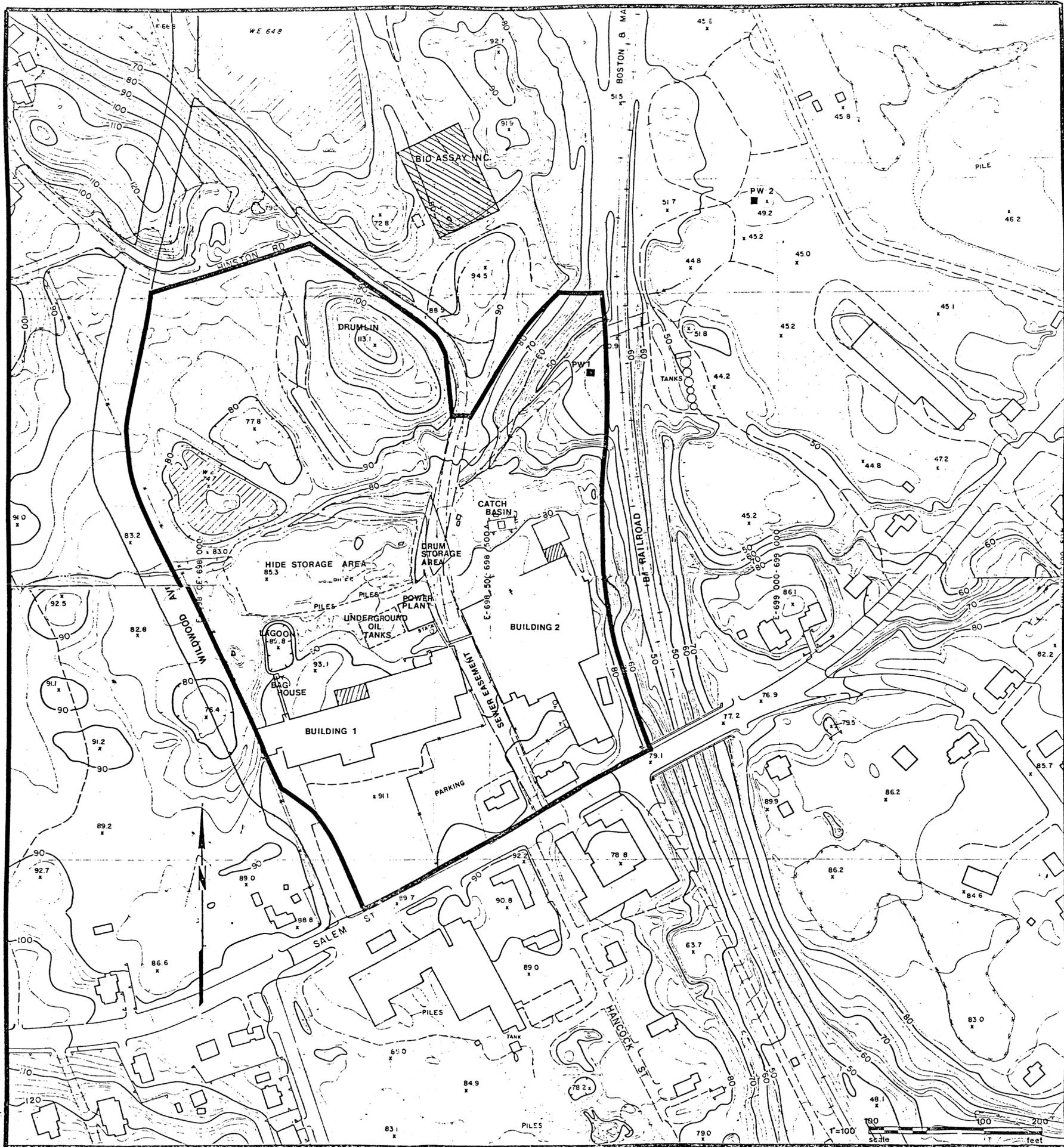
Ecology and Environment, Inc., April 3, 1981. Interim Report on the Geology and Groundwater of North and East Woburn, Massachusetts. EPA, FIT Project. Buffalo, New York.

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Riley, John J., October 1983. Personal Communication with M. Hanley, Yankee Environmental Engineering and Research Services, Inc., Concerning Discussion of Historical Land Use at Riley Tanning Company Inc., 228 Salem Street, Woburn, Massachusetts. President, John J. Riley Tanning Company Inc., Woburn, Massachusetts.

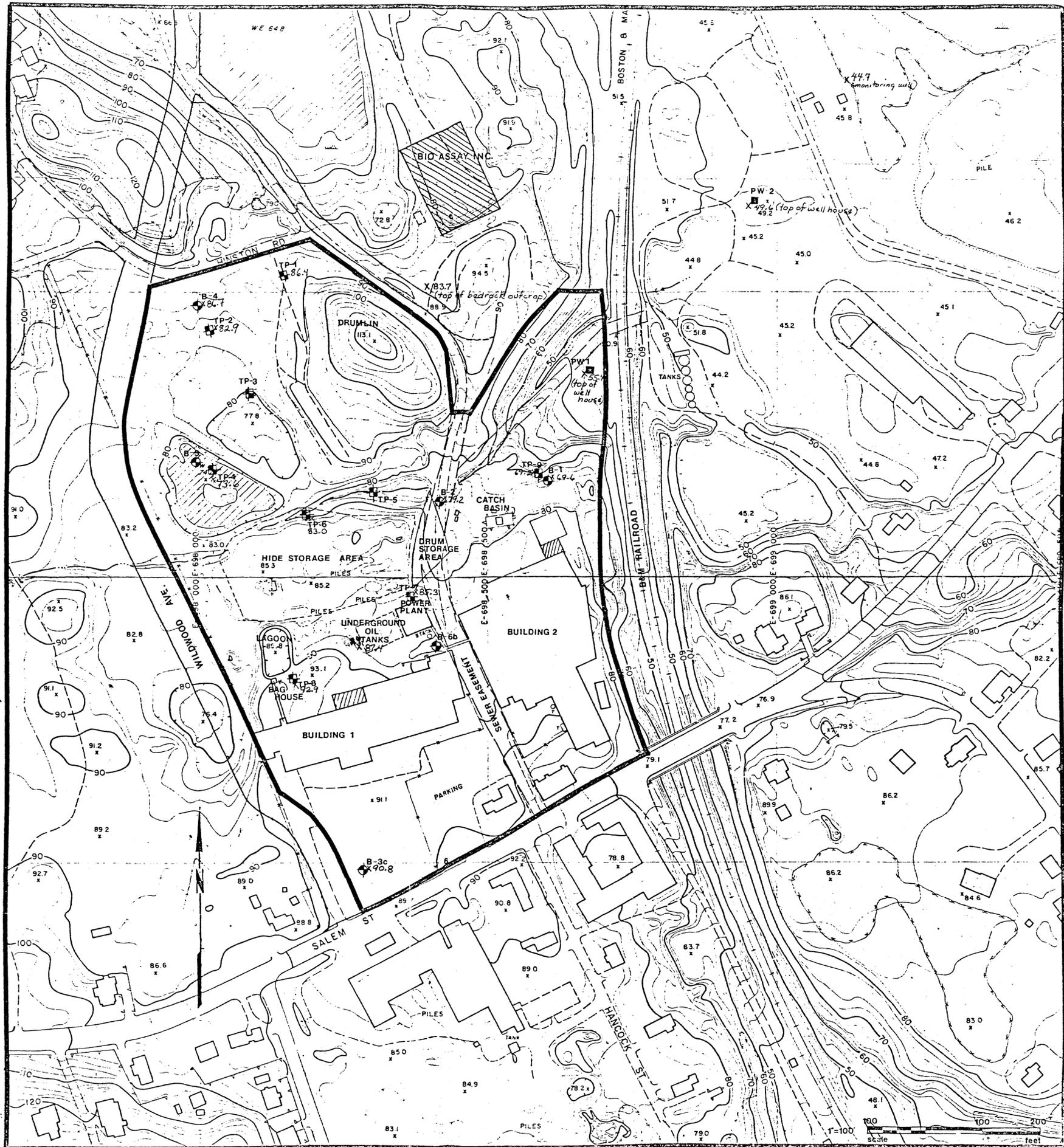
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LEGEND

-  PERIMETER OF STUDY AREA
-  INTERMITTANT STREAM
-  ADDITIONS, NEW BUILDINGS
-  VARIOUS STORAGE AREAS
-  SEWER EASEMENT
-  PW 1 PRODUCTION WELL

FIGURE 1. SITE PLAN		
SCALE: 1"=100'	APPROVED BY	DRAWN BY MH
DATE: 11/7/53		
JOHN J. RILEY TANNING COMPANY, INC. 228 SALEM STREET, WOBURN, MASSACHUSETTS		
HYDROGEOLOGIC INVESTIGATION		DRAWING NUMBER 1



LEGEND

- PERIMETER OF STUDY AREA
- INTERMITTANT STREAM
- ADDITIONS, NEW BUILDINGS
- VARIOUS STORAGE AREAS
- SEWER EASEMENT
- PRODUCTION WELL
- MONITORING WELL
- TEST PIT
- SURVEYED ELEVATION

NOTES: HORIZONTAL CONTROL ESTABLISHED IN GROUND BY LOCATING EXISTING BUILDINGS AND OVERLAY WORK PRINT.

BENCHMARK USGS DATUM - ABERJONA RIVER #5, NORTHWEST OF SALEM STREET, SOUTHWEST END OF BRIDGE OVER THE ABERJONA RIVER AT INNER BASE OF FENCE. CHISELED SQUARE. ELEVATION = 47.96.

SURVEY WORK COMPLETED 10/3/83. DANA F. PERKINS ASSOC., INC. READING, MASSACHUSETTS.

FIGURE 2. LOCATION OF TEST PITS, MONITORING WELLS, AND OTHER FEATURES		
SCALE: 1"=100'	APPROVED BY	DRAWN BY: MH
DATE: 11/8/83	JOHN J. RILEY TANNING COMPANY, INC. 228 SALEM STREET, WOBURN, MASSACHUSETTS	
HYDROGEOLOGIC INVESTIGATION	DRAWING NUMBER 2	



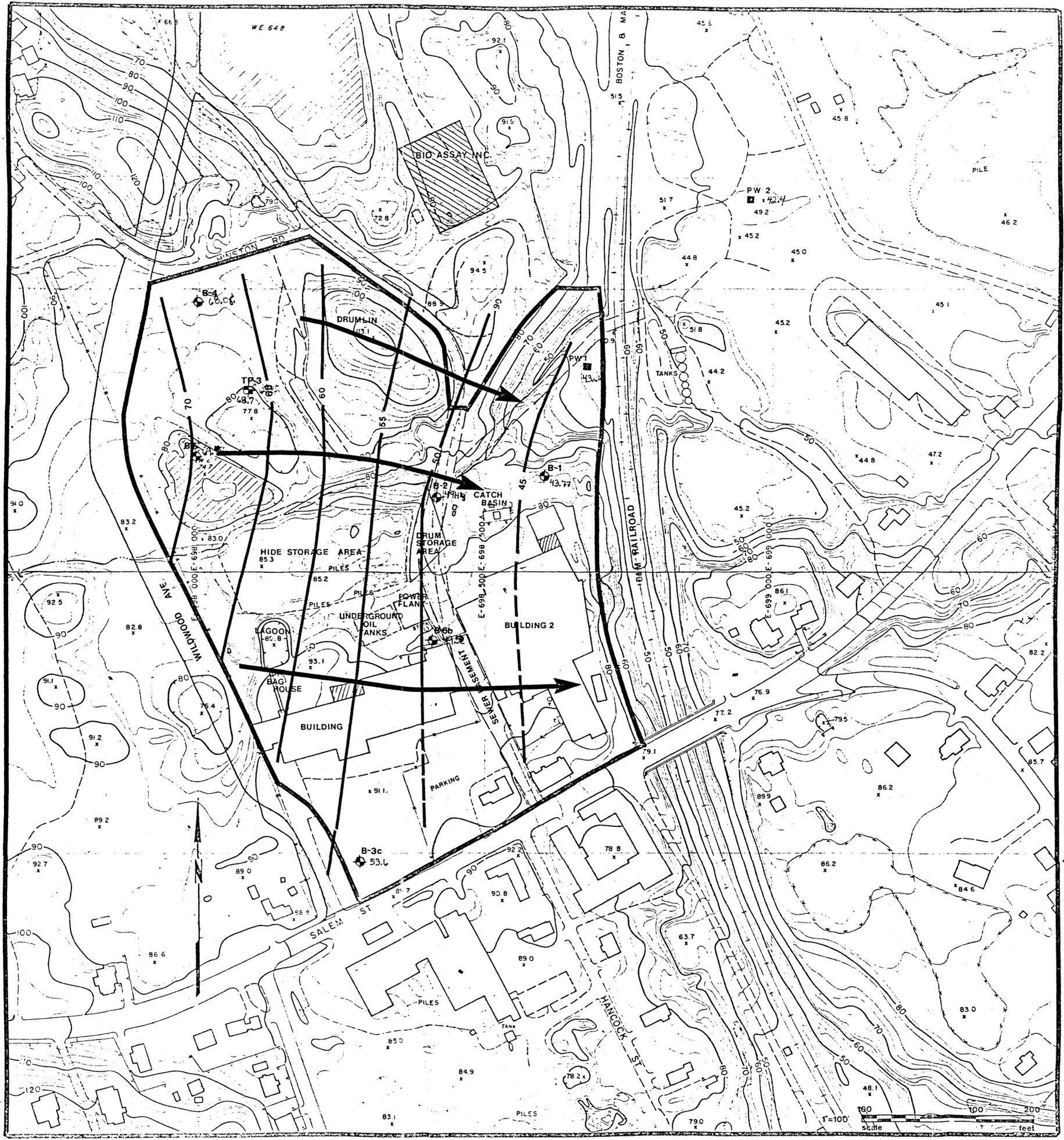
LEGEND

-  PERIMETER OF STUDY AREA
-  INTERMITTENT STREAM
-  ADDITIONS, NEW BUILDINGS
-  VARIOUS STORAGE AREAS
-  SEWER EASEMENT
-  PRODUCTION WELL, APPROXIMATE ELEVATION OF BEDROCK SURFACE (NGVD)
-  MONITORING WELL, APPROXIMATE ELEVATION OF BEDROCK SURFACE (NGVD)
-  BEDROCK OUTCROP
-  BEDROCK CONTOUR ELEVATION IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM (NGVD)
-  GEOLOGIC CROSS-SECTION (FIGURE 3)

NOTES: DEPTH TO BEDROCK DATA OBTAINED DURING MONITORING WELL INSTALLATION.

SURVEY WORK COMPLETED 10/8/83.
 DANA F. PERKINS ASSOC., INC.
 READING, MASSACHUSETTS

FIGURE 4. BEDROCK CONTOUR MAP		
SCALE: 1"=100'	APPROVED BY	DRAWN BY MH
DATE: 11/8/83		
JOHN J. RILEY TANNING COMPANY, INC. 228 SALEM STREET, WOBURN, MASSACHUSETTS		
HYDROGEOLOGIC INVESTIGATION	DRAWING NUMBER 4	



LEGEND

-  PERIMETER OF STUDY AREA
-  INTERMITTENT STREAM
-  ADDITIONS, NEW BUILDINGS
-  VARIOUS STORAGE AREAS
-  SEWER EASEMENT
-  PRODUCTION WELL, GROUNDWATER CONTOUR ELEVATION (NGVD)
-  MONITORING WELL, GROUNDWATER CONTOUR ELEVATION (NGVD)
-  DIRECTION OF GROUNDWATER FLOW
-  GROUNDWATER CONTOUR IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM (NGVD)

NOTES: DATES OF GROUNDWATER ELEVATION NOTED IN TABLE 4

FIGURE 5. GROUNDWATER CONTOUR MAP		
SCALE: 1"=100'	APPROVED BY	DRAWN BY: MH
DATE: 11/8/83	JOHN J. RILEY TANNING COMPANY, INC. 228 SALEM STREET, WOBURN, MASSACHUSETTS	
HYDROGEOLOGIC INVESTIGATION	DRAWING NUMBER 5	

APPENDIX A

Chemical Analysis of Effluent from
John J. Riley Tanning Company Inc.

to

City of Woburn Sewer System
May 2, 1979

and

Report of Analysis for
EP Toxicity Test of
Landfilled Tannery Waste
from
John J. Riley Tanning Company Inc.
July 15, 1983

Analysis of Effluent Parameters

JOHN J. RILEY CO., WOBURN, MA.

Sampling Date: May 2, 1979

Effluent Temperature: 22°C

EFFLUENT PARAMETERS (mg/l)

Time ¹	Proportion of Total Daily Flow %	pH	BOD ₅	COD	Grease
4 A.M.	5.18	12.7	1,710	15,600	1,400
5	9.82	12.7	2,100	6,200	11,600
6	6.73	11.8	1,920	5,100	2,200
7	10.96	11.7	1,410	3,800	9,100
8	11.02	12.5	2,310	7,000	6,100
9	8.77	10.5	3,930	4,600	7,100
10	10.73	11.0	2,520	6,000	1,900
11	7.06	12.1	2,370	5,500	1,100
12	5.71	12.1	3,000	6,600	1,700
1 P.M.	5.39	9.4	1,650	3,200	2,200
2	9.13	7.2	2,340	5,000	2,000
3	4.55	6.8	2,310	4,900	2,200
4	2.95	6.2	1,890	4,100	1,400
5	0.50	6.8	2,130	4,000	2,400
6	0.40	7.0	990	2,000	1,400
7	1.07	4.8	1,410	3,800	1,800
8	0.01	6.3	390	800	2,100
9	0.01	6.6	630	500	2,400
10	0.01	6.7	240	800	2,100
11	0.0	6.9	150	800	1,800
12	0.0	7.0	270	600	1,400
1 A.M.	0.0	7.1	270	800	1,000
2	0.0	7.1	270	1,200	1,000
3	0.0	7.1	240	900	1,000
<u>100%</u>					

Flow Weighted

Average Values (mg/l)	10.8	2,290	5,800	4,500
(lb/1000 lb of hide)	10.8	70	177	137
Industry Average ² (lb/1000 lb. of hide)		95	260	19

¹ Indicates hour that sampling began. Samples collected on the hour and every 15 minutes thereafter.

² Taken from the Development Document for the Leather Tanning and Finishing Industry. EPA-440 (1-74-016-9) March, 1974.

EFFLUENT PARAMETERS CONTINUED (mg/l)

May 2, 1979

Time	TOTAL					
	TS	TSS	Sulfide	Cr	Pb	Cd
4 A.M.	21,500	12,800	520	12	0.0	0.01
5	10,700	2,900	240	11	0.0	0.01
6	9,500	3,900	120	197	0.0	0.00
7	7,700	3,000	100	133	0.0	0.00
8	11,800	4,500	180	86	0.0	0.00
9	6,800	3,100	100	97	0.0	0.00
10	9,200	3,500	140	103	0.0	0.00
11	9,000	3,000	200	36	0.0	0.00
12	12,100	3,000	300	25	0.0	0.00
1 P.M.	7,200	2,000	80	49	0.0	0.00
2	14,400	2,700	60	24	0.0	0.00
3	2,100	2,700	60	4	0.0	0.00
4	18,500	1,400	60	27	0.0	0.00
5	12,100	1,800	60	40	0.0	0.00
6	7,900	2,000	20	32	0.0	0.00
7	5,700	700	60	17	0.0	0.00
8	12,500	500	20	12	0.0	0.00
9	2,600	200	100	6	0.0	0.00
10	2,000	200	60	5	0.0	0.00
11	1,900	200	60	4	0.0	0.00
12	1,800	200	60	3	0.0	0.00
1 A.M.	2,000	200	40	3	0.0	0.00
2	2,000	300	40	3	0.0	0.00
3	2,100	300	60	2	0.0	0.02
(mg/l)	10,400	3,600	160	69	0.0	<0.01
(lb/1000 lb of hide)	317	110	5	2		
" "	525	140	8.5	4.3		

CHEMICAL ANALYSES

JOHN. J. RILEY CO., WOBURN, MA.

24-Hour Composite Samples

Effluent Parameters mg/l

	Sampling Dates 3/5-3/6/81	Sampling Dates 3/11-3/12/81
COD	5913	5022
BOD	2240	1017
TS	10516	10840
TSS	1835	2340
TDS	8681	8500
Chlorides	2169	3179
Sulfides	182	200
Grease	2498	1371
Cr Total	24.5	41.0
Cr(VI)	0	0
Pb	0.3	1.3
Cd	0	0

Sea Plantations Environmental Services, Ltd.
Engineering and Environmental Consultants

John J. Riley Co.
228 Salem Street
Woburn, MA 01801

Date: June 17, 1981
Project No.:
Reference: Special - Hourly

ATTENTION: Richard Jones

Sampling date: 5/20/81

LABORATORY REPORT

TIME	SAMPLE	TEST										% of TOTAL FLOW 30 MIN BEFORE & AFTER
		BOD 5-Day mg/l	COD mg/l	Total Susp. Solids mg/l	Sul- fide mg/l	Oil & Grease mg/l	Chlor- ides mg/l	Total Chrom. mg/l	Lead mg/l	Cad- mium mg/l	Total Solids mg/l	
4AM	05126	1320	2080	440	0.8	40	610	9.0	0.6	0.13	2560	3.64
5AM	05127	2760	7170	1020	18.4	60	1800	0.8	0.8	0.17	10,060	7.93
6AM	05128	1920	6336	900	15.2	70	750	1.3	0.2	0.07	7660	7.89
7AM	05129	2520	5423	1620	15.2	590	3270	334	0.1	0.16	13,770	9.08
8AM	05130	1440	2240	1920	13.6	570	1160	352	0.6	0.16	7290	10.14
9AM	05131	2580	5245	4320	17.6	2610	3060	202	0.7	0.18	15,880	8.29
10AM	05132	2460	5742	1300	12.0	2140	1160	176	0.8	0.21	9600	7.82
11AM	05133	1440	2262	1880	2.4	250	1260	30	0.4	0.11	6430	7.50
12N	05134	1380	1392	1080	8.0	446	5000	59	2.4	0.18	10,100	7.53
1PM	05135	2100	3828	2620	0.8	556	9940	53	5.0	0.18	21,210	8.74
2PM	05136	1800	3040	1560	6.4	180	5850	29.9	1.6	0.12	9330	9.02
3PM	05137	1680	1740	1140	14.4	2470	3500	19.2	0.4	0.17	8510	5.89
4PM	05138	1260	2958	900	0.8	1220	4430	10.9	0.2	0.07	10,220	3.01
5PM	05139	540	1218	400	4.0	380	850	16.9	1.7	0.06	3820	3.32
COMPOSITE BASED ON 1/2 OF TOTAL FLOW 30 MINS BEFORE & AFTER THE HOUR		1915	3867	1670	10.3	820	3025	113.1	1.2	0.15	10,340	
		↑ Incorrect. Test method failure. See report dated 10/30/81 using new method.										
		80 mg/l										


 Date: _____ Supervisor, Testing Services
 Laboratory

EP Toxicity Report
Landfilled Tannery Waste



Cambridge Analytical Associates

222 Arsenal Street / Watertown, Massachusetts 02172 / (617)923-9376

FORMAL REPORT OF ANALYSIS

PREPARED FOR: Yankee Environmental Engineering and
Research Services, Inc.
27 Salem Street
Woburn, MA 01801

ATTN: Bob Young

CUSTOMER ORDER NUMBER:

CAMBRIDGE ANALYTICAL ASSOCIATES, INC.

REPORT NUMBER: 83-572

DATE PREPARED: July 29, 1983



Cambridge Analytical Associates

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2. ANALYTICAL METHODS

3. RESULTS

4. QUALITY ASSURANCE DOCUMENTATION
 - 4.1 Quality Control Data
 - 4.2 Certification

1. INTRODUCTION

This report summarizes results of chemical analyses performed on samples received by CAA on July 15, 1983. Analytical methods employed for these analyses are described in Section 2 and results are presented in Section 3. The last section contains quality control data and certifications supporting the analytical results.

2. ANALYTICAL METHODS

Analytical methods utilized for sample analysis are summarized in Table 1. For analysis of EP toxicity, a 100 gram sample was extracted according to methods specified by EPA (1980). The leachate was then analyzed for metals according to methods of EPA (1979).

3. RESULTS

Results of analyses are presented in Table 2.

Table 1

SUMMARY OF ANALYTICAL METHODS

Constituent	Method Reference	Method Description
Extraction	EPA 1980 (1)	EP Test
Metals		
-As	Method 206.2 (2)	Graphite furnace atomic absorption
-Ba	Method 208.1 (2)	Flame atomic absorption
-Cd	Method 213.1 (2)	Flame atomic absorption
-Cr (total)	Method 218.1 (2)	Flame atomic absorption
-Cr (hexavalent)	Method D1687-80 (3)	Colorimetric; diphenyl carbizide
-Pb	Method 239.2 (2)	Graphite furnace atomic absorption
-Hg	Method 245.1 (2)	Cold-vapor atomic absorption
-Se	Method 270.2 (2)	Graphite furnace atomic absorption
-Ag	Method 272.1 (2)	Flame atomic absorption
Cyanide	Method 335.2 (2)	Distillation; colorimetric
Sulfide	Method 376.1 (2)	Titrimetric

- (1) U.S. EPA. 1980. Hazardous Waste and Consolidated Permit Regulations - Appendix II - EP Toxicity Test Procedure. Federal Register 45(98): 33127-33128.
- (2) U.S. EPA. 1979. Methods for Chemical Analysis of Water and Waste. EPA 600/4-79-020. EPA/EMSL, Cincinnati, Ohio.
- (3) ASTM, 1980. Annual Book of ASTM Standards. Part 31 - Water. ASTM, Philadelphia, Pennsylvania.

Table 2

RESULTS OF CHEMICAL ANALYSES

Constituent	Maximum Contamination Level	Client ID: 0	N	B
		CAA ID: 8305791	8305792	8305793
METALS (ppm)				
As	5.0	<0.005	<0.005; <0.005 ^a	<0.005
Ba	100	<0.1	<0.1; <0.1 ^a	<0.1
Cd	1.0	<0.005	0.008; <0.005 ^a	<0.005
Cr (total)	5.0	0.35	<0.1; <0.1 ^a	0.27
Cr (hexavalent)	5.0	0.17	<0.1	<0.1
Pb	5.0	0.10	0.11; 0.11 ^a	1.2
Hg	0.2	<0.0002	<0.0002; <0.0002 ^a	<0.0002
Se	1.0	<0.005	<0.005; <0.005 ^a	<0.005
Ag	5.0	<0.01	<0.01; <0.01 ^a	<0.01
Cyanide (ppm, wet weight)	--	0.66	6.5	--
Sulfide (ppm, wet weight)	--	<5	<5	--

^aDuplicate analyses performed.

Table 3

QUALITY CONTROL DATA
SPIKE RECOVERIES AND CHECK STANDARDS

Constituent	Client ID	CAA ID	Concentration (ppm)		Recovery (%)
			Theoretical Value	Observed Value	
As	O	8305791	0.100	0.114	114
	N	8305792	0.100	0.081	81
	B	8305793	0.100	0.103	103
Ba	O	8305791	1.00	1.13	113
	N	8305792	1.00	1.08	108
	B	8305793	1.00	1.08	108
Cd	O	8305791	0.100	0.096	96
	N	8305792	0.100	0.098	98
	B	8305793	0.100	0.099	99
Cr (total)	O	8305791	1.79	1.61	90
	N	8305792	0.50	0.46	92
	B	8305793	1.64	1.51	92
Cr (hexavalent)	B	8305793	0.250	0.267	107
Pb	O	8305791	2.50	2.44	98
	N	8305792	2.50	2.48	99
	B	8305793	2.50	2.54	102
Hg	O	8305791	0.100 ug	0.106 ug	106
	N	8305792	0.100 ug	0.102 ug	102
	B	8305793	0.100 ug	0.106 ug	106
Se	O	8305791	0.100	0.087	87
	N	8305792	0.100	0.085	85
	B	8305793	0.100	0.109	109
Ag	O	8305791	0.500	0.497	99
	N	8305792	0.500	0.503	101
	B	8305793	0.500	0.503	101

For your information, the following information is provided for your information.

4. QUALITY ASSURANCE DOCUMENTATION

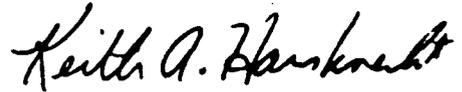
4.1 Quality Control Data

Quality control data associated with these analyses are summarized in Table 3. These results consist of recoveries of spikes from analyte solutions.

4.2 Certification

This work has been checked for accuracy by the following staff personnel:

Director, Inorganic
Chemistry Laboratory



Keith A. Hausknecht

APPENDIX B

Specifications for Soil Sampling,
Drilling, and Installation of
Monitoring Wells

at the

John J. Riley Tanning Company
228 Salem Street
Woburn, Massachusetts

SERVICE AGREEMENT AND QUOTATION
FOR
SOIL SAMPLING, DRILLING
AND
INSTALLATION OF MONITORING WELLS
WOBURN, MASSACHUSETTS
JOHN J. RILEY COMPANY INCORPORATED
228 SALEM STREET

Section 1 - General

Yankee Environmental Engineering and Research Services, Inc. (hereafter, YE²ARS), of 27 Salem Street, Woburn, Massachusetts has been hired by the John J. Riley Company Inc. to conduct a hydro-geologic investigation of their tanning facility at 228 Salem Street in Woburn, Massachusetts.

This investigation will require soil boring, soil sampling and the installation of groundwater monitoring wells.

Section 2 - Information to Subcontractor

The Scope of Work indicates that approximately six monitoring wells will be installed and several additional test borings will be advanced on property owned and used by the John J. Riley Company Inc.

The John J. Riley Company Inc., a tannery, is located in the town of Woburn, Massachusetts, south of Route 128 on Salem Street. The location of the John J. Riley Company Inc. tannery is indicated on the attached USGS topographic map. Low levels of volatile organic contamination has been detected in monitoring wells located east of the tannery on adjacent property.

Data developed during YE²ARS investigation will be used to determine the direction of groundwater flow on the John J. Riley Tannery Site, and assess groundwater quality. The approximate location of the proposed wells and borings are indicated on the attached map. The precise locations of the wells and borings will be determined by YE²ARS personnel prior to the commencement of drilling. All boring and well locations will be reviewed by the site owner to insure that underground utilities will not be encountered during drilling. It is anticipated that all well and boring locations will be accessible for a truck-mounted drilling rig.

Existing site data has been reviewed to determine if any potentially hazardous substances have been disposed of on the Site. In addition, nine test pits were excavated to assess subsurface geologic conditions and the presence of tannery wastes.

Although tannery sludge, which exhibits objectionable odors, but is not hazardous, has been landfilled on some portions of the Site, YE²ARS staff does not anticipate that large quantities of tannery waste will be encountered during drilling.

In addition, low levels of volatile organic compounds have been detected in groundwater samples collected from wells located east, and presumably downgradient of the site. There is a possibility that volatile organic compounds, such as those present in contaminated groundwater east of the site, may be encountered during drilling. YE²ARS anticipates that volatile organic contaminant levels in groundwater or soil, if encountered, will not be significant.

As a precautionary measure, however, YE²ARS personnel will monitor soil and ambient air during borehole advancement for volatile organic compounds and will inform the subcontractor if respiratory protection is required.

Questions with respect to the technical work and contract procedures should be directed to the attention of YE²ARS technical manager, M. Margret Hanley.

Section 3 - Site Geology

USGS data and existing boring logs indicate that the study area is characterized by 15 to 50 feet of silt, sand, some gravel, and boulders overlying crystalline bedrock. Portions of the study area have been developed and some resultant fill or rip-rap may be encountered during drilling. Anticipated depths to groundwater vary from 10 to 25 feet.

Section 4 - Scope of Work

4.0 Scope of Work

The work to be performed includes the furnishings of all material, labor, and equipment necessary for access to boring locations, for soil boring, and for the construction and installation of groundwater monitoring wells.

All monitoring wells and boreholes will be drilled with a 3 3/4 inch inside diameter hollow stem auger or drive casing.

4.1 Soil Sampling

Soil samples will be collected during drilling with a 24-inch split-barrel sampler having a 2-inch outside diameter (OD). Unless otherwise specified by YE²ARS, drilling will be carried to refusal. For the purposes of this investigation, refusal will be defined as the driving resistance of 2 inches or less per 100 blows for a 140-pound hammer falling 30 inches. In addition, 2-5 feet of bedrock coring may be done to insure that refusal is at the bedrock surface.

The subcontractor will obtain representative samples of soil at the beginning of every change of stratum and at intervals of 5 feet. Samples will be representative of the material encountered and will be collected with a 2-inch OD sample spoon with a 140 pound weight free-falling 30 inches. The driving resistance will be recorded for each 6-inch increment sampled with the split-spoon.

If requested by YE²ARS personnel, the split-spoon sampler will be cleaned by the subcontractor before each sample is taken. The cleaning process will consist of rinsing the split-spoon sampler with clean wash water. YE²ARS personnel may require that sampling equipment be decontaminated with methanol in addition to clean wash water. All cleaning material will be provided by the subcontractor.

Representative portions of each split-spoon sample will be preserved in round, screw-top, airtight, clear-glass jars. Size of jars will be 8 ounces or larger for 2-inch-diameter samples. The specimens will be placed in the jars as soon as they are taken in order to preserve the original moisture content. The jars will be tightly capped and will be suitably boxed, marked, and identified with legible labels as directed by YE²ARS. These labels and jars, provided by the subcontractor, will show the date, well location number, sample number, depth at which the sample was taken, record of number blows for each 6-inch drive increment, and length of sample recovery.

Samples of bedrock will be collected and placed in an 8 ounce jar and labelled. One sample jar of rock fragments per well will be collected by the subcontractor.

In general, all drilling coring and sampling operations will conform to American Society for Testing and Materials (ASTM) standards unless otherwise designated.

4.2 Monitoring Well Construction and Installation

Construction of the wells will be in accordance with standard procedures. The well construction is subject to change as subsurface conditions warrant as determined in the field by YE²ARS. The monitoring well casing will be PVC with a nominal diameter of 2 inches. The pipe will extend 2.0 feet above ground level. The pipe will have threaded flush joints and be equivalent to Schedule 80 ASTM standards. The casing will terminate in a factory-slotted PVC well screen with a slot size of 0.010 inches. Screens will be continuously slotted or slotted in three rows placed at 120° intervals around the circumference of the pipe. Threaded PVC bottom plugs will be used for each well installation.

4.3 Backfilling

If bedrock is cored, open boreholes in bedrock will be backfilled with formation material until the bottom of hole is coincident with the depth of bedrock.

The annular space of the monitoring wells above bedrock will be backfilled with a suitable grade of Ottawa sand or similar medium-grain clean sand to a level approximately one foot above the top of the screen.

All backfilling should be done in 2-foot increments or less as augers or drive casing are withdrawn to keep the hole from collapsing around the well screen before the sand chamber is established.

A 2-foot seal of bentonite pellets or slurry as determined necessary by YE²ARS will be placed above the sand chamber and will be firmly tamped into place. Special care will be exercised to obtain an adequate, bentonite seal as casing or augers are withdrawn.

4.4 Well Security

To provide well security, a 3 or 4-inch nominal diameter steel casing 5 feet in length will be placed around the PVC casing and set into a 2-foot depth of concrete. The top of the steel casing will extend above the inner casing and will be fitted with a cap. The security casing and cap will be provided by the subcontractor.

4.5 Well Development/Completion

Upon completion of the monitoring well installation, the well is to be developed by flushing with clean water from the bottom of the well until the fluid runs clear. YE²ARS will determine when the well is properly developed. The monitoring well must pass a 1-inch stainless steel bailer.

4.6 Reports

Upon completion of the work, soil samples and well logs containing the following information will be submitted to the YE²ARS office within 5 working days of completion of field work:

- a. Location
- b. Start and completion dates
- c. Boring/well number
- d. Depth of static water table
- e. Soil classification and depths
- f. Blow counts
- g. Driller's remarks
- h. Sample depths and types
- i. Screen depths
- j. Filter depths
- k. Seal depths
- l. Monitoring well material used and lengths per well
- m. Driller's names

Section 5 - Clean-Up

At YE²ARS descretion, the driller may be required to clean drilling equipment (split-spoon, auger, etc.) with a pressurized steam cleaner and detergent or methanol before proceeding to the next well. The sub-contractor shall collect contaminated solvents, wash water, and related materials in 55 gallon drums to be provided by the site owner.

Prior to the mobilization of the drill rig on site, the rig and all associated equipment shall be thoroughly cleaned to remove all oil, grease, mud, tar, etc. This cleaning process will consist of 1) high pressure hot water claning of the drilling equipment 2) rinsing the equipment with methanol and 3) a high pressure hot-water final rinse. The subcontractor must provide all equipment necessary for this cleaning process which may include clean water, methanol and a mobile hot water, high-pressure washer.

Unless otherwise specified by YE²ARS technical manager, all sampling equipment must be cleaned between samples with clean water rinse in order to minimize contamination. If requested, the augers, cutting bits and drill rods shall be cleaned with pressurized water and rinsed with methanol and and clean water.* Special attention must be given to the thread section of the casing, and drill rods. Petroleum based lubricants shall not be used to prevent binding. The subcontractor will be responsible for providing a means for collecting contaminated solvents and related materials.

Section 6 - Safety

All subcontractors may be required to wear hard hats within the John J. Riley Company Inc. facility. Decontamination of equipment may require that the contractor wear rubber gloves and safety goggles.

* YE²ARS anticipates that drilling equipment will require decontamination on two separate occasions during the drilling project.

During borehole advancement, YE²ARS will monitor ambient air and split-spoon samples for volatile organic compounds. YE²ARS will inform the drilling subcontractor if respiratory protection (i.e. NIOSH approved air-purifying respiratory face mask with protection levels up to 1000 ppm total volatile organics) is required.

If YE²ARS determines that organic vapor concentrations in ambient air exceed levels above the design specifications of the air purifying respiratory equipment used by the subcontractor, the subcontractor will be directed to cease operations at that borehole and withdraw from the area.

Section 7 - Service Agreement Particulars

The subcontractor will, on his own time and at his own expense procure all permits, licenses, and certificates (birth certificate or proof of identification) that may be required of him by law for the execution of the work hereunder. The subcontractor will comply with all federal, state and local laws, ordinances, rules and regulations relating to the performance of the work hereunder.

The owner of the Site will determine the location of all public and private utilities in advance of the drilling program. During the progress of the work, the subcontractor will cooperate with the owners of utilities and permit their representatives access to the work area to determine if their utilities are being endangered in any way.

At the completion of field operations, it will be the responsibility of the subcontractor to restore the site as nearly as possible to its original condition.

Should boulders or other obstructions be encountered, the subcontractor will attempt to redrill at an alternate location selected by YE²ARS personnel. If it is necessary to move a drilling location to a new site, the new location will be designated by a new boring number, and the boring location will be marked in the field by YE²ARS personnel. Where a reasonable depth is not obtained due to boulders or other obstructions, the subcontractor will be paid for the depth reached for all drilling attempts.

Upon completion of the field work, complete drilling logs of all borings, together with complete sets of soil and rock samples, will be delivered at the expense of the subcontractor to the office of YE²ARS located at 27 Salem Street, Woburn, Massachusetts, Attention: Ms. M. Margret Hanley.

Section 8 - Project Particulars

The quantities and items stated on the attached bid sheet are YE²ARS best approximation of the scope of work. YE²ARS does not guarantee that the bid quantities are correct or that stated tasks will be performed. YE²ARS reserves the right to vary the quantities or delete items in their entirety, and the Subcontractor will not be entitled to any extra payment due to such amended quantities or deleted items. It must be stated, however, that at this time every item discussed in the work plan is expected to be performed under this contract.

Fixed Prices quoted will remain valid for a period of 90 days from the receipt by YE²ARS of this service agreement for work performance as described in this specification package.

A letter accompanying the Fixed Price Quotation Sheet and Service Agreement will also include:

- a. An estimate of the number of days required to complete the drilling and construction of the wells.
- b. The earliest date the subcontractor can commence work on site.
- c. Proof of minimum insurance coverage.

The Service Agreement quotation items will include all services, labor, equipment, transportation, material, and supplies needed to complete the work. Payment of these items will be provided in the compensation for drilling and well installation and will also include obtaining, packaging, marking, and submitting soil samples and recording and submitting data incidental to each item. Any down time incurred by the subcontractor other than a delay at the request of YE²ARS will not be a payment item.

No other payments for any specified or indicated work nor for any work implied therefrom will be made. No payment will be made for drilled holes abandoned without authorization of YE²ARS, for drilling holes for which satisfactory samples and data are not submitted, or for wells which do not allow passage of a 1 inch diameter bailer.

Prior to the start of field operations, the subcontractor will designate his foreman or representative who will be the only individual authorized to discuss work schedules and related matters with YE²ARS personnel.

Information gathered during this investigation is confidential and will not be discussed with any individual other than YE²ARS technical manager, M. Margret Hanley.

Section 9 - Quotation Items

Item 1. Mobilization and Demobilization

This item will carry all charges incidental to equipment set-up and removal, in order that the charges need not be distributed among the more variable items of the contract. This item will be paid at the contract lump sum price for mobilization and demobilization and will include the furnishing of personnel, machinery, tools, and all other equipment necessary to carry on and complete the work properly. All material or equipment furnished under this item will remain the property of the subcontractor and will be maintained, cared for, and disposed of by him.

Item 2. Decontamination

This item will include any costs incurred by the subcontractor for the decontamination of equipment and supplies, including all charges for labor and hourly rates for equipment down time necessary to decontaminate drilling equipment when requested by YE²ARS personnel.

Item 3. Soil Borings with Sampling

This work will be paid for at the respective contract unit prices per linear foot of drilling/soil sampling. This work will be measured for payment by the actual number of vertical linear feet drilled for each accepted hole between the ground surface at the hole and the bottom of the accepted well or the bottom of the last soil sample taken, whichever is deeper. This item will include the furnishing of a complete well log as outlined in the specifications and necessary sample containers. This item will also include any split-spoon sampler decontamination requested by YE²ARS.

Item 4. Bedrock Coring and Sampling

This item will be paid for at the respective contract unit prices per linear foot of bedrock coring. Coring methods will be determined by YE²ARS technical manager in the field. This item will also include the collection of one representative sample of rock/per well by the subcontractor.

Item 5 and 6. Monitoring Well Casing and Screen

This item will be paid at the respective unit prices per linear foot for installed material only of the type as specified in the Scope of Work.

Item 7. Installation of Monitoring Wells

This item will include all costs and time for installation, backfilling and grouting between the bottom of the well screen and the ground surface. This item includes all backfilling materials specified such as sand, bentonite pellets or slurry, concrete or other impermeable materials.

Item 8. Installation of Well Protection and Well Development

This item will include all costs for material and time necessary to fabricate and install the required well protection at each well location.

This item will also include all time and necessary equipment to properly develop each monitoring well. Wells will be developed until deemed acceptable by YE²ARS.

APPENDIX C

Well Logs of Monitoring Wells
Installed Under the Supervision of YE²ARS, Inc.
September - October 1983

at the

John J. Riley Tanning Company
228 Salem Street
Woburn, Massachusetts

and

Well Log of John J. Riley Company
Production Well #1

DATE START 9-12-83
 DATE FINISH 9-15-83
 WEIGHT OF HAMMER 140 300
 HEIGHT OF FALL 30" 24"
 GROUND WATER OBSERVATION
 DATE 10-12 TIME AM DEPTH 25'10"
 SAMPLER OD 2" ID 1 3/8"
 TYPE OF RIG CME 45

GEO-METRICS, INC.
 SUBSURFACE EXPLORATIONS

LONG POND ROAD
 P.O. BOX 288
 DANVILLE, NH 03819

PROJ. NO
 LOCATION Woburn, Mass
 LINE & STA
 OFFSET
 GROUND ELEVATION
 HOLE NO. 1
 CASING SAMPLER CORE BARRIS
 TYPE Pipe SS Hy core
 SIDE ID 37/8" 1 3/8" 2 1/8"

CLIENT
 Yankee Environmental Eng. and
 Research Services, Inc.

ep. of. inf.	Sample Depths	Type of Sample	Blows Per 6" On Sampler				Moist.	Profile Change Depth Elev.	Field Identification Of Soils Remarks	Sample	
			From		To					No	Pen
			0-6	6-12	12-18	18-24					
							Gs				
	4-6	ss	8	9	10	10	D	Brown medium to coarse sand and gravel, with cobbles and boulder	1	24	
	9-11	ss	18	26	15	14	D		2	24	
	14-16	ss	32	20	32	41	D		3	24	
	18-20	ss	30	21	25	40	D		4	24	
	24-26	ss	16	35	30	44	W		5	24	
	29-31	ss	27	29	37	14	W		6	24	
	34-36	ss	12	20	23	20	W		7	24	
	39-41	ss	16	28	36	38	W		8	24	

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and 35-50%.

Driller L. Knox
 Helper K. Knox
 Soil Engineer _____
 Drilling Inspector _____

SAMPLE TYPE
 C = Cored W = Washed
 SS = Split Spoon
 UP = Undisturbed Piston
 TP = Test Pit

COHESIONLESS DENSITY
 0-4 very loose
 4-10 loose
 10-30 compact
 30-50 dense
 50-100 very dense

COHESIVE CONSISTENCY
 0-2 very soft
 2-4 soft
 4-8 medium
 8-15 stiff
 15-30 very stiff

TOTAL FOOTAGE
 Earth Boring ft 58.5'
 Rock Coring ft 5'
 Hole No 1

DATE START 9-12-83

GEO-METRICS, INC.
SUBSURFACE EXPLORATIONS

SHEET 2 of 2

DATE FINISH 9-15-83

LONG POND ROAD
P.O. BOX 288
DANVILLE, NH 03819

PROJ. NO
LOCATION Woburn, Mass.

WEIGHT OF HAMMER 140 300

HEIGHT OF FALL 30" 24"

LINE & STA

OFFSET

GROUND ELEVATION

HOLE NO. 1

CASING SAMPLER CORE BARRIS

TYPE Pipe SS Hy core

SIDE ID 4 7/8" 1 3/8" 2 1/8"

GROUND WATER OBSERVATION
DATE 10-12 TIME AM DEPTH 25' 10"

CLIENT
Yankee Environmental Eng. and
Research Services, Inc.

SAMPLER OD 2" ID 1 3/8"

TYPE OF RIG CME 45

p. i. r.	Sample Depths	Type of Sample	Blows Per 6" On Sampler				Moist.	Profile Change Depth Elev.	Field Identification Of Soils Remarks	Samples	
			From 0-6	6-12	12-18	18-24				No	Pen
							42	See page #1			
	44-46	ss	24	43	50	72	W	Brown medium sand trace clay and silt with occasional boulders	9	24	
	49-51	ss	5	17	51	43	W		10	24	
	54-56	ss	27	70	150		W	Fine yellow sand, trace silt and clay with occasional boulders.	11	15	
							58.5	Cored rock 58.5-61.5 Rec. 1' Cored rock 61.5-63.5 Rec. 10" Installed observation well at 58' using 45' screen and 15' solid pipe. Backfill 63.5' 1 protective casing			

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

Driller L. Knox

Helper K. Knox

Soil Engineer

Drilling Inspector

SAMPLE TYPE

C = Cored W = Washed
SS = Split Spoon
UP = Undisturbed Piston
TP = Test Pit

COHESIONLESS DENSITY

0-4 very loose
4-10 loose
10-30 compact
30-50 dense

COHESIVE CONSISTENCY

0-2 very soft
2-4 soft
4-8 medium
8-15 stiff
15-30 very stiff

TOTAL FOOTAGE

Earth Boring ft 58.5'

Rock Coring 5 ft

Hole No 1

DATE START 9-19-83

GEO-METRICS, INC.
SUBSURFACE EXPLORATIONS

SHEET 1 of 2

DATE FINISH 9-22-83

WEIGHT OF HAMMER 140 300

HEIGHT OF FALL 30" 24"

LONG POND ROAD
P.O. BOX 288
DANVILLE, NH 03819

PROJ. NO
LOCATION Woburn, Mass.

LINE & STA

OFFSET

GROUND ELEVATION

GROUND WATER OBSERVATION
DATE 10-12 TIME AM DEPTH 29'11"

CLIENT

Yankee Environmental Eng. and
Research Services, Inc.

HOLE NO. 2

SAMPLER OD 2" ID 1 3/8"

CASING SAMPLER CORE BARREL

TYPE Pipe SS Hy core
SIDE ID 47/8" 1 3/8" 2 18"

TYPE OF RIG CME 45

Sample No.	Sample Depths	Type of Sample	Blows Per 6" On Sampler				Moist.	Profile Change Depth Elev.	Field Identification Of Soils Remarks	Sample	
			From 0-6	6-12	12-18	18-24				No	Pen
							18	Gs Medium silty sand and gravel with occasional cobbles and boulders.			
	4-6	ss	2	5	4	6	W		1	24	
	9-11	ss	13	30	20	15	W		2	24	
	14-16	ss	34	21	19	13	D		3	24	
	19-21	ss	30	20	19	21	M	29	Gray-brown silty sand and gravel with occasional boulders and fine sandy silt layers	4	24
	24-26	ss	20	22	26	110	M			5	24
	30-32	ss	21	40	44	50	W	35	Coarse silty sand and gravel with occasional boulders.	6	24
	35-37	ss	19	29	35	108	W			7	24
									Fine brown silty sand and boulders		

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%.

Driller L. Knox
Helper K. Knox
Soil Engineer _____
Logging Inspector _____

SAMPLE TYPE
C = Cored W = Washed
SS = Split Spoon
UP = Undisturbed Piston
TP = Test Pit

COHESIONLESS DENSITY
0- 4 very loose
4-10 loose
10-30 compact
30-50 dense

COHESIVE CONSISTENCY
0- 2 very soft
2- 4 soft
4- 8 medium
8-15 stiff
15-30 very stiff

TOTAL FOOTAGE
Earth Boring ft 48.7'
Rock Coring 2 ft
Hole No. 2

DATE START 9-19-83

GEO-METRICS, INC.
SUBSURFACE EXPLORATIONS

SHEET 2 of 2

DATE FINISH 9-22-83

WEIGHT OF HAMMER 140 300

HEIGHT OF FALL 30" 24"

GROUND WATER OBSERVATION

DATE 10-12 TIME AM DEPTH 29'11"

SAMPLER OD 2" ID 1 3/8"

TYPE OF RIG CME 45

LONG POND ROAD
P.O. BOX 288
DANVILLE, NH 03819

PROJ. NO
LOCATION Woburn, Mass.

LINE & STA

OFFSET

GROUND ELEVATION

HOLE NO. 2

CASING SAMPLER CORE BARREL

TYPE Pipe SS Hy Core
SIDE ID 37/8" 1 3/8" 2 1/8"

CLIENT
Yankee Environmental Eng. and
Research Services, Inc.

Sample Depths	Type of Sample	Blows Per 6" On Sampler				Moist.	Profile Change Depth Elev.	Field Identification Of Soils Remarks	Sample	
		From		To					No	Pen
		0-6	6-12	12-18	18-24					
40-42	ss	11	22	28	31	W	42 See page # 1.	8	24	
47-48	ss	70	130			W	48.7' Coarse silty sand and gravel with occasional boulders.	9	12	
							50.7' Cored bed rock 48.7'-50.7' Rec.2'			
							Installed well using 33' screen and 18' solid Pvc. Backfill 50.7' 1 protective casing			

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%

Driller _____
Helper _____
Soil Engineer _____
Drilling Inspector _____

SAMPLE TYPE
C = Cored W = Washed
SS = Split Spoon
UP = Undisturbed Piston
TP = Test Pit

COHESIONLESS DENSITY
0-4 very loose
4-10 loose
10-30 compact
30-50 dense
50+ very dense

COHESIVE CONSISTENCY
0-2 very soft
2-4 soft
4-8 medium
8-15 stiff
15-30 very stiff

TOTAL FOOTAGE

Earth Boring #
Rock Coring #
Hole No

DATE START 10-23-83

DATE FINISH 10-23-83

WEIGHT OF HAMMER 140 300

HEIGHT OF FALL 30" 24"

GROUND WATER OBSERVATION

DATE 10-23 TIME comp. DEPTH dry

SAMPLER OD 2" ID 1 3/8"

TYPE OF RIG CME 45

GEO-METRICS, INC.
SUBSURFACE EXPLORATIONS

LONG POND ROAD
P.O. BOX 288
DANVILLE, NH 03819

CLIENT

Yankee Environmental Eng. and
Research Services, Inc.

PROJ. NO
LOCATION Woburn, Mass.

LINE & STA

OFFSET

GROUND ELEVATION

HOLE NO. 3B

CASING SAMPLER CORE BARRIS

TYPE Pipe SS Hy core
SIDE ID 37/8" 1 3/8" 2 1/8"

Sp. No.	Sample Depths	Type of Sample	Blows Per 8" On Sampler				Moist.	Profile Change Depth Elev.	Field Identification Of Soils Remarks	Sample	
			From		To					No	Pen
			0-6	6-12	12-18	18-24					
							Gs	Gray-brown coarse sand, gravel, and boulders.			
							4				
								Cored boulders 4-7			
							7				
								Abandoned boring			

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%.

Driller L. Knox
Helper K. Knox
Soil Engineer _____
Drilling Inspector _____

SAMPLE TYPE
C = Cored W = Washed
SS = Split Spoon
UP = Undisturbed Piston
TP = Test Pit
T = Undisturbed Thinwall

COHESIONLESS DENSITY
0-4 very loose
4-10 loose
10-30 compact
30-50 dense
50+ very dense

COHESIVE CONSISTENCY
0-2 very soft
2-4 soft
4-8 medium
8-15 stiff
15-30 very stiff

TOTAL FOOTAGE

Earth Boring 4 ft.
Rock Core 3 ft.
Hole No. 3B

DATE START 9-26-83

DATE FINISH 9-29-83

WEIGHT OF HAMMER 140 300

HEIGHT OF FALL 30" 24"

GROUND WATER OBSERVATION

DATE 10-12 TIME AM DEPTH 37.3'

SAMPLER OD 2" ID 1 3/8"

TYPE OF RIG CME 45

GEO-METRICS, INC. SUBSURFACE EXPLORATIONS

LONG POND ROAD P.O. BOX 288 DANVILLE, NH 03819

CLIENT

Yankee Environmental Eng. and Research Services, Inc.

SHEET 2 of 2

PROJ. NO

LOCATION Woburn, Mass.

LINE & STA

OFFSET

GROUND ELEVATION

HOLE NO. 3C

CASING SAMPLER CORE BARREL

TYPE Pipe SS Hy core

SIDE ID 37/8" 1 3/8" 1 3/8"

Table with columns: Depth, Sample Depths, Type of Sample, Blows Per 6" On Sampler (From 0-6, 6-12, 12-18, 18-24), Moist., Profile Change Depth Elev., Field Identification Of Soils Remarks, Sample No, Pen.

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and 35-50%.

Driller L. Knox
Helper K. Knox
Soil Engineer
Drilling Inspector

SAMPLE TYPE: C = Cored, W = Washed, SS = Split Spoon, UP = Undisturbed Piston, TP = Test Pit
COHESIONLESS DENSITY: 0-4 very loose, 4-10 loose, 10-30 compact, 30-50 dense, 50+ very dense
COHESIVE CONSISTENCY: 0-2 very soft, 2-4 soft, 4-8 medium, 8-15 stiff, 15-30 very stiff

TOTAL FOOTAGE

Earth Boring n 39'
Rock Coring 3 ft
Hole No. 3C

DATE START 9-30-83
 DATE FINISH 10-4-83
 WEIGHT OF HAMMER 140 300
 HEIGHT OF FALL 30" 24"
 GROUND WATER OBSERVATION
 DATE 10-12 TIME AM DEPTH 18.66'
 SAMPLER OD 2" ID 1 3/8"
 TYPE OF RIG CME 45

GEO-METRICS, INC.
 SUBSURFACE EXPLORATIONS

LONG POND ROAD
 P.O. BOX 288
 DANVILLE, NH 03819

PROJ. NO
 LOCATION Woburn, Mass.
 LINE & STA
 OFFSET
 GROUND ELEVATION
 HOLE NO. 4
 CASING SAMPLER CORE BARREL
 TYPE Pipe SS Hy core
 SIDE ID 37/8" 1 3/8" 1 3/8"

CLIENT
 Yankee Environmental Eng. and
 Research Services, Inc.

Sp. No.	Sample Depths	Type of Sample	Blows Per 6" On Sampler				Moist.	Profile Change Depth Elev.	Field Identification Of Soils Remarks	Sample	
			From		To					No	Pen
			0-6	6-12	12-18	18-24					
	4-6	ss	1	2	2	1	D	Gs Brown coarse to fine sand, gravel, and boulders.	1	24	
	9-9.25	ss	100				D	10	2	3	
	14-14.5	ss	110				D	18 Fine gray sand and gravel with occasional cobbles and boulders.	3	6	
	19-21	ss	30	36	55	32	W	18 Fine yellow silty sand and gravel.	4	24	
	24-26	ss	10	27	20	21	W	28 Refusal at 28'	5	24	
								29 Cored 28'-29'			
								Installed well using 18' screen and 12' solid PVC. Backfill 28' 1 protective casing			

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%.

Driller L. Knox
 Helper K. Knox
 Soil Engineer _____
 Drilling Inspector _____

SAMPLE TYPE
 C = Cored W = Washed
 SS = Split Spoon
 UP = Undisturbed Piston
 TP = Test Pit

COHESIONLESS DENSITY
 0-4 very loose
 4-10 loose
 10-30 compact
 30-50 dense
 50+ very dense

COHESIVE CONSISTENCY
 0-2 very soft
 2-4 soft
 4-8 medium
 8-15 stiff
 15-30 very stiff

TOTAL FOOTAGE
 Earth Boring 1 ft 28'
 Rock Coring 1 ft
 Hole No. 4

DATE START 10-5-83

DATE FINISH 10-6-83

WEIGHT OF HAMMER 140 300

HEIGHT OF FALL 30" 24"

GROUND WATER OBSERVATION

DATE 10-13 TIME AM DEPTH 3.75'

SAMPLER OD 2" ID 1 3/8"

TYPE OF RIG CME 45

GEO-METRICS, INC.
SUBSURFACE EXPLORATIONS

LONG POND ROAD
P.O. BOX 288
DANVILLE, NH 03819

CLIENT

Yankee Environmental Eng. and
Research Services, Inc.

SHEET 1 of 1

PROJ. NO

LOCATION Woburn, Mass.

LINE & STA

OFFSET

GROUND ELEVATION

HOLE NO. 5

CASING SAMPLER CORE BARREL

TYPE Pipe SS by Core
SIDE ID 37/8" 1 3/8" 1 3/8"

Depth	Sample Depths	Type of Sample	Blows Per 8" On Sampler				Moist.	Profile Change Depth Elev.	Field Identification Of Soils Remarks	Sample	
			From		To					No.	Pen
			0-6	6-12	12-18	18-24					
							Gs	Brown sand and gravel (fill)			
	4-6	ss	54	28	14	15	W	4	Black to gray silt and organic matter some fill	1	24
0	9-9.5	ss	1	100			W	9.5		2	6
								11	Fine yellow silty sand & boulders		
								13	Cored 11-13' Recovered boulders		
0									Installed observation well using 7' screen and 6' solid PVC.		
									Backfill 13'		
									1 Protective casing		

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%.

Driller L. Knox
Helper K. Knox
Soil Engineer _____
Drilling Inspector _____

SAMPLE TYPE	COHESIONLESS DENSITY	COHESIVE CONSISTENCY
C = Cored W = Washed	0-4 very loose	0-2 very soft
SS = Split Spoon	4-10 loose	2-4 soft
UP = Undisturbed Piston	10-30 compact	4-8 medium
TP = Test Pit	30-50 dense	8-15 stiff
	50+ very dense	15-30 very stiff

TOTAL FOOTAGE

Earth Boring n 11'
Rock Coring 2 ft.
Hole No. 5

DATE START 10-7-83
 DATE FINISH 10-7-83
 WEIGHT OF HAMMER 140 300
 HEIGHT OF FALL 30" 24"
 GROUND WATER OBSERVATION
 DATE 10-14 TIME AM DEPTH 41'
 SAMPLER OD 2" ID 1 3/8"
 TYPE OF RIG CME 45

GEO-METRICS, INC.
 SUBSURFACE EXPLORATIONS

LONG POND ROAD
 P.O. BOX 288
 DANVILLE, NH 03819

PROJ. NO
 LOCATION Woburn, Mass.
 LINE & STA
 OFFSET
 GROUND ELEVATION
 HOLE NO. 6
 CASING SAMPLER CORE BARREL
 TYPE Pipe SS Hy core
 SIDE ID 3 7/8" 1 3/8" 1 3/8"

CLIENT
 Yankee Environmental Eng. and
 Research Services, Inc.

Sample Depths	Type of Sample	Blows Per 8" On Sampler				Moist.	Profile Change Depth Elev.	Field Identification Of Soils Remarks	Sample	
		From 0-6	6-12	12-18	18-24				No	Pen
							ss-25" Black top			
							Yellow brown to gray fine to coarse sand, gravel, cobbles, and boulders			
10-12	ss	8	10	27	21	D		1	24	
14-16	ss	118	46	29	24	D		2	24	
19-21	ss	21	15	56	21	D		3	24	
25-27	ss	15	15	18	15	D	*Note: No samples from 27'. Samples either wash or refusal on boulders.	4	24	

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%.

TOTAL FOOTAGE

Driller L. Knox
 Helper K. Knox
 Soil Engineer M. Hanley
 Drilling Inspector

SAMPLE TYPE	COHESIONLESS DENSITY	COHESIVE CONSISTENCY
C = Cored W = Washed	0-4 very loose	0-2 very soft
SS = Split Spoon	4-10 loose	2-4 soft
UP = Undisturbed Piston	10-30 compact	4-8 medium
TP = Test Pit	30-50 dense	8-15 stiff

Earth Boring n 42'
 Rock Coring 3"
 Note No 6

GEO-METRICS, INC.
SUBSURFACE EXPLORATIONS

LONG POND ROAD
P.O. BOX 288
DANVILLE, NH 03819

PROJ. NO _____
LOCATION Woburn, Mass.
LINE & STA _____
OFFSET _____
GROUND ELEVATION _____
HOLE NO. 6
CASING SAMPLER CORE BARREL
TYPE Pipe SS Hy core
SIDE ID 37/8" 13/8" 1 3/8"

DATE START 10-7-83
DATE FINISH 10-7-83
WEIGHT OF HAMMER 140 300
HEIGHT OF FALL 30" 24"
GROUND WATER OBSERVATION
DATE 10-14 TIME AM DEPTH 41'
SAMPLER OD 2" ID 1 3/8"
TYPE OF RIG CME 45

CLIENT
Yankee Environmental Eng. and
Research Services, Inc.

Depth	Sample	Type of Sample	Blows Per 6" On Sampler				Moist.	Profile Change Depth Elev.	Field Identification Of Soils Remarks	Sample	
			From		To					No	Pen
			0-6	6-12	12-18	18-24					
							42	See page # 1			
							50	Cored boulders 41'-44' Fine Yellow-brown silty sand and gravel with occasional layers of cobbles and boulders.			
								End of boring Installed observation well using 20' of screen and 30' of solid PVC casing. Back fill 50' installed one roadway box			

Proportions used trace = 0-10%, little = 10-20%, some = 20-35%, and = 35-50%.

Driller L. Knox
Helper K. Knox
Soil Engineer M. Hanley
Drilling Inspector _____

SAMPLE TYPE	COHESIONLESS DENSITY	COHESIVE CONSISTENCY
C = Cored W = Washed	0-4 very loose	0-2 very soft
SS = Split Spoon	4-10 loose	2-4 soft
UP = Undisturbed Piston	10-30 compact	4-8 medium
TP = Test Pit	30-50 dense	8-15 stiff
_____ = _____	50+ very dense	15-30 very stiff

TOTAL FOOTAGE
Earth Boring n. 47'
Rock Coring 3 ft.
Hole No. 6

March 5, 1945

John J. Riley Co.
228 Salem Street
Woburn, Mass.

Gentlemen:

We are submitting herewith a log of test and observation wells as driven by us recently on your property near your present pumphouse.

Test Well #1

0 - 2'	Loam
2'-15'	Brown medium sand
15'-20'	Gray fine sand to rock
	Tight - did not pump freely.

Test Well #2

0 - 3'	Mud and loam
3'-18'	Medium sand and gravel
18'-23'	Coarse gravel
23'-38'	Sand and gravel to rock
	Pumped free - 60 G.P.M.
	Observation Well at 37'
	This well tested for both capacity and drawdown.

PW#1

It is in our opinion that at location #2 we could develop you, with one of our large diameter gravel filter wells, 500 G.P.M. with a safe drawdown and would run a preliminary test on this well at the above rated capacity for a period of forty-eight hours to determine the actual drawdown on this well.

D. L. MAHER CO.

LOG OF TEST WELL

Log of Well for J. J. [unclear] Test No. 2
 Address [unclear]
 Well located at [unclear] in [unclear] County, State of [unclear]
 Date Drilling started [unclear] Date Test Hole Completed [unclear]
 Total depth to bottom of Well 32' Diameter Test Hole [unclear]
 Water stands when not pumping [unclear] feet [unclear] inches from the surface of the ground.

EACH STRATUM	DEPTH OF STRATA	FORMATION FOUND EACH STRATUM	
			Did Well Clear Up? <u>[unclear]</u>
			How Long? <u>10</u>
			Time Pumped? <u>8</u>
			Drawdown <u>Ft. 10 In</u>
			Capacity <u>100</u>
			Time Required for Recovery? <u>[unclear]</u>
			Was Well Pulled? <u>71</u>
			Observation <u>71</u> What Depth? <u>27'</u>
			Was Observation Well Pulled? <u>720</u>
			Map of Location

Remarks and opinion of Test This well down to 18' to 23'
(Good well)

Well # 1.

Driller [unclear]
 Helpers [unclear]
[unclear]
[unclear]

APPENDIX D

Specifications for Topographic Survey
of Test Pits, Monitoring Wells and
other Features on the
John J. Riley Tanning Company Site
228 Salem Street
Woburn, Massachusetts

DANA F. PERKINS & ASSOC., INC.

Consulting Engineers

September 26, 1983

Ms. M. Margaret Hanley
Yankee Environmental Engineering
and Research Services, Inc.
27 Salem Street
Woburn, Massachusetts 01801

Re: J. J. Riley Tanning Company
Salem Street, Woburn, MA

Dear Ms. Hanley:

This correspondence is to confirm our meeting last week (September 16, 1983) at the site to discuss the survey requirements required by your firm. It is our understanding from the work print you gave us that there are approximately 17 to 20 points to be located with elevation. These points are test pit, boring or well locations as shown. In addition an elevation of a bedrock outcrop on the Bio Assay property is also required (as noted).

The scope of survey services will include the following:

1. Establish bench mark datum on U.S.G.S. datum.
2. Establish horizontal control on site by locating existing buildings, etc. as shown on the work print and preparing a scaled work plan overlay.
3. Elevations of the ground at test pit, borings and ledge outcrop location will be established. The elevation of concrete roofs of the well houses will also be established. All elevations will be to the nearest 0.1 foot.
4. A mylar of the working plan will be given to us by your firm in order for us to add the locations and elevations as noted above. (This will be the finish drawing with note relative to field work data by Dana F. Perkins & Assoc., Inc.)

It is our understanding that all points will be identified and clearly marked prior to the field crew location. It is also our understanding that you will have some tree clearing between the well #1 and well #2 line of sight completed to minimize delay of our survey time.

Civil • *Environmental* • *Land Surveys*
125 Main Street, Box 506, Reading, Mass. 01867 - 944-3060
43 Lakeview Avenue, Box 1322, Lowell, Mass. 01852 - 452-9871

September 26, 1983

As expressed to you during our meeting last Friday, we have estimated the cost of the survey work based on one day of field time. Your assistance during the set-up phase of the control lines with the crew would be appreciated so we don't miss any information you need. Based on our best judgement of the manpower requirements to complete the survey work as noted, we have established an upper limit of \$1000.00. It is planned to have the field crew at the site Thursday, September 29th at 7:30 AM to complete the field survey work. The mylar updated drawing should be available within two to three working days after completion of the field work.

It was a pleasure to meet with you last Friday and we look forward to working with you to complete this project to your satisfaction.

Very truly yours,

DANA F. PERKINS & ASSOC., INC.



Donald E. Martinage, P.E.

DEM/hmk

APPENDIX E

Description of Sampling Procedures
and

Report of Analysis of Groundwater Samples
Collected from Monitoring Wells
John J. Riley Tanning Company
228 Salem Street
Woburn, Massachusetts
October 12, 1983

Appendix E. Description of Sampling Procedures

Groundwater samples were collected from four monitoring wells installed under the direction of YE²ARS staff on the John J. Riley Tanning Company site, and the Riley Production Well #1.

Prior to sampling, groundwater elevations were measured at each well. At each monitoring well, a minimum of three static volumes of water were bailed and the well was permitted to equilibrate prior to sampling. Production Well #1 was pumped for five minutes to purge the well of standing water (the exact pumping rate is unknown).

The samples from monitoring wells were bailed using a copper bailer. Production Well #1 was sampled from a discharge pipe located at the west side of the pump house at Production Well #1. Two full 40 ml septum vials were filled with groundwater from each well for chemical analysis. Bailing equipment was decontaminated with methanol between sampling.

Samples were labeled and stored on ice until delivered to Cambridge Analytical Associates of Watertown, Massachusetts for chemical analysis.



Cambridge Analytical Associates

222 Arsenal Street / Watertown, Massachusetts 02172 / (617)923-9376

October 25, 1983

Ms. M. Margaret Hanley
Yankee Environmental Engineering
and Research Services, Inc.
27 Salem Street
Woburn, MA 01801

Dear Margaret:

On October 12, 1983 Cambridge Analytical Associates received 5 samples for volatile organics analysis by EPA Method 601. These analyses were completed on October 17, 1983. The attached data are the results of these tests.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

A handwritten signature in cursive script that reads "Ed Lawler". The signature is written in black ink and is positioned above the typed name.

Edward A. Lawler
Senior Analytical Chemist

CAMBRIDGE ANALYTICAL ASSOCIATES, INC.

Table 1: Concentrations of Volatile Organic Compounds (Method 601¹)

Client: Yankee Report No.: 83-887
 Date Samples Received: October 12, 1983 Reported by: *EL*
 Date Analysis Completed: October 17, 1983 Checked by: *AF*

Compound	Sample ID: CAA ID:	Concentration ug/l (ppb) ²		
		JJR #1 8308582	JJR B-2 8308583	Prod. Well 1 8308584
		B-1	B-2	PW #1
chloromethane				
dichlorodifluoromethane				
vinyl chloride				
chloroethane				
methylene chloride				
trichlorofluoromethane				
1,1-dichloroethene				
1,1-dichloroethane				
trans-1,2-dichloroethene			0.7	0.4
chloroform				
1,2-dichloroethane				
1,1,1-trichloroethane				
carbon tetrachloride				
bromodichloromethane				
1,2-dichloropropane				
trans-1,3-dichloropropane				
trichloroethene				0.4
dibromochloromethane				
1,1,2-trichloroethane				
cis-1,3 dichloropropene				
2-chloroethylvinyl ether				
bromoform				
1,1,2,2-tetrachloroethane				
tetrachloroethene				
chlorobenzene			2.3	

¹U.S. EPA. 1982. Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater. EPA 600/4-82-057. EPA/EHSL, Cincinnati, Ohio.

²Concentrations less than 0.1 ug/l are not detected and are left blank.

04 November 1980

Page 1 of 3

CLIENT: John J. Riley Company
228 Salem Street
Woburn, MA 01801

Attention: Mr. Charles J. Sheehan

CASE NO: 13677

REFERENCE: Letter of 10/1/80

PROJECT DESCRIPTION:

Analysis of five (5) water samples and two (2) sludge samples.

SAMPLE IDENTIFICATION:

Samples received from client 9/26/80:

1 of 2 - Beamhouse water (well), sampled 9/26/80.

Additional samples received from client 10/1/80:

3 of 5 - Buffing sludge.

4 of 5 - Hair sludge.

METHODS OF TESTS:

PCB and Purgeable Halocarbons - EPA Procedures, "Guidelines Establishing Test Procedures for the Analysis of Pollutants, Proposed Regulations" - Federal Register, Volume 44, No. 233, Monday, December 3, 1979 - water samples.

EP Toxicity Test Procedure - EPA-SW-846, "Test Methods for Evaluating Solid Waste" - May 1980, Section 7 - sludge samples.

Metals were determined by atomic absorption spectroscopy.

5/20/81
Copies of 275 sheets to client 2-2-81
C.L.S.

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skinner & sherman laboratories inc.

New England Laboratories

300 SECOND AVENUE, WALTHAM, MASSACHUSETTS 02254 • 617-890-7200

04 November 1980

Page 2 of 3

CLIENT: John J. Riley Company

CASE NO: 13677

RESULTS:

Beamhouse Water (Well) And
1 and 2

- Samples

No PCB's were detected in these samples. The sensitivity limit for PCB's was 10 parts per billion by volume.

	Micrograms per liter (parts per billion)			
	<u>Trans-1,2 Dichloroethylene</u>	<u>Chloroform</u>	<u>1,1,1-tri- chloroethane</u>	<u>Trichloro- ethylene</u>
Buffing Sludge EP Extract	*NR	*NR	*NR	*NR
Hair Sludge EP Extract	*NR	*NR	*NR	*NR

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04 November 1980

Page 3 of 3

CLIENT: John J. Riley Company

CASE NO: 13677

Milligrams per liter (parts per million)

Buffing Sludge EP Extract	0.011	1.8	0.48
Hair Sludge EP Extract	0.036	4.4	0.15

What are these?

*NR = Not Requested

Note: The maximum allowable concentrations of cadmium, chromium and lead in EP extracts are 1.0, 5.0 and 5.0 parts per million, respectively.

Respectfully submitted,

SKINNER & SHERMAN LABORATORIES, INC.

Haldean Dalzell

Haldean Dalzell, Ph.D.
Laboratory Manager

HD/lis

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skinner & sherman laboratories inc.

New England Laboratories

300 SECOND AVENUE, WALTHAM, MASSACHUSETTS 02254 • 617-890-7200

11.9

FORMAL REPORT OF ANALYSIS

PREPARED FOR: John J. Riley Co.
228 Salem Street
Woburn, Massachusetts 01901

Attn: Dick Jones

CUSTOMER ORDER NUMBER: J-187

CAMBRIDGE ANALYTICAL ASSOCIATES, INC.

REPORT NUMBER: 83-267

DATE PREPARED: April 26, 1983
DATE SAMPLED: April 7, 1983

IDENTIFICATIONS:

A Composite of two samples collected from hill at back of catch basin at a depth of 12". One sample was of "fresh" material and the other of "old" material.

TABLE OF CONTENTS

1. INTRODUCTION
2. ANALYTICAL METHODS
3. RESULTS
4. QUALITY ASSURANCE DOCUMENTATION
 - 4.1 Quality Control Data
 - 4.2 Certification

1. INTRODUCTION

This report summarizes results of chemical analyses performed on samples received by CAA on April 8, 1983. Analytical methods employed for these analyses are described in Section 2 and results are presented in Section 3. The last section contains quality control data and certifications supporting the analytical results.

2. ANALYTICAL METHODS

Analytical methods utilized for instrumental and colorimetric analysis are summarized in Table 1. For bulk analysis, total chromium was determined by atomic absorption spectrophotometry. Hexavalent chromium was determined colorimetrically following extraction with distilled water.

3. RESULTS

Results of analyses are presented in Table 2 and 3.

Table 1. Summary of Analytical Methods

Constituent	Method Reference	Method Description
Extraction	1	EP Test
Arsenic(As)	Method 206.2 ²	Atomic Absorption Spectrophotometry
Barium(Ba)	" 208.1 ²	Atomic Absorption Spectrophotometry
Cadmium(Cd)	" 213.1 ²	Atomic Absorption Spectrophotometry
Chromium(Cr)	" 218.1 ²	Atomic Absorption Spectrophotometry
-total	" 307B ³	Colorimetric
-hexavalent	"	
Lead(Pb)	" 239.1 ²	Atomic Absorption Spectrophotometry
Mercury(Hg)	" 245.1 ²	Atomic Absorption Spectrophotometry
Selenium(Se)	" 270.2 ²	Atomic Absorption Spectrophotometry
Silver(Ag)	" 272.1 ²	Atomic Absorption Spectrophotometry

- (1) U.S. EPA 1980. Hazardous waste and consolidated permit regulations - Appendix II - EP Toxicity test procedure. Federal Register 45(98): 33127-33128.
- (2) U.S. EPA 1979. Methods for Chemical Analysis of Water and Waste. EPA 600/4-79-020. EPA/EMSL, Cincinnati, Ohio.
- (3) APHA. 1975. Standards Methods for the Examination of Water and Wastewater. 14th edition. APHA, Washington, D.C.

Table 2. Results of Analyses of EP Extract

Constituent	Maximum Contamination Level	CONCENTRATION in EP Extract	
		Sludge Sample (CAA#83-4076) ¹	Blank
Metals (mg/l _e)			
Arsenic	5.0	<0.01;<0.01	0.01
Barium	100	<1.25;<1.25	<0.2
Cadmium	1.0	<0.01;<0.01	<0.01
Chromium			
-total	5.0	2.3;2.2	<0.01
-hexavalent	5.0	<0.1;<0.1	<0.1
Lead	5.0	<0.05;<0.05	<0.05
Mercury	0.2	<0.0005;<0.0005	<0.0005
Selenium	1.0	<0.15;<0.15	<0.01
Silver	5.0	<0.02;<0.02	<0.02

¹ Duplicate analyses performed.

Table 3. Results of Bulk Analyses

Client ID	CAA ID	Concentration (a)		
		Total Chromium (wt%)	Hexavalent Chromium (ppm)	Moisture (wt%)
Sludge sample	83-4076	1.39;1.61	<1.4	68.1

(a) All concentrations are on a dry weight basis.

Note: pH of sludge during EP extraction procedure
(after addition of demineralized water and prior
to acidification w/ 2.5N acetic acid.)
was 8.4.

Table 4. Quality Control Data - Spike Recoveries

Element	Client ID	CAA ID	Concentration(ppm)		Recovery %
			Theoretical Value	Observed Value	
As	Sludge sample	83-4076 EP	0.050	0.049	98
	"	4076 dupe	0.050	0.049	98
Ba	"	83-4076 EP	1.0	0.86	86
Cd	"	83-4076 EP	0.5	0.5	100
	"	4076 dupe	0.5	0.5	100
Cr - total	"	83-4076 EP	0.70	0.68	97
	"	4076 dupe	0.69	0.68	99
	"	4076 Bulk	1.13	1.15	102
Pb	"	83-4076 EP	2.5	2.7	106
	"	4076 dupe	2.5	2.5	100
Hg	"	83-4076 EP	0.025	0.028	112
	"	4076 dupe	0.025	0.024	96
Se	"	83-4076 EP	0.05	0.03	60
Ag	"	83-4076 EP	0.53	0.50	96
	"	4076 dupe	0.53	0.53	100
Cr - hexavalent	"	83-4076 EP	0.50	0.33	66
	"	4076 bulk	0.50	0.35	70



Cambridge Analytical Associates

1106 Commonwealth Avenue / Boston, Massachusetts 02215 / (617) 232-2267

11.9

FINAL REPORT

John J. Riley
228 Salem Street
Woburn, MA 01801
Attn: Dick Jones

PROJECT NUMBER: J-274

CAMBRIDGE ANALYTICAL ASSOCIATES, INC.

REPORT NUMBER: 84-1216

PREPARED BY: Keith A. Hausknecht

DATE PREPARED: November 21, 1984
Revised November 30, 1984



Cambridge Analytical Associates

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1. INTRODUCTION

2. ANALYTICAL METHODS

3. RESULTS

4. QUALITY ASSURANCE DOCUMENTATION
 - 4.1 Quality Control Data
 - 4.2 Certification

1. INTRODUCTION

This report summarizes results of chemical analyses performed on samples received by CAA on October 11, 1984. Analytical methods employed for these analyses are described in Section 2 and results are presented in Section 3. The last section contains quality control data and certifications supporting the analytical results.

2. ANALYTICAL METHODS

Analytical methods utilized for sample analysis are summarized in Table 1. For analysis of EP toxicity, the sample was extracted according to methods specified by EPA (1982). The leachate was then analyzed for metals according to methods of EPA (1979, 1982) and ASTM (1980). Water samples were acidified and analyzed by furnace atomic absorption spectrophotometry.

3. RESULTS

Results of EP toxicity analyses are presented in Table 2. The finished leather trimmings exceeded the MCL for total chromium, but hexavalent chromium levels were below the MCL. All other samples were EP non-toxic. Water samples (Table 3) contained undetectable levels of metals.

4. QUALITY ASSURANCE DOCUMENTATION

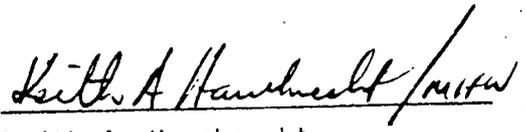
4.1 Quality Control Data

Quality control data associated with these analyses are summarized in Table 4. These results consist of recoveries of spikes from analyte solutions.

4.2 Certification

This work has been checked for accuracy by the following staff personnel:

Director, Inorganic
Chemistry Laboratory


Keith A. Hausknecht

Quality Assurance
Administrator

Leanne Schwamb

Table 1. Summary of Analytical Methods

Constituent	Method Reference	Method Description
<u>Metals</u>		
Sample Preparation (EP toxicity)	Method 1310 (1)	EP test
Instrumental Analysis (EP Test)		
Cadmium (Cd)	Method 213.1/2 (2)	FAAS; GFAAS
Chromium (Cr) (total)	Method 218.1/2 (2)	FAAS; GFAAS
Lead (Pb)	Method 239.1/2 (2)	FAAS; GFAAS
Chromium (Cr) (hexavalent)	Method D1687-80 (3)	Colorimetric, diphenylcarbazide

(1) U.S. EPA. 1982a. Test Methods for Evaluating Solid Waste-Physical/Chemical Methods. SW-846. Office of Solid Waste, U.S. EPA, Washington, D.C.

(2) U.S. EPA. 1979. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020 (Revised, March 1983). EPA/EMSL, Cincinnati, Ohio.

(3) ASTM. 1981. Annual Book of ASTM Standards. Part 31-Water. American Society for Testing and Materials. Philadelphia, PA 19103.

GFAAS - Graphite furnace atomic absorption spectrophotometry
 ICP - Inductively coupled argon plasma emission spectroscopy
 FAAS - Flame atomic absorption spectrometry

Table 2. Results of EP Toxicity Analyses

Client: John J. Riley
Project No: 84-1216

Constituent	Maximum Contaminant Level (MCL) ^a	Client ID:	Sludge/Soil- Old Lagoons 8406751	Sludge- Back of Catch Basin 8406752
<hr/>				
Metals (mg/l)				
Cadmium	1.0		<0.02	<0.02
Chromium	5.0		<0.05	0.27
Total Hexavalent Chromium	5.0		<0.05	<0.05
Lead	5.0		<0.2	<0.2

^aEPA(1982a)

Table 3. Results of Surface Water Analyses

Client: John J. Riley
Project Number: 84-1216

Constituent	Client ID: CAA ID:	Well #1 8406755
Cd (mg/l)		<0.001
Cr (total-mg/l)		<0.005
Cr (hexavalent-mg/l)		<0.05
Pb (mg/l)		<0.005

Table 4. Quality Control Data for Inorganic Analysis -
Spike Recoveries and Reference Standards

Constituent	Client ID	CAA ID	Concentration (ppm)		Recovery (%)
			Theoretical Value	Observed Value	
Cd	Check Standard	(EPA 475 #6)	0.070	0.071	101
	Check Standard	(NBS 1643a)	0.010	0.011	110
	8406751-Spike		0.50	0.50	100
	8406752-Spike		0.50	0.51	102
	8406753-Spike		0.50	0.51	102
	8406754-Spike		0.50	0.53	106
	8406755-Spike		0.0050	0.0056	112
Cr (total)	Check Standard	(EPA 475 #6)	0.250	0.230	92
	Check Standard	(NBS 1643a)	0.015	0.013	89
	8406751-Spike		3.3	2.8	85
	8406752-Spike		3.3	2.7	82
	8406753-Spike		3.3	3.0	91
	8406754-Spike		3.3	4.3	130
	8406755-Spike		0.050	0.049	98
Pb	Check Standard	(EPA 475 #6)	0.40	0.39	98
	Check Standard	(NBS 1643a)	0.027	0.025	93
	8406751-Spike		5.0	4.7	94
	8406752-Spike		5.0	4.9	98
	8406753-Spike		5.0	4.9	98
	8406574-Spike		5.0	5.0	100
	8406755-Spike		0.050	0.051	102

4. QUALITY ASSURANCE DOCUMENTATION

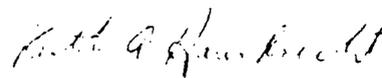
4.1 Quality Control Data

Quality control data associated with these analyses are summarized in Table 4. These results consist of recoveries of spikes from analyte solutions and analyses of reference standards used to verify the accuracy of instrument calibration.

4.2 Certification

This work has been checked for accuracy by the following staff personnel:

Director, Inorganic
Chemistry Laboratory



Keith A. Hausknecht

ANALYTICAL REPORT

25 June 1982

Page 1 of 3

11.9

CLIENT: John J. Riley Company
228 Salem Street
P.O. Box 316
Woburn, MA 01801

Attention: Mr. Richard Jones

CASE NO: 15658

REFERENCE: Purchase Order No. 0167

PROJECT DESCRIPTION:

Analysis of two (2) water samples and four (4) sludge samples for volatile organic materials, and two (2) sludge samples for pH.

SAMPLE IDENTIFICATION:

- 1 of 6 - Well Water #1, 5/27/82 (6 volatiles)*
- 3 of 6 - Sludge Sample #1, 5/27/82 (6 volatiles)*, pH
- 4 of 6 - Sludge Sample #2, 5/27/82 (6 volatiles)*, pH
- 5 of 6 - Sludge Sample #3, 5/27/82 (all volatiles)
- 6 of 6 - Sludge Sample #4, 5/27/82 (all volatiles)

*(trichloroethylene, tetrachloroethylene, trans-1,2-dichloroethylene, 1,1,1-trichloroethane, benzene, chloroform)

The above samples were received on 27 May 1982.

METHODS OF TESTS:

Water Samples - purgeable organics: EPA Methods 601 and 602; "Guidelines Establishing Test Procedures for the Analysis of Pollutants, Proposed Regulations", Federal Register, Volume 44, No. 233, Monday, December 3, 1979. The analysis was done by gas chromatography using electron capture and flame ionization detection.

Sludge Samples - volatile organics: Each sample was extracted with a measured volume of methanol. The methanol extracts were analyzed by gas chromatography using electron capture and flame ionization detection.

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New England Laboratories

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25 June 1982

Page 2 of 3

CLIENT: John J. Riley Company

CASE NO: 15658

pH: Each sample was stirred with ten times its weight of distilled water for one hour, filtered and the pH of the filtrates was determined.

RESULTS:

Water Samples

Well Water #1

Micrograms per liter (parts per billion)

Chloroform	<1.
trans-1,2-Dichloroethylene	1.
1,1,1-Trichloroethane	<1.
Trichloroethylene	<1.
Tetrachloroethylene	<1.
Benzene	12.
Toluene	11.

Sludge Samples

#1 #2 #3 #4

Micrograms per gram (parts per million)

Chloroform	<0.05	<0.05	<0.05	<0.05
trans-1,2-Dichloroethylene	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	<0.005	<0.005	<0.005	<0.005
Trichloroethylene	<0.01	<0.01	<0.01	<0.01
Tetrachloroethylene	<0.005	<0.005	<0.005	<0.005
Benzene	<0.1	<0.1	<0.1	<0.1

pH (10% extract)

7.85

7.50

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25 June 1982

Page 3 of 3

CLIENT: John J. Riley Company

CASE NO: 15658

Note: Two substances of volatility similar to that of the dichlorobenzenes were detected in the extract of sludge sample #1. These substances were not identified. They do not appear to be any of the three isomeric dichlorobenzenes however. No other substances were detected in any significant quantity in the extracts of the four sludge samples.

Respectfully submitted,

SKINNER & SHERMAN LABORATORIES, INC.



Harel Lacey, Ph.D.
Chemist

HL/lrs

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THORSTENSEN LABORATORY, INC.

CHEMISTS ** BACTERIOLOGISTS ** ENGINEERS

66 LITTLETON ROAD

P. O. BOX 426

WESTFORD, MASS. 01886

TEL. 617-692-8395

692-2051

Report To: John J. Riley Company
228 Salem Street
Woburn, MA. 01801

LABORATORY REPORT

Report No. E1251/2936

Date: July 10, 1980

Sampling Date:

Sample Received: July 3, 1980

Attention: Mr. Charlie Sheehan

Subject: Chromium Content on 5 samples

Five water samples were received on July 3rd, 1980 from the John J. Riley Co. These samples were described in a note from Mr. Sheehan (see attached). The analysis was made for pH and Chromium. Chromium was by atomic absorption on the sample as received. The limit of detection of our Instrument (IL Model 153) is .01 PPM.

<u>SAMPLE</u>	<u>pH</u>	<u>Chrome PPM</u>
1	6.5	< .01
2	6.5	< .01
3	6.5	< .01
4	6.5	< .01
5	6.5	< .01.

Signed by: Madhu Shah

Madhu Shah, Chief Chemist

Remarks:

Method:



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Cambridge Analytical Associates

222 Arsenal Street / Watertown, Massachusetts 02172 / (617)923-9376

EXHIBIT 8

March 30, 1983

Mr. Richard Jones
John J. Riley Co.
228 Salem Street
Woburn, Mass. 01801

Dear Mr. Jones:

On March 22, 1983, Cambridge Analytical Associates Inc. received 3 samples for volatile organics analysis by EPA method 624 (GC/MS). These analyses were completed on March 24, 1983. The results of these tests are listed in the enclosed table.

Should you have any questions, please do not hesitate to call.

Sincerely,

A handwritten signature in cursive script that reads "Edward A. Lawler". The signature is written in dark ink and is positioned above the typed name.

Edward A. Lawler
Senior Analytical Chemist

Table 1: Concentrations of Volatile Organic Compounds (Method 624¹)

Client: John J. Riley Co., Inc.

Project No.: 83-208

Date Samples Received: 3/22/83

Reported by: 

Date Samples Completed: 3/24/83

Checked by: 

Compound	Sample :	W-1	Concentration (ug/l) ²
(2v) Acrolein			
(3v) Acrylonitrile			
(4v) Benzene			
(6v) Carbon Tetrachloride			
(7v) Chlorobenzene			
(10v) 1,2-Dichloroethane			
(11v) 1,1,1,-Trichloroethane			
(13v) 1,1-Dichloroethane			
(14v) 1,1,2-Trichloroethane			
(15v) 1,1,2,2-Tetrachloroethane			
(16v) Chloroethane			
(19v) 2-Chloroethylvinyl ether			
(23v) Chloroform			
(29v) 1,1-Dichloroethylene			
(30v) Trans-1,2-Dichloroethylene			
(32v) 1,2-Dichloropropane			
(33v) Trans-1,3-Dichloropropene			
Cis-1,3-Dichloropropene			
(38v) Ethylbenzene			
(44v) Methylene Chloride			
(45v) Chloromethane			
(46v) Bromomethane			
(47v) Bromoform			
(48v) Bromodichloromethane			
(49v) Fluorotrichloromethane			
(50v) Dichlorodifluoromethane			
(51v) Chlorodibromomethane			
(85v) Tetrachloroethylene			
(86v) Toluene			
(87v) Trichloroethylene			
(88v) Vinyl Chloride			
1,1,2-Trichloro-1,2,2-Trifluoroethane			
Xylenes			

¹ EPA 1982 Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater. EPA 600/4-82-057. EPA/EMSL Cincinnati, Ohio.

² Concentrations less than 1 ug/l are not detected and are left blank. Concentrations between 1 and 9 ug/l are listed as trace levels (TR).