NACIP PROGRAM
CONFIRMATION STUDY

SITE SUITABILITY ASSESSMENT
PROPOSED BRIG EXPANSION (P-977)
NAVAL STATION, NORFOLK, VIRGINIA

CONTRACT NO. N62470-83-C-6079

FOR: ENVIRONMENTAL QUALITY BRANCH
CODE 114
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA 23511

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PROPOSED BRIG EXPANSION (P-977)
NAVAL STATION, NORFOLK, VIRGINIA

I. PURPOSE:

- This study was performed to evaluate conditions and assess site suitability for a proposed brig expansion at the Camp Allen area of the Naval Station, Norfolk, Virginia.

II. BACKGROUND:

- The proposed brig expansion site is adjacent to the existing brig in an area formerly used as a landfill.
- The area has been identified as a site where the potential for adverse impacts on human health or the environment may exist due to the landfill operations.
- Malcolm Pirnie's Contract N62470-83-C-6079 was change ordered in November, 1983 to assess the site suitability with respect to adverse conditions due to hazardous waste disposal in the area of the proposed construction.

III. FINDINGS:

- A magnetometer survey and visual observations indicated significant quantities of metal exist beneath the ground surface. Identification of the type of metal (drums, tanks, cylinders, etc.) was not possible.
- Ground water measurements indicated the flow was in a westerly direction towards a marsh and drainage ditch area.
- Gas monitoring identified methane in concentrations less than 220 ppm in all but one location. An existing sewer pipe was possibly the cause of the one high reading.
- Analyses of organic compounds in eleven ground water samples identified only one location as having organic pollutants in concentrations which exceeded EPA water quality criteria for freshwater and/or salt water aquatic life.
- Analyses of inorganic compounds in the eleven ground water samples identified eight pollutants from several wells which exceeded the EPA water quality criteria for fresh water and/or salt water aquatic life. Average concentrations of copper, mercury, selenium and zinc exceeded these criteria in the construction area.

- Comparison of average concentrations of organic and inorganic compounds found in the construction area with EPA electroplating discharge guidelines indicated the pollutant concentrations did not exceed monthly average discharge limits.

IV. CONCLUSIONS:

- Organic pollutants found to exceed EPA aquatic life toxicity criteria in one well should not affect the proposed brig expansion because the well is located outside the proposed construction limits.

- Organic pollutants may be encountered during construction in localized areas at concentrations which could have adverse environmental effects. Isolation and removal of these contaminates would be required.

- Inorganic pollutants found to exist at the site may have adverse environmental impacts during excavation and dewatering activities.

- Buried containers containing hazardous materials may be uncovered or ruptured during excavation work and adverse health or environmental conditions may result.

- Methane gas may be released during construction, however, no adverse effects are anticipated if proper precautions are taken.

V. RECOMMENDATIONS

- Proceed with the construction of new facilities only with implementation of health, safety and environmental safeguards.

- Designate a safety coordinator to develop, implement and insure compliance with a construction safety program.

- The safety program should address the potential problems related to construction and facility operations and include:

  - General safety protocols.

  - Gas and water monitoring.

  - Description of safety equipment and clothing required if questionable materials are encountered.

  - Contingency plans for handling hazardous materials and emergency situations.

- o Ground water on-site should not be used as a potable or non-potable water source.

- o Dewatering activities, if required during construction, may discharge pollutants to surface waters in concentrations which could adversely affect the aquatic life of the localized discharge area. Three options for this discharge are:

  - Direct discharge to surface water with monitoring of pollutants.

  - Discharge to Hampton Roads Sanitation District (HRSD).

  - Eliminate the need to dewater through construction methods or facility design.

- o Excavation activities may uncover or rupture drums containing hazardous materials. Leaking drums may also be encountered which have contaminated a localized area. Safety protocol to address these problems should include:

  - Removal of sealed drums under the direction of the safety coordinator and place them in a designated holding area.

  - Removal of leaking drums and discolored soils under the direction of the safety coordinator and stockpile the materials in a designated holding area.

  - EP Toxicity tests should be run on materials stockpiled to determine the appropriate method of disposal.

- o The release of gases from the site was not found to be significant during the testing period, however, the following precautionary measures are advised:

  - Conduct periodic monitoring during construction to detect any significant gas concentrations being released. Daily monitoring should be conducted during excavation activities.

  - After construction, conduct a quarterly monitoring program during the first year of operation to identify any potential problems. After review of this data, a long term sampling program should be developed.

2. INTRODUCTION

General

The Department of the Navy has retained Malcolm Pirnie, Inc. (Contract No. N62470-83-C-6079, Change Order No. 1) to prepare a site suitability assessment for a proposed brig expansion (P-977) at the Naval Station, Norfolk, Virginia. The assessment addresses the possible impacts on construction of hazardous waste disposal. The proposed facilities are to be constructed adjacent to the existing brig in an area formerly known as the Camp Allen Landfill. The landfill site location is shown in Figure 1. The Camp Allen landfill site was identified in an Initial Assessment Study (IAS) Report, NEESA 13-016, completed in February, 1983 as a site where the potential exists for adverse impacts on human health or the environment due to past disposal operations.

Objectives

This site suitability assessment was designed to accomplish three goals in connection with the proposed construction:

- Determination of subsurface contamination existing at the site due to prior landfill operations.
- Evaluation of the extent of contamination and the significance of these findings with regard to constructibility at the site and of operation of the proposed facilities.
- If construction is not contra-indicated, recommendations for remedial measures and design guidelines required to initiate construction of the brig expansion facilities.

The following tasks were performed in order to achieve these goals:

- Identification and quantification of the existence of soil or ground water contamination by any of 128 priority pollutants reported by the Environmental Protection Agency (EPA) that have the potential for adverse health or environmental effects.
- Development of ground water contour and flow diagrams and assessment of the potential for contaminant migration.
- Identification and determination of the potential for gas production, release, and any consequent adverse health or environmental effects.
- Location of buried ferromagnetic materials such as drums, cylinders and tanks to at least five feet below ground water.

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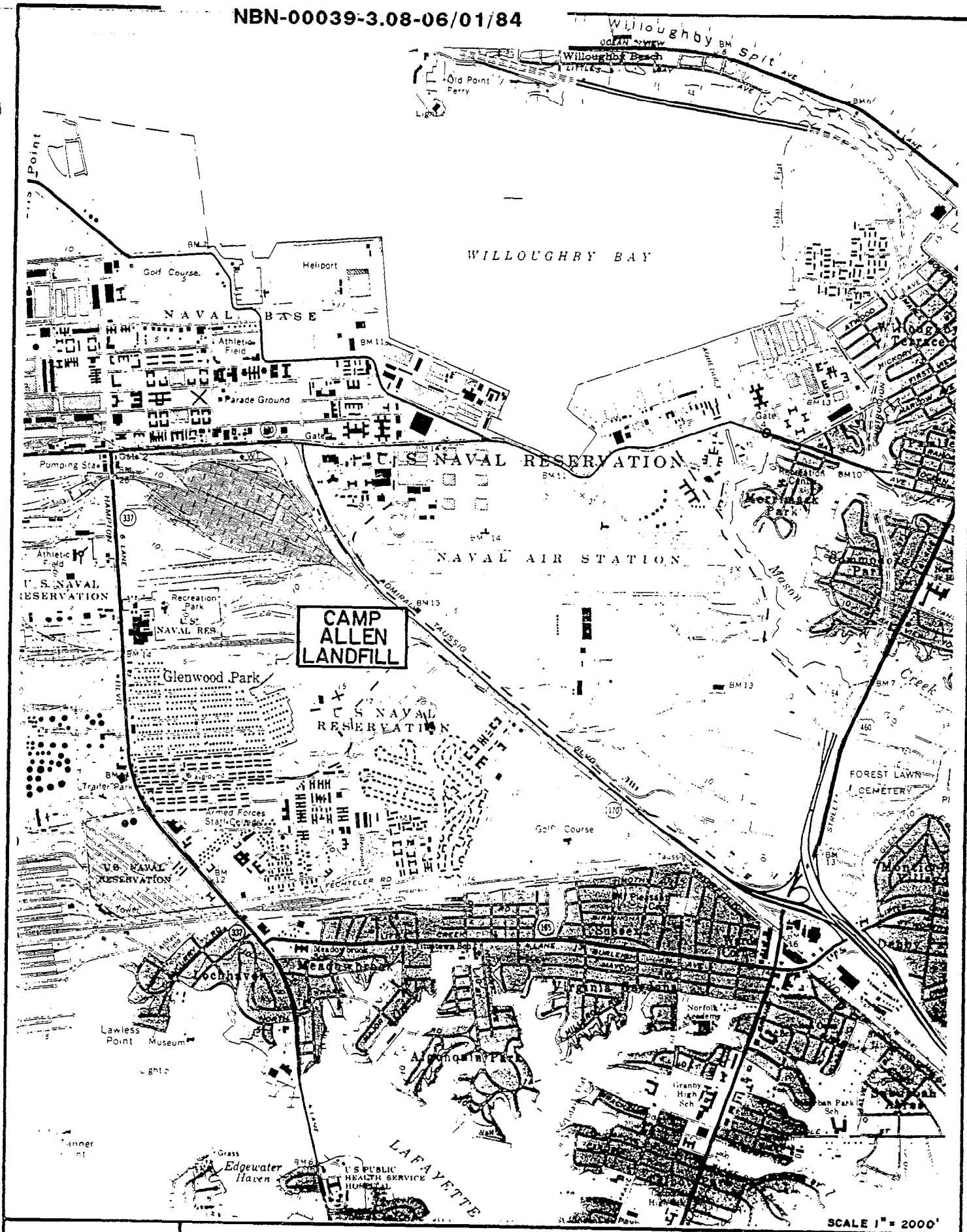

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LOCATION PLAN

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FIGURE 1

- o Comparison of contaminants encountered against standards, guidelines, recommendations, etc., for health and safety significance.

- o Development of alternatives to reduce contaminants below adverse levels if found at concentrations which may threaten health or environment.

- o Development of recommendations and design guidelines for on-site construction.

Background

The Department of the Navy is conducting an ongoing program, The Navy Assessment and Control of Installation Pollutants (NACIP) Program, to identify, assess, and control possible contamination from past hazardous material operations. The purpose of the program is to locate areas at naval installations which may pose a potential threat to human health or the environment. This Program consists of three phases: (1) initial assessment study (IAS); (2) confirmation study (CS); and (3) corrective measures.

In April, 1982 the initial assessment phase of the NACIP program began at the Sewells Point Naval Complex. This phase included record searches and personnel interviews to collect and evaluate all evidence supporting the possible existence of a contamination problem at several sites within the Naval Complex.

Results of the IAS identified the Camp Allen Landfill area as one of six locations potentially contaminated by disposal activities. It was reported that operations at the Camp Allen Landfill were conducted from the early 1940's until about 1974 to dispose of a variety of materials. Materials disposed of at the site included incinerator ash, fly and bottom ash from the Navy power plant, metals plating, parts cleaning and paint stripping sludges, overage chemicals, chlorinated organic solvents, acids, caustics, paints, paint thinners, pesticides, asbestos, scrap metal, and construction and demolition debris.

The IAS report concluded that the potential exists for adverse impacts on human health or the environment at the landfill. This conclusion was based on the quantities of hazardous materials disposed of at the landfill site, the proximity of the site to potential receptors, and the availability of surface and subsurface contaminant migration pathways. Based on these conclusions, it was recommended that the Confirmation Study phase of the NACIP program be performed at the Camp Allen Landfill site.

Malcolm Pirnie was contracted in September, 1983 and is conducting the CS of five locations identified in the IAS, including the Camp Allen Landfill area. The sixth site is currently being monitored by LANTNAVFACENGCOM/Public Works Center. The objectives of the CS,

as outlined earlier, include performing on-site investigations and physical and analytical monitoring around the perimeter of each site to confirm or refute the existence of contamination at the site boundaries.

The Department of the Navy requested a change order to Malcolm Pirnie's CS contract in November, 1983. The change order authorized that a site suitability assessment be conducted at the proposed brig expansion site. This assessment required a more extensive field investigation than that being performed under the NACIP program since the proposed construction limits were within the landfill boundaries rather than near the site perimeter.

Work Description

This Site Suitability Assessment for the proposed brig expansion included development of a safety program, a field investigation and subsequent data analyses to evaluate site conditions for future construction and use of facilities.

The Safety Plan was submitted to the Navy Engineer-in-Charge (EIC) prior to the field investigation. This plan was comprised of both general safety protocols as well as site specific requirements to insure the safety of field personnel. It included an initial site characterization, specification of safety equipment, on-site operational procedures, and contingency planning. A training course was also conducted to insure personnel were adequately informed of potential hazards and safety protocols.

The field investigation included a magnetometer survey, soil borings and loggings, installation of ground water monitoring wells and installation of gas monitoring stations. Ground water monitoring included testing for chemicals on the priority pollutant list, and determination of ground water contours and flows. Gas sampling was conducted for combustible gas, oxygen, hydrogen sulfide, methane, and the volatile organics from the priority pollutant list.

The results of the laboratory analyses were compared with EPA Water Quality Criteria, EPA Electroplating and Metal Finishing Effluent Guidelines, Virginia State Water Control Board Ground Water Standards, National Academy of Science exposure guidelines and SNARLS (Suggested No Adverse Response Limits). The feasibility and effectiveness of alternatives to reduce the contamination below adverse levels were evaluated. If contaminants were found that posed adverse health/safety conditions, recommendations and design guidelines were established for on-site facility construction. Site monitoring methodology, monitoring results and construction guidelines are presented in the following sections.

3. SITE INVESTIGATION METHODOLOGY

The field investigation at the site of the proposed brig expansion included a magnetometer survey, twenty borings with continuous soil sampling and development of boring logs. Eleven ground water monitoring wells and nine gas monitoring stations were installed. The wells and monitoring stations were used to develop ground water contours, test ground water samples for priority pollutants, and test gas samples for combustible gas, oxygen, hydrogen sulfide, methane and volatile organics.

The following sections provide a brief discussion of the installation and monitoring methods used.

Analytical Methods

The analytical methods used for gas and water analyses are based on those described by EPA. In general, the gas chromatography/mass spectrometry (GC/MS) analytical technique was used for analysis of organic compounds while atomic absorption spectrophotometry (AAS) was used for metal analysis. The following methods are listed for reference:

Volatile Organics	Method 624 - Federal Register 12-3-79
Acid Extractables	Method 625 - Federal Register 12-3-79
Base/Neutral/Pesticide Extractables	Method 625 - Federal Register 12-3-79
Pesticides	Method 608 - Federal Register 12-3-79
Inorganics	EPA: Analysis of Water and Waste Water (1974, 1979)
RCRA	Federal Register 5-19-80

Monitoring Locations

Prior to the implementation of the field program a site reconnaissance was conducted to determine the best location for the borings and installation of the ground water monitoring wells or gas monitoring stations. Monitoring well locations, gas station locations, and the approximate limits of the past landfill operation are shown in Figure 2. The locations were selected to give adequate coverage of the proposed brig facility as well as the existing facilities. Borings and installation of permanent ground water monitoring wells were located to obtain data concerning water table elevations and site ground water characteristics. Locations were selected to avoid future construction activities and to avoid underground utilities as checked by PWC personnel. Borings and temporary gas monitoring stations were located in areas adjacent to existing structures and within the confines of the proposed construction activities in order to determine if adverse health or safety conditions exist.

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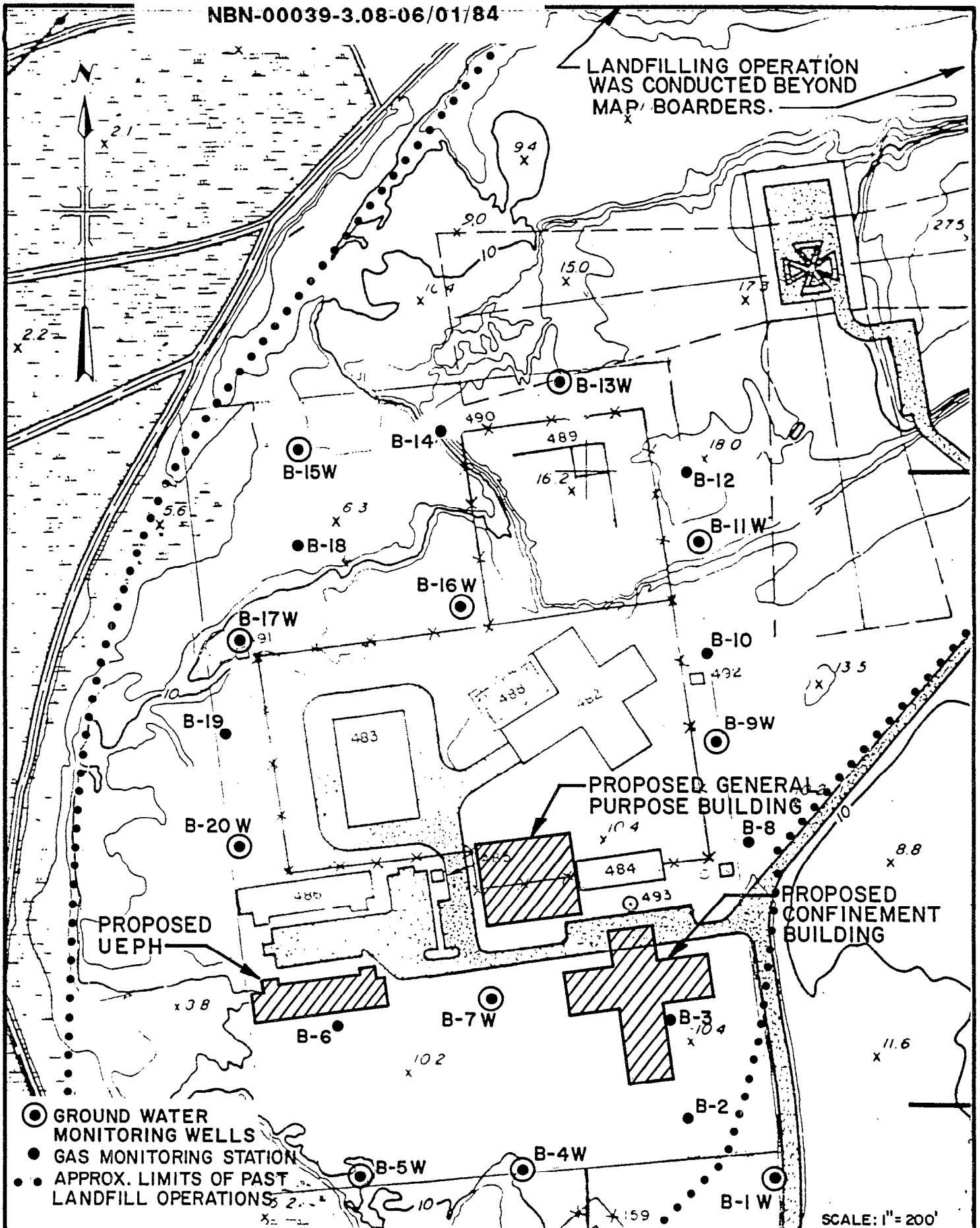

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MONITORING WELL/STATION LOCATIONS BRIG EXPANSION SITE

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FIGURE 2

Magnetometer Survey

The magnetometer is an instrument which measures magnetic fields. Because magnetic material within the Earth's magnetic field produce an induced magnetism, an anomaly in the Earth's ambient field can be detected when an induced field is superimposed on the ambient field. Strong magnetic anomalies which are detected may indicate local concentrations of buried metallic objects.

A magnetometer survey was conducted on October 26-27, 1983, by International Exploration, Inc., using a Geometrics G-856 Proton Precession magnetometer. This instrument is capable of producing a high resolution measurement of the earth's magnetic field. In general, localized metal drums or tanks are expected to increase the magnetic field measurement by approximately 200 gammas. Because the signal amplitude from the sensor is on the order of microvolts, the measurements can be affected by interference due to power sources, buried utilities and buildings.

The magnetometer survey at the site was conducted in an attempt to locate buried metallic objects (drums, cylinders, tanks, etc.) over a 15 acre area to a depth at least 5-feet below ground water. The majority of work was performed in the vicinity of the proposed confinement and housing building locations. A series of traverse lines running approximately north-south were set up at 25-foot intervals in this area. Measurements were obtained at 10-foot increments along each line. Additional traverse lines were positioned in the vicinity of boring locations which were not covered by the primary grid.

Soil Sampling

Soil samples were collected continuously to a depth of 25-feet at each ground water monitoring well and gas monitoring station. A 2-inch O.D. split-spoon capable of collecting a 2-foot long sample was used in accordance with the standard penetration test as specified in ASTM D-1586. Boring logs identifying subsurface soils were developed from the samples obtained. The boring logs are included in Appendix B.

These samples were also tested using an organic vapor analyzer to determine if volatile organics were present, and in what concentrations. These field tests were conducted as part of the safety program to monitor the release of volatile gases which may have had an adverse impact on the field personnel.

Ground Water Monitoring Wells

Ground water monitoring wells were installed at eleven locations in the vicinity of the existing brig. These wells were used to take water samples which were analyzed for the EPA 128 priority pollutants by Mead CompuChem. The analyses were conducted to identify and

quantify pollutants which existed in the ground water. The wells were constructed of 2-inch, schedule 80, pvc pipe with threaded flush joints. The well screens were 20-feet long with 0.01-inch slot size. The wells were set at an approximate depth of 24-feet below ground surface. A uniform sand between 0.01 and 0.03-inches in diameter was gradually placed in the annulus around the screen and to approximately 1-foot above the top of the screen. A bentonite pellet seal approximately 1-foot thick was then placed above the sand backfill. A protective casing with locking cap and four steel bollards was installed at each location for well protection (Figure 3).

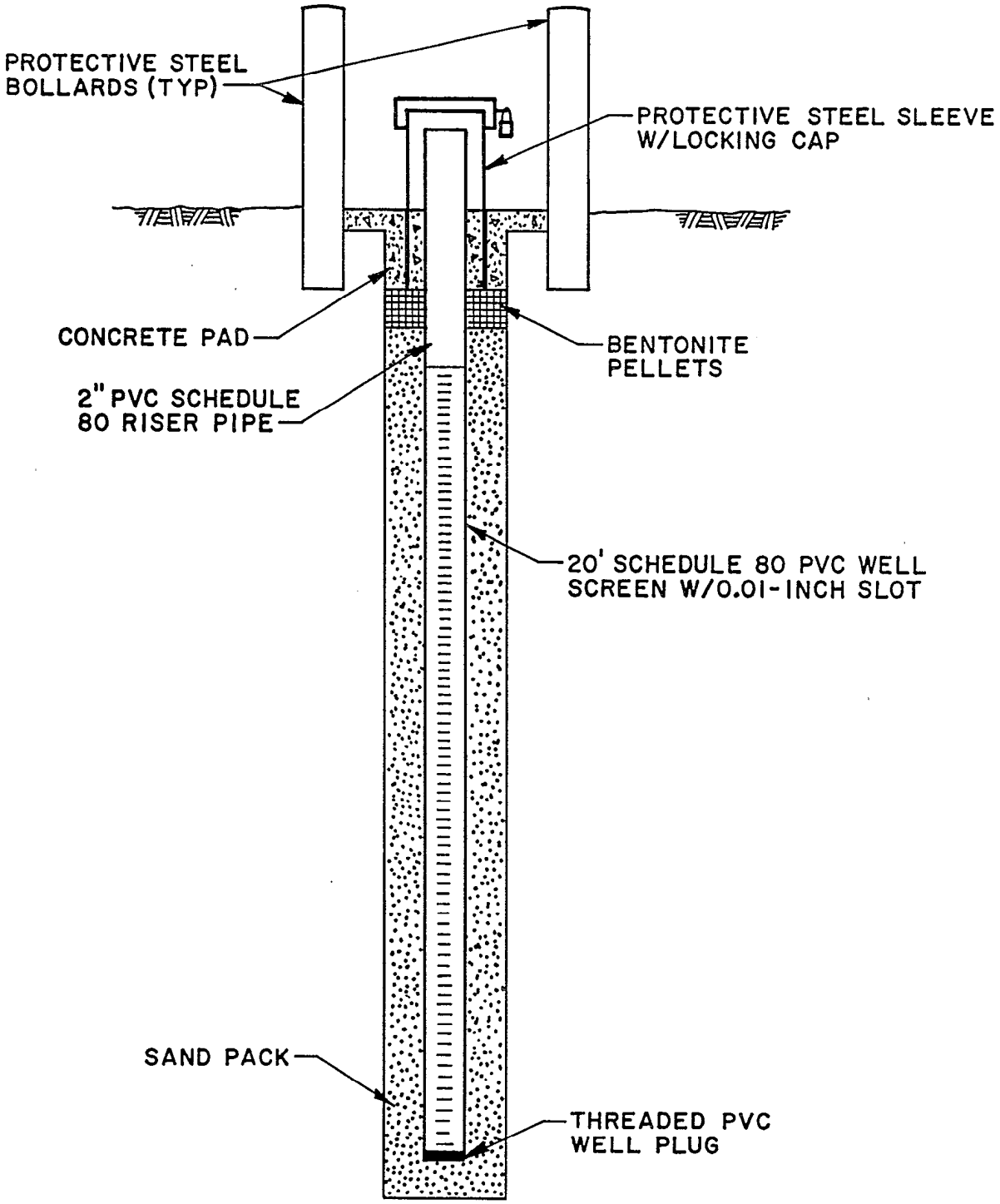
Ground water samples were taken on December 2, 1983, from each ground water monitoring well. Prior to sampling each well was developed for a minimum 15 minutes with a modified two-inch suction pump. Water samples were taken using a 1¼-inch by 4-foot pvc standard bailer which was dedicated to the sampled well. The sample water was poured into bottles supplied by Mead CompuChem and refrigerated. The samples were delivered to the laboratory within 24 hours of the sampling event.

A location and elevation survey was conducted to determine the ground water contours and flow direction. This information was required to determine the potential for pollutant migration. Water level measurements were made using an electronic water level indicator made by Slope Indicator Co. and McCabe water level indicator paste.

Gas Monitoring Stations

Gas monitoring stations were installed at nine locations in the vicinity of the existing brig. These stations were used to extract gas samples from the subsurface soils to identify the potential for adverse health effects caused by the release of gases. Each station was constructed of a 10-foot long 3-inch diameter schedule 40, pvc pipe. The bottom 6-feet had 4, ½-inch diameter holes drilled 90-degrees apart at 3-inch increments for the full 6-feet. A nylon mesh was wrapped around the 6-foot screen section to keep soils from reducing the available gas storage volume inside the pipe. The bottom of the station was set at approximately 7-feet below ground surface. A bentonite pellet seal was placed at ground surface. A ½-inch diameter hole was drilled approximately 6-inches below an air-tight cap at the top of the pvc pipe to be used for gas extractions and testing. A rubber stopper was used to seal the hole when sampling was not being performed (Figure 4).

Gas sampling for the volatile priority pollutants was performed using a charcoal tube and sipin pump supplied by Gollob Analytical Service. The pumps were calibrated by Gollob to transfer approximately 75 cc/min. of air. A charcoal tube was connected, using tygon tubing, to each gas monitoring station and a sipin pump. Sample air was then drawn through the tube for a 6-hour duration (Figure 5). Approximately 25 liters of air passed through the tube. The tubes



NOT TO SCALE

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MONITORING WELL CONSTRUCTION

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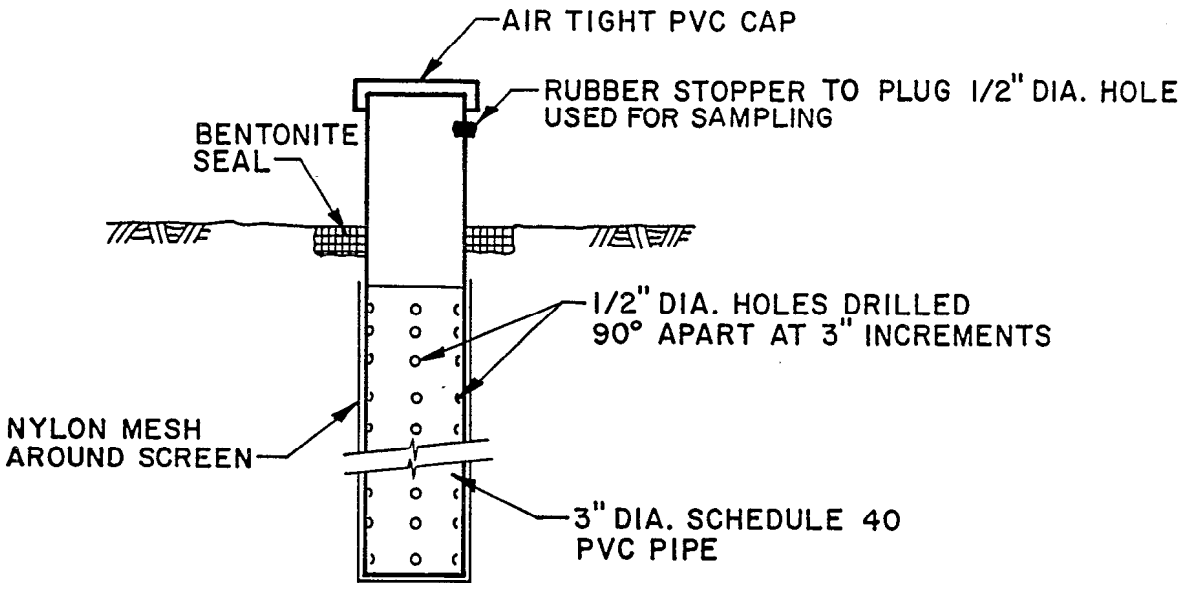
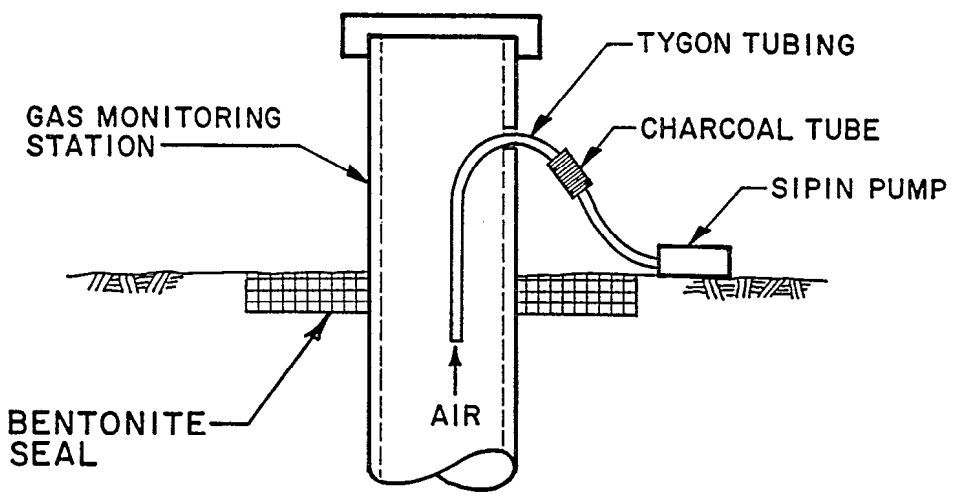
FIGURE 3



GAS MONITORING STATION

FIGURE 4



GAS SAMPLING APPARATUS

FIGURE 5

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were then sealed at both ends and delivered to Mead CompuChem for analysis.

Additional gas monitoring for hydrogen sulfide, combustible gas, toxic gas, oxygen and methane was performed in the field. The rubber stopper was removed from the gas monitoring station and tubing was immediately inserted into the casing and a sample extracted. An Ecolyzer H_2S Analyzer by Energetics Science was used to monitor hydrogen sulfide in ppm. A CGS-80 Tritector by Enmet was used to determine oxygen levels. The instrument measured specific oxygen percentages ranging from 17-25%. Oxygen is normally 20.9% in fresh water. The Enmet was also used to measure combustible and toxic gas. The unit was calibrated to alarm for combustible gas at 20% of the lower explosive limit for pentane and for toxic gas at 100 ppm methyl. Any combustible or toxic gas which would effect the electrical sensor's in the same manner as the calibration gas would set off the alarm. A quantitative number is not obtainable from the Enmet. A Gascope Model 60 Combustible Gas Indicator by MSA was also used to measure combustible gas as percent methane. Total organic vapor and methane were measured using a Century Organic Vapor Analyzer.

Gas production tests were performed at each monitoring station for a 24-hour period. A 1.2 mil, 13 gallon capacity plastic bag was used to enclose each station. Care was taken to minimize the amount of air seepage into the bags during placement. The bags were checked after 24 hours to determine if production and/or release of gas from the subsurface soils had occurred.

4. SITE INVESTIGATION RESULTS

The field investigation at the brig expansion site was conducted from October 24 through December 16, 1983. The analytical results of this investigation are summarized below. The analytical data are included in Appendix A, B and C.

Magnetometer Survey

The results of the magnetometer survey showed that large portions of the site exhibited strong magnetic anomalies. Readings were higher than the earth's ambient field, which may indicate an abundance of metallic debris. Figure 6 shows the traverse grid lines (light lines) and areas where the magnetic field was observed to be greater than the earth's ambient field (dark lines). Large quantities of metallic debris were observed protruding from the ground surface. Sheet metal, crane cable, and concrete with embedded reinforcing bar were also encountered at several locations during the boring and well installation work.

The amplitude of many of the anomalies recorded, however, was much higher than expected of individual tanks, drums, etc. These abnormally high magnetic readings could be the result of a large quantity of metal creating a larger than anticipated magnetic field measurement. Interference from an external source could also cause the high readings. Several traverse lines were rerun at different times of the day to verify the high initial readings. Significant variations in instrument readings occurred during these reruns which indicated an external source was probably influencing the survey. A high voltage electric power substation located south of the site with overhead lines running to the brig, and overhead power lines and buried communications wire east of the site were the probable cause of the interference. Consequently, no definite conclusions as to the nature or extent of buried metal objects can be made although visual observations indicated that significant quantities of metal are present. Appendix A contains the magnetometer survey report.

Site Geology

Geological information for the site was developed from soil samples taken at each monitoring well and gas monitoring station location. The data collected showed an upper strata of silt and sandy silt ranging in thickness from 5 to 8-feet exists over the southern and central portion of the site. The thickness of the silt strata increases to as much as twenty feet at the northern edge of the study area. Samples taken from the silt layer at several of the boring locations contained fragments of metal, concrete, glass, rope, slag, wood and plastic. These fragments indicated the type of material disposed of at the site. They were observed in samples taken from a depth ranging from 0 to 10-feet.

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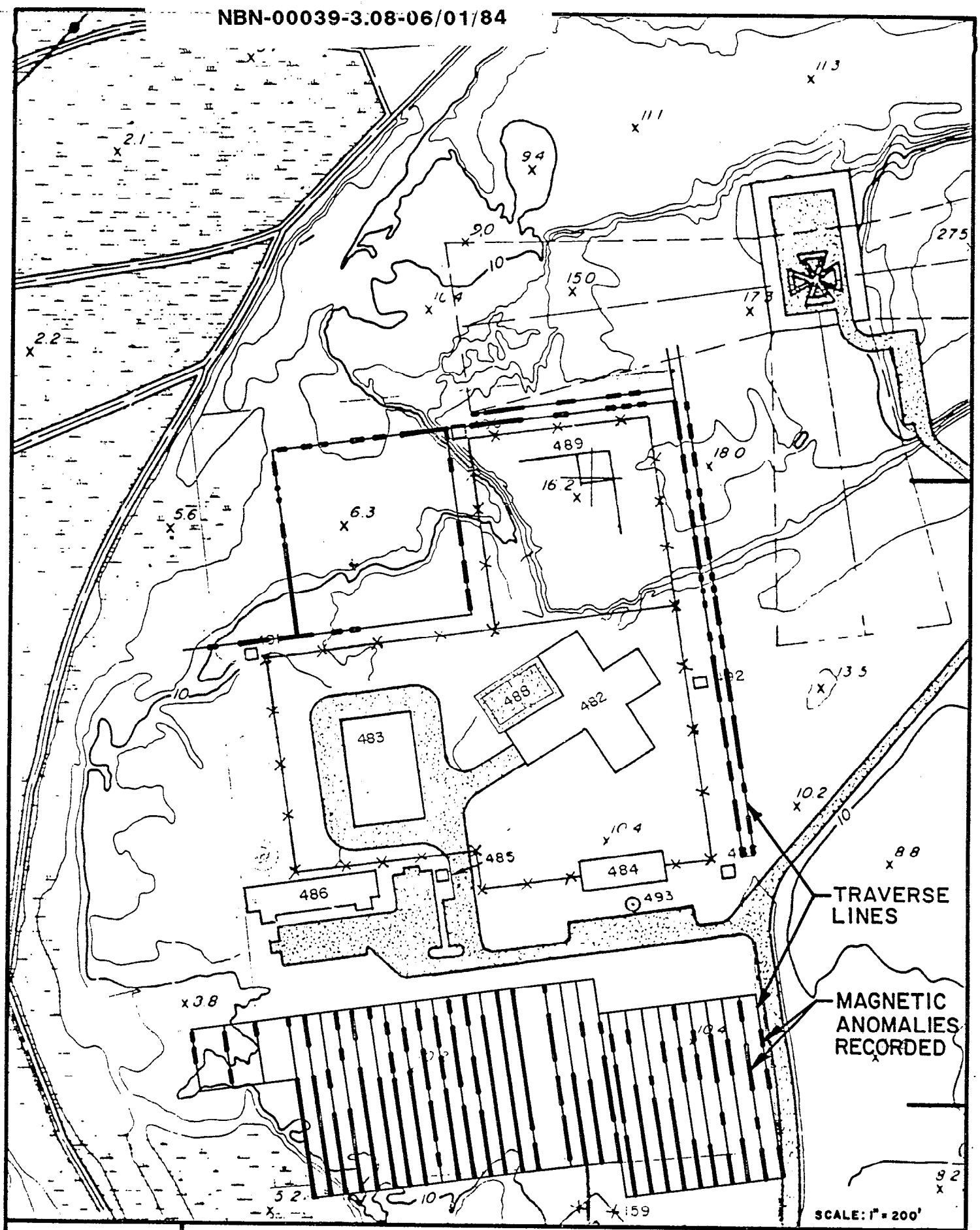

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MAGNETOMETER SURVEY
BRIG EXPANSION SITE

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FIGURE 6

Beneath the surface layer of silt, a silty sand was present from the silt interface to the bottom of the bore holes (25-feet below ground surface) along the eastern edge of the study area. Towards the western edge of the site, the silty sand was replaced by a relatively impermeable silty clay. The silty clay layer extended to the bottom of the bore hole at location B-5W and B-20W. Between these locations, at B-6, the thickness of the silty clay reduced to approximately 8-feet with a silty sand present beneath the clay layer. The silty clay also disappeared north of boring B-17W and was replaced by a silty sand zone. Site geology profiles are shown in Figures 7 and 8. Appendix B contains the soil boring logs.

Ground Water Flows

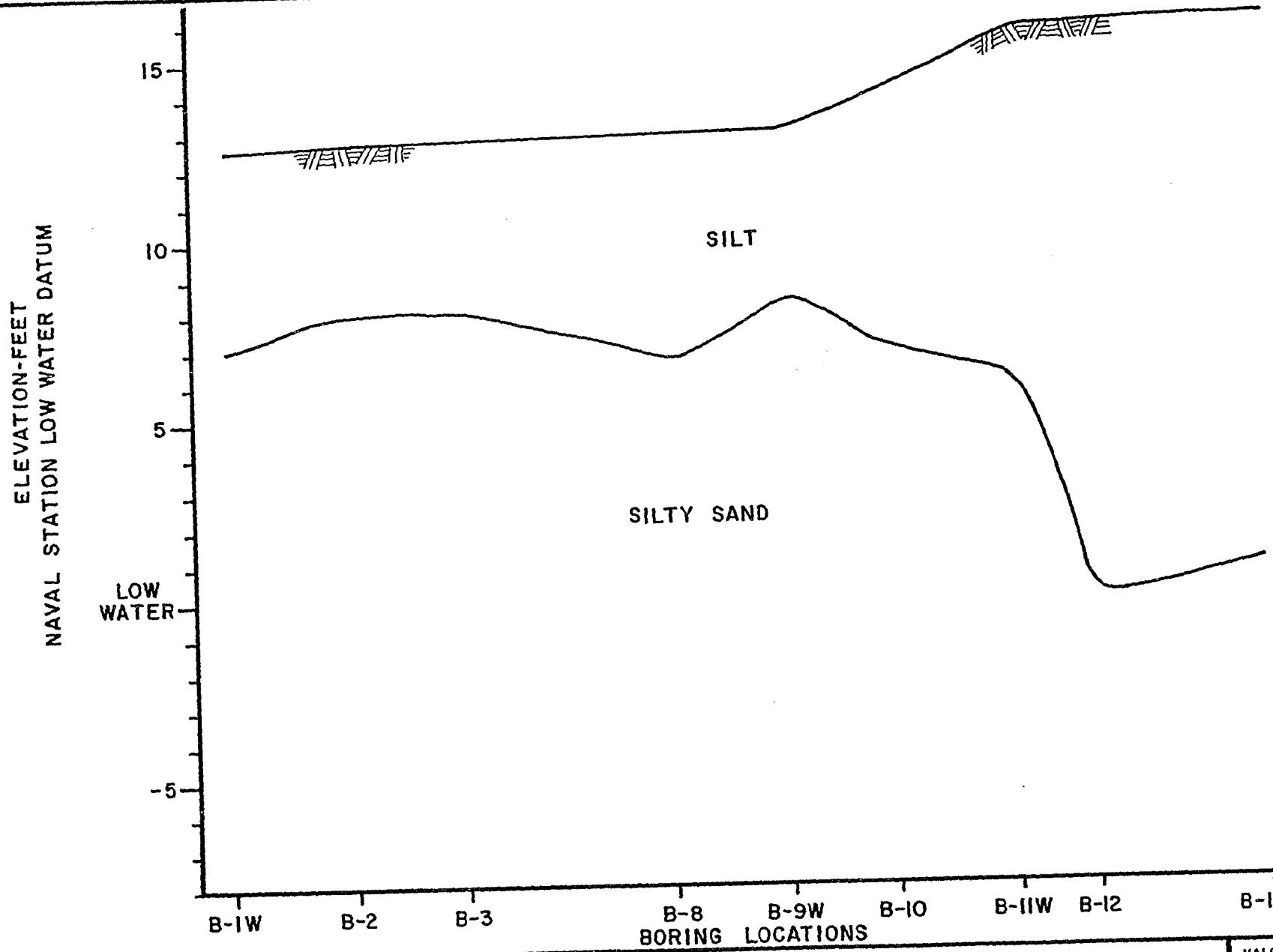
Ground water elevations were taken at the proposed brig site on December 13 and 21, 1983. Table 1 gives the elevations of the PVC well casings and ground water measurements. Ground water contours and flow direction derived from the data are shown in Figure 9. The general trend for ground water flow was in a westerly direction towards a marsh and drainage ditch area which flows to the Elizabeth River. However, a localized mounding of ground water was observed at location B-20W. This may have been caused by the silty clay at this location, which typically has low permeability, and a heavy rainfall prior to the measuring event. This localized effect did not appear to greatly effect the overall site flow patterns.

TABLE 1

GROUND WATER LEVEL DATA

Monitoring Well	Elevation Top of PVC (Ft.)	12/13/83 Water Level (Ft. Below PVC)	12/21/83 Water Level (Ft. Below PVC)
B-1W	13.54	4.45	5.25
B-4W	14.32	5.60	6.20
B-5W	11.97	6.20	6.45
B-7W	14.42	5.60	6.00
B-9W	15.33	6.35	6.65
B-11W	17.43	4.15	5.55
B-13W	17.87	7.55	8.05
B-15W	10.15	2.55	2.65
B-16W	15.38	6.70	6.80
B-17W	13.40	5.30	5.70
B-20W	15.24	2.55	2.95

NOTE: Elevations based on Naval Station Low Water Datum.



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SITE GEOLOGY PROFILE

SCALES: HORIZ. 1"= 200' VERT. 1"= 5'

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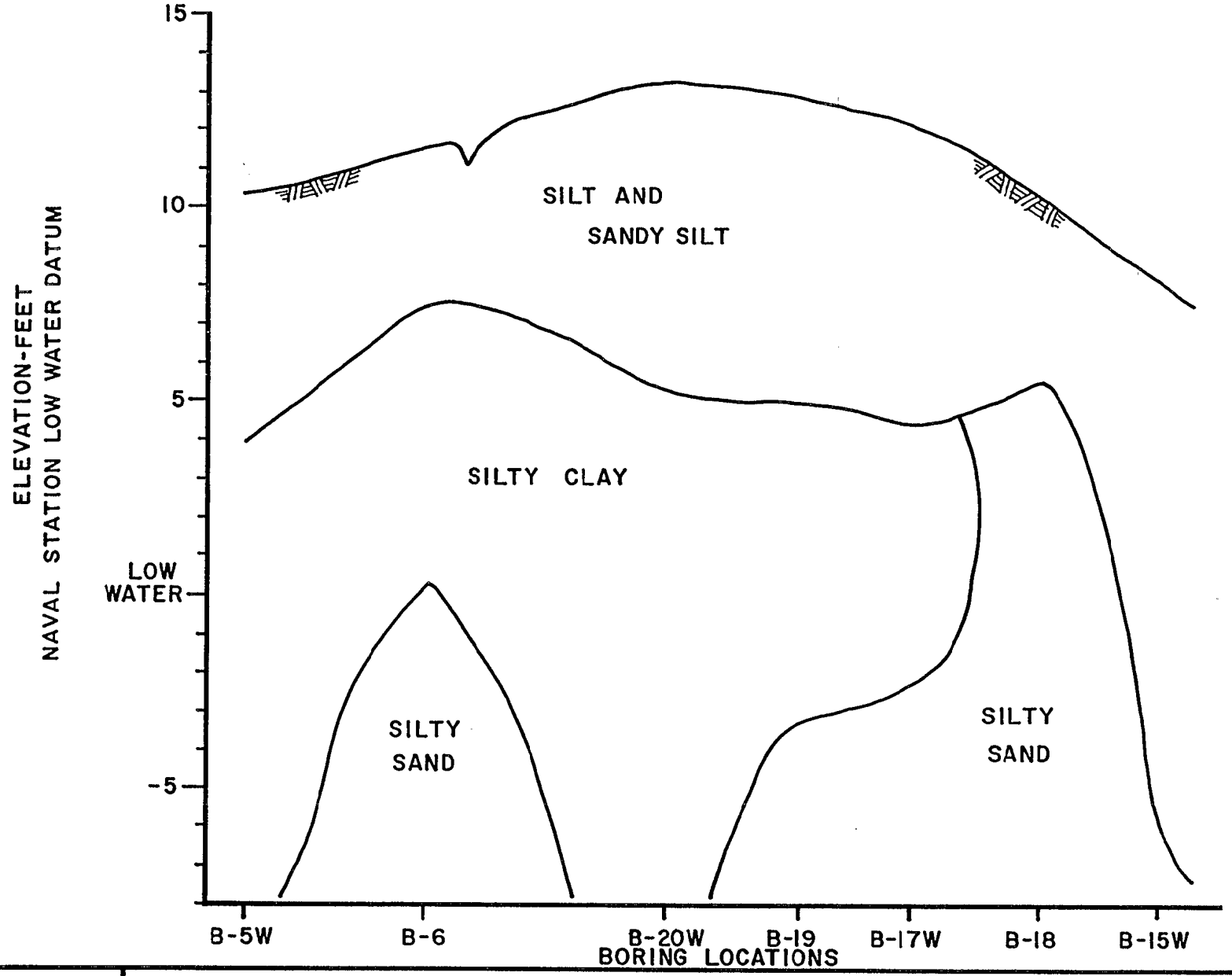
FIGURE 7



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SITE GEOLOGY PROFILE

SCALES: HORIZ. 1"= 200' VERT. 1"= 5'

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FIGURE 8

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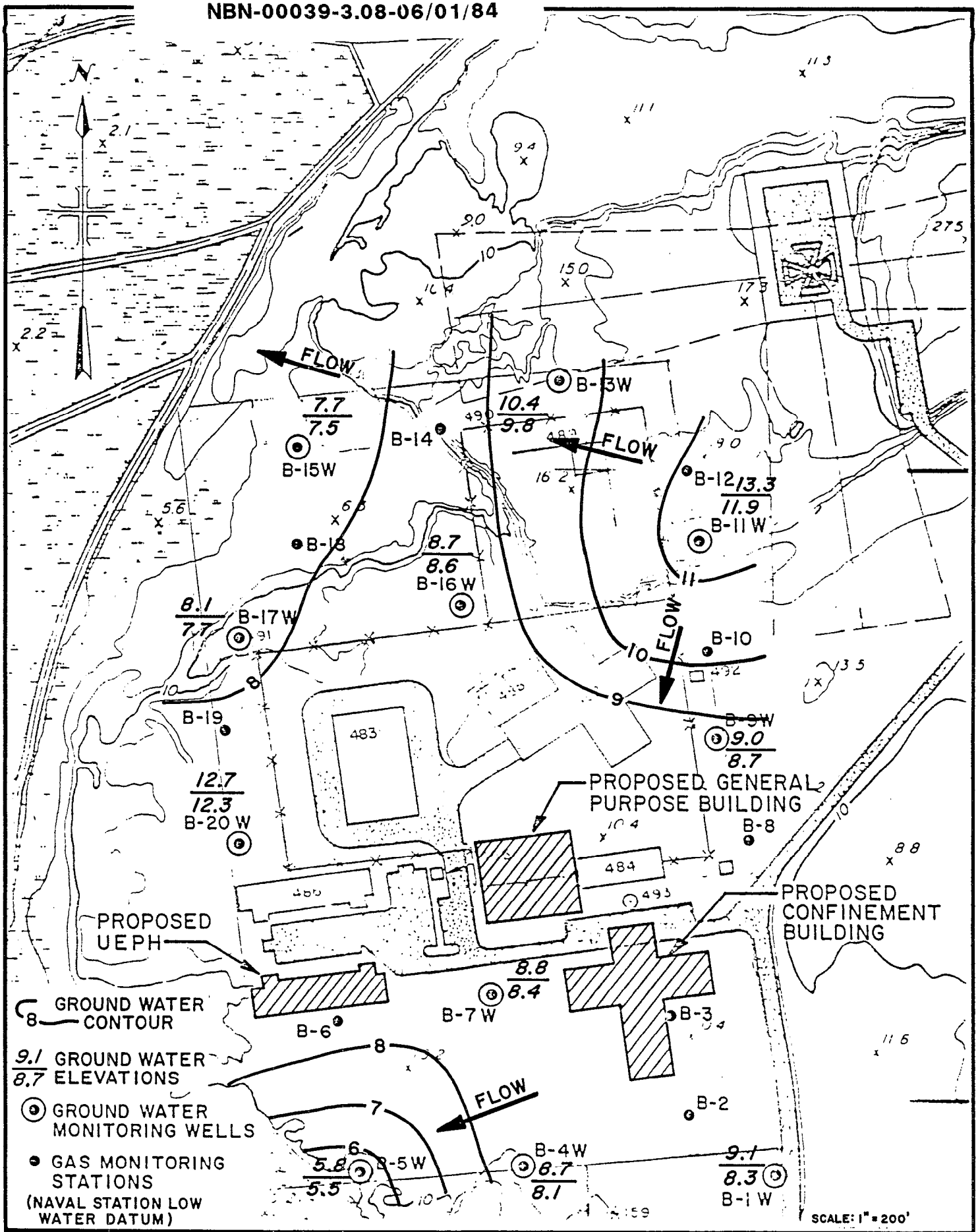

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GROUND WATER ELEVATIONS AND FLOW DIRECTION

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FIGURE 9

The ground water flow rate is estimated to be on the order of tens of feet per year. This is based on an assumed permeability of 10^{-2} cm/sec for the silty sand water table aquifer which underlies much of the site. It is also based on a measured gradient of 0.005 ft/ft across the northern portion of the site.

Gas Monitoring

Gas monitoring for the thirty volatile organic priority pollutants was performed at the brig site from November 29 through December 1, 1983. Nine samples using the charcoal tube method were taken and shipped to Mead CompuChem for analyses. No pollutants were found to be above the detection limit of the equipment used. The detection limit is 0.4 ug/l for all pollutants except Acrolein and Acrylonitrile which have a detection limit of 4.0 ug/l. Field testing for Hydrogen Sulfide was performed on December 7, 1983. The results of this testing showed that no hydrogen sulfide was present. The equipment used had a detection limit of 0.50 ppm.

Monitoring for methane gas was performed on December 2, 1983 at each of the nine monitoring stations using the Century OVA meter. The results showed the presence of methane from a trace at locations B-2, B-3 and B-18 to a substantial quantity at B-8 (Table 2). The levels of methane at all locations except B-8 are levels (less than 300 ppm) in the range anticipated from the natural breakdown of organics in soil, and are not considered significant for a landfill area. At location B-8, the measured value of 1000+ ppm methane was much higher than expected from the natural breakdown of organics. The high methane reading cannot be conclusively attributed to the landfill materials, however, because it was possibly caused by leaks in a sewer pipe and/or grease trap adjacent to the monitoring location. Additional monitoring would be required to determine the cause of the high concentration measured.

Monitoring for oxygen, combustible gas, and toxic gas using equipment and procedures discussed in Chapter 3 was performed on December 7, 1983. Oxygen deficiencies, meaning levels of oxygen less than the ambient of 20.9 percent oxygen in air, were recorded at locations B-10 (18 percent), and B-12 and B-18 (less than 17 percent). At location B-10 and B-12, the MSA gascope device indicated trace amounts of combustible gas, measured as percent methane. The Enmet combustible gas measurement was negative at all locations. At B-18, the Enmet device alarm was triggered and a positive reading for toxic gas was recorded (Table 2).

The readings for combustible gas at locations B-10 and B-12 were 1.5 and 1.8 percent, respectively. The monitoring instrument was calibrated to the lower explosive limit for methane of 5 percent. Therefore, the readings were approximately 1/3 of the lower explosive limit.

The positive reading of toxic gas at location B-18 is an indicator of a potential problem. This finding, however, does not appear to be consistent with measurements from the analysis for the thirty volatile organics which were negative at this location. Additional sampling of this location would be prudent to verify the presence or absence of toxic gases. This location is not near any of the proposed construction locations and, therefore, should not have an impact on the proposed activities. The impact on existing facilities should be further investigated.

TABLE 2

GAS MONITORING RESULTS

Well No.	12/2/83 Methane OVA (ppm)	12/7/83 O_2 (%) ENMET (Percent)	12/7/83 Combustible Gas ENMET	12/7/83 Combustible Gas GASCOPE (Percent)	12/7/83 Toxic Gas ENMET
B-2	1.2	21	NEG	0	NEG
B-3	1.0	20	NEG	0	NEG
B-6	220	20	NEG	0	NEG
B-8	1000+	20	NEG	0	NEG
B-10	0	18	NEG	1.5	NEG
B-12	0	less than 17	NEG	1.8	NEG
B-14	0	21	NEG	0	NEG
B-18	15	less than 17	NEG	0	11
B-19	95	21	NEG	0	NEG

Additional tests were performed from December 13 to December 14 at each monitoring station in order to determine if an appreciable amount of gas was being released. The gas production tests, performed over a 24 hour period, indicated no significant amount of gas had been released from any of the monitoring locations.

Ground Water Sample Results

Ground water samples from 11 monitoring wells were analyzed for 128 priority pollutants plus xylene by Mead CompuChem laboratories. Table 3 gives a summary of sample locations where one or more of these chemicals were found to exist. Appendix C contains a complete list of the priority pollutants analyses.

Several sources of water quality standards or criteria were used to assess the results of the sampling program. These standards and/or criteria are listed in Tables 4 and 5 and include information from the following sources:

TABLE 3

WATER QUALITY RESULTS

VOLATILE ORGANICS	DETENTION LIMIT (UG/L)	1W-01 (UG/L)	4W-01 (UG/L)	5W-01 (UG/L)	7W-01 (UG/L)	9W-01 (UG/L)	11W-01 (UG/L)	13W-01 (UG/L)	15W-01 (UG/L)	16W-01 (UG/L)	17W-01 (UG/L)	20W-01* (UG/L)
VINYL CHLORIDE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	20.0	BDL	2000
METHYLENE CHLORIDE	10	BDL	BDL	BDL	BDL	14.0	BDL	BDL	BDL	BDL	BDL	
TRANS-1,2-DICHLOROETHYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	46
CHLOROFORM	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10.0	BDL	BDL	
TRICHLOROETHYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	110.0	BDL	5
BENZENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
1,1,2,2-TETRACHLOROETHYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	12.0	BDL	
TOLUENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	18
ACID EXTRACTABLE ORGANICS	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/
PHENOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
2,4-DIMETHYLPHENOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
BASE-NEUTRAL EXTRACTABLE ORGANICS	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/
NAPHTHALENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
FLUORANTHENE	10	BDL	BDL	BDL	BDL	BDL	BDL	10.0	BDL	BDL	BDL	1
BIS(2-ETHYLHEXYL)PHTHALATE	10	450	BDL	BDL	BDL	BDL	BDL	22.0	16.0	BDL	BDL	1
PESTICIDES/PCB's	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/L)	(UG/
INORGANICS PRIORITY POLLUTANTS	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)
ARSENIC, TOTAL	0.05	BDL	0.45	0.13	0.10	0.45	0.13	0.65	0.10	1.40	0.30	0.09
BERYLLIUM, TOTAL	0.02	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	BDL	BDL
CADMIUM, TOTAL	0.02	BDL	0.02	0.02	BDL	0.02	0.04	0.15	0.02	0.04	0.04	0.04
CHROMIUM, TOTAL	0.10	BDL	0.11	0.10	0.55	0.13	0.10	0.36	0.10	0.20	0.43	BDL
COPPER, TOTAL	0.10	BDL	0.50	0.42	BDL	0.15	0.64	6.10	0.75	0.72	0.44	0.13
LEAD, TOTAL	0.20	0.25	1.00	0.67	BDL	0.50	1.00	5.90	0.80	0.83	1.20	0.27
MERCURY, TOTAL	0.0002	BDL	0.0007	0.0003	BDL	BDL	BDL	0.0005	BDL	BDL	BDL	BDL
NICKEL, TOTAL	0.10	BDL	BDL	BDL	BDL	0.10	BDL	0.60	0.11	0.24	0.10	BDL
SELENIUM, TOTAL	0.05	BDL	BDL	0.06	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
THALLIUM, TOTAL	0.05	0.10	0.20	BDL	BDL	BDL	0.24	0.50	0.20	0.10	0.22	BDL
ZINC, TOTAL	0.02	0.23	1.50	1.90	0.12	0.80	2.50	15.00	1.60	1.20	5.40	0.57
CYANIDE, TOTAL	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.09
PHENOLS, TOTAL	0.01	BDL	0.01	0.02	BDL	0.01	0.03	BDL	0.03	0.06	0.01	BDL

*DUE TO CONCENTRATIONS FOUND AND REQUIRED DILUTION
DETECTION LIMITS FOR VOLATILE ORGANICS ARE 200 UG/L
AND EXTRACTABLE ORGANICS ARE 250 UG/L

TABLE 4

WATER QUALITY CRITERIA

	EPA WATER QUALITY CRITERIA DOCUMENTS						ODW & NAS CRITERIA	SWCB
	TOXICITY TO AQUATIC LIFE				HUMAN HEALTH		ONE DAY	
	FRESH WATER		SALT WATER		INGESTION		EXPOSURE	G.W.
							LIMITS	STDS.
VOLATILE ORGANICS	ACUTE (UG/L)	CHRONIC (UG/L)	ACUTE (UG/L)	CHRONIC (UG/L)	WATER (UG/L)	AQUATIC (UG/L)	(UG/L)	(UG/L)
VINYL CHLORIDE	NA	NA	NA	NA	20	5246 *	NA	NA
METHYLENE CHLORIDE	NA	NA	NA	NA	NA	NA	13000	NA
TRANS-1,2-DICHLOROETHYLENE	11600	NA	224000	NA	0.33	18.5 *	2700	NA
CHLOROFORM	28900	1240	NA	NA	1.9	157 *	NA	NA
TRICHLOROETHYLENE	45000	NA	2000	NA	27	807 *	2000	NA
BENZENE	5300	NA	5100	NA	6.6	400 *	350	NA
1,1,2,2-TETRACHLOROETHYLENE	5280	840	10200	450	8	88.5 *	NA	NA
TOLUENE	17500	NA	6300	5000	14300	424000	120000	NA
ACID EXTRACTABLE ORGANICS								
PHENOL	10200	2560	5800	NA	3500	3500	NA	NA
2,4-DIMETHYLPHENOL	2120	NA	NA	NA	NA	NA	NA	NA
BASE-NEUTRAL EXTRACTABLE ORGANICS								
NAPHTHALENE	2300	620	2350	NA	NA	NA	NA	NA
FLUORANTHENE	3980	NA	40	16	42	54	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	NA	NA	NA	NA	NA	NA	NA	NA
INORGANICS PRIORITY POLLUTANTS								
ANTIMONY, TOTAL	9000	1600	NA	NA	146	45000	NA	NA
ARSENIC, TOTAL	440	440	508	NA	0.022	0.175 *	NA	50
BERYLLIUM, TOTAL	130	5.3	NA	NA	0.037	0.641 *	NA	NA
CADMIUM, TOTAL	NA	NA	NA	NA	10	NA	NA	0.4
CHROMIUM, TOTAL	NA	44	NA	NA	50	NA	NA	50
COPPER, TOTAL	5.6	NA	4	NA	NA	NA	NA	1000
LEAD, TOTAL	NA	NA	668	25	50	NA	NA	50
MERCURY, TOTAL	0.00057	NA	3.7	NA	0.144	0.146	NA	0.05
NICKEL, TOTAL	NA	NA	7.1	NA	13.4	100	NA	NA
SELENIUM, TOTAL	35	NA	54	NA	10	NA	NA	10
SILVER, TOTAL	NA	0.12	NA	NA	50	NA	NA	NA
THALLIUM, TOTAL	1400	40	2130	NA	13	48	NA	NA
ZINC, TOTAL	47	NA	58	NA	NA	NA	NA	50
CYANIDE, TOTAL	3.5	NA	30	NA	200	NA	NA	5
PHENOLS, TOTAL	NA	NA	NA	NA	NA	NA	NA	1

*VALUES FOR RISK FACTOR OF 1/10000

TABLE 5

WATER QUALITY CRITERIA

ORGANICS	EPA ELECTROPLATING AND METAL FINISHING EFFLUENT GUIDELINES MON.AVG (mg/l)	EPA ELECTROPLATING AND METAL FINISHING EFFLUENT GUIDELINES MAX.DAY (mg/l)	HRSD INDUSTRIAL WASTEWATER DISCHARGE LIMITS MON.AVG (mg/l)	HRSD INDUSTRIAL WASTEWATER DISCHARGE LIMITS MAX.DAY (mg/l)
TOXIC ORGANICS, TOTAL	NA	4.57	NA	NA
INORGANICS				
ANTIMONY, TOTAL	NA	NA	NA	NA
ARSENIC, TOTAL	NA	NA	0.10	0.10
BERYLLIUM, TOTAL	NA	NA	NA	NA
CADMIUM, TOTAL	0.26	0.69	0.10	0.10
CHROMIUM, TOTAL	1.71	2.77	2.00	5.00
COPPER, TOTAL	2.07	3.38	2.00	5.00
LEAD, TOTAL	0.43	0.69	1.00	2.00
MERCURY, TOTAL	NA	NA	0.01	0.02
NICKEL, TOTAL	2.38	3.98	1.00	2.00
SELENIUM, TOTAL	NA	NA	NA	NA
SILVER, TOTAL	0.24	0.43	0.25	0.50
THALLIUM, TOTAL	NA	NA	NA	NA
ZINC, TOTAL	1.48	2.61	2.00	5.00
CYANIDE, TOTAL	0.65	1.20	0.50	1.00
PHENOLS, TOTAL	NA	NA	1.00	2.00

- EPA Water Quality Criteria Documents
- Office of Drinking Water (ODW) Health Advisories
- National Academy of Science (NAS) Drinking Water Criteria
- State Water Control Board (SWCB) Ground Water Standards
- EPA Electroplating and Metal Finishing Effluent Guidelines
- Hampton Roads Sanitation District (HRSD) Industrial Wastewater Discharge Regulations

The EPA Water Quality Criteria Documents, reported in the Federal Register dated November 28, 1980, indicate pollutant concentration levels which have been observed to cause acute and chronic toxicity to fresh water and salt water aquatic life. The document also addresses the toxicity or carcinogenic risk due to human ingestion by drinking contaminated water or by eating contaminated aquatic life. These levels are recommended ambient levels for receiving waters depending upon the designated use of the receiving water.

The ODW and NAS criteria provide information and evaluation of the health risk when a drinking water contaminate is detected. The SWCB standards consist of limits designed to protect and conserve the natural quality of ground water and to provide guidance for preventing ground water pollution.

The EPA Electroplating guidelines address the discharge of Total Toxic Organics (TTO) and inorganics into surface waters. These guidelines provide effluent limitations based on "best available technology" for electroplating/metal finishing facilities discharging to receiving waters. The HRSD discharge regulations show the maximum day and monthly average industrial discharge concentration for inorganics acceptable for treatment.

A list of organic pollutant concentrations which exceeded any of the referenced criteria is shown in Table 6. The EPA human health ingestion and ODW and NAS drinking water criteria were not considered appropriate for data comparison since the ground water in the vicinity of the brig is not used as a potable or non-potable water source.

Four pollutants, all found at monitor well 20-W, exceeded the EPA fresh water and/or salt water aquatic life criteria. No evidence of migration of these pollutants was found based on the results of the well sampling program associated with this study and sampling of the surface water drainage ditch near well 20-W performed as part of the Confirmation Study of 5 sites discussed briefly in Chapter 2.

A list of inorganic pollutant concentrations which exceeded any of the referenced criteria are shown in Table 7. The EPA human health and ODW and NAS drinking water criteria were again considered inappropriate since the ground water is not used as a water source.

TABLE 6

ORGANIC POLLUTANTS FOUND TO EXCEED REFERENCED CRITERIA

POLLUTANT	WELL NUMBERS		
	15W	16W	20W
Vinyl Chloride			E
Trans-1,2-Dichloroethylene			A EFG
Chloroform	E		
Trichloroethylene		E	C EFG
Benzene			E G
1,1,2,2-Tetrachloroethylene		E	
Toluene			CD
Phenol			B EF

EPA FRESHWATER CRITERIA

A o Acute
B o Chronic

EPA SALT WATER CRITERIA

C o Acute
D o Chronic

EPA HUMAN HEALTH INGESTION CRITERIA

E o Water
F o Aquatic

G ODW and NAS Criteria
H SWCB Ground Water Standards

The SWCB standards were also deemed inappropriate for comparison of data since the standards were "designed to protect and conserve the natural quality of ground water and to provide guidance for preventing ground water pollution". At the study location, the degradation of the ground water has already occurred and construction and/or use of facilities at the site will not cause further degradation. In addition, the ground water is not currently being used nor should it be used in the future as a water source.

Eight pollutants at one or more monitoring wells were found to exceed the EPA acute toxicity levels for fresh water and/or salt water aquatic life. The chronic toxicity levels were not used for determination of potential hazards because the proposed brig expansion would not create a long term exposure situation to human and/or aquatic life.

TABLE 7

INORGANIC POLLUTANTS FOUND TO EXCEED REFERENCED CRITERIA

POLLUTANT	1W-01	4W-01	5W-01	7W-01	9W-01	11W-01	13W-01	15W-01	16W-01	17W-01	20W-01
ARSENIC	-	AB EF H J	EF H J	EF H	AB EF H J	EF HJ	ABC EF	EF H	ABC EF H J	EF H J	EF H
BERYLLIUM	-	-	-	-	-	-	H J	-	B EF	-	-
CADMIUM	-	E H	E H	-	E H	E H	E H J	E H	E H	E H	E H
CHROMIUM	-	B E H	B E H	B E H	B E H	B E H	B E H	B E H	B E H	B E H	-
COPPER	-	A C	AB	-	A C	A C	A C HIJ	A C	A C	A C	A C
LEAD	DE H	CDE HI	CDE HI	-	DE HI	CDE HI	CDE HIJ	CDE HI	CDE HI	CDE HIJ	DE H
MERCURY	-	A EF H	A EF H	-	-	-	A EF H	-	-	-	-
NICKEL	-	-	-	-	C E	-	C EF	C EF	C EF	CD	-
SELENIUM	-	-	A C E H	-	-	-	-	-	-	-	-
THALLIUM	B EF	B EF	-	-	-	B EF	B EF	B EF	B EF	B EF	-
ZINC	A C H	A C HI	A C HI	A C H	A C H	A C HIJ	A C HIJ	A C HI	A C H	A C HIJ	A H
CYANIDE	-	-	-	-	-	-	-	-	-	-	A C H
PHENOLS	-	H	H	-	H	H	-	H	H	H	-

EPA FRESHWATER CRITERIA
- A — o Acute
- B — o Chronic

EPA SALT WATER CRITERIA
- C — o Acute
- D — o Chronic

EPA HUMAN HEALTH INGESTION CRITERIA
- E — o Water
- F — o Aquatic
- G — ODW and NAS Criteria
- H — SWCB Ground Water Standards
- I — EPA Electroplating Guidelines (Monthly Ave.)
- J — HRSD Discharge Limits (Monthly Ave.)

5. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The suitability of the Camp Allen Landfill site for the proposed brig construction was reviewed to determine the following:

- o the presence of ground water contamination and its effect
- o the existence of tanks, drums, etc. which may contain or have contained hazardous materials
- o the potential for release of hazardous materials during construction
- o the production and release of gaseous hazardous constituents

The following discussion presents the conclusions and recommendations resulting from the monitoring conducted in connection with each of these areas.

Ground Water Contamination

Water quality analyses were performed on eleven ground water samples. Four organic pollutants were found to exceed EPA fresh water and/or salt water toxicity criteria at well B-20W. A waste oil and solvent dumping site was identified by the Navy within 50 feet of well 20-W and could be the reason for the pollutant concentrations found. Additional investigation would be required to determine if the pollutants come from this source. However, no construction in the area of B-20W has been proposed because of the existing buildings and an adjacent radio tower. Consequently, no pathways of potential exposure were identified.

The presence of elevated organic concentrations at well B-20W indicated that other localized areas at the site, although not identified from the one sampling event, may also contain organics at concentrations of concern. It is possible that these areas may be encountered during construction and precautionary measures should be undertaken. Recommendations for precautionary measures during construction are presented following the conclusions.

Eight inorganic pollutants were found to exceed EPA criteria for acute toxicity to fresh water and/or salt water aquatic life. Comparison of average concentrations of these pollutants in the vicinity of the proposed construction (wells 1W, 4W, 5W and 7W) show that copper (.28 mg/l), mercury (.00035 mg/l), selenium (.05 mg/l) and zinc (.94 mg/l) exceeded the EPA acute aquatic life toxicity criteria shown in Table 4. There was no indication based on these one time sampling results that inorganic contaminants will affect the proposed facility operation. As

mentioned earlier, ground water on site should not be used as a potable or non-potable water source.

The potential does exist for transferring the ground water pollutants to surface waters during construction. Specifically, dewatering operations conducted during the construction phase would probably discharge the ground water to surface water on the western edge of the site.

Ground water pollutant levels in the vicinity of proposed construction, as referenced earlier, exceeded EPA toxicity criteria. These concentrations, however, will be diluted when discharged into the receiving surface waters. The amount of dilution available at the discharge point should be reviewed prior to discharge. This will allow for a determination of the levels of chemicals which may be expected in local surface waters. Direct discharge may be discouraged depending upon the amount of dilution anticipated and the designated use of the receiving waters. Previous discussions with the SWCB have revealed that discharge permits have been required for dewatering operations at landfill sites.

A comparison of the data with EPA's "Final" electroplating effluent guidelines, dated July 15, 1983 was also performed. These guidelines, shown in Table 5, give industrial discharge limits for inorganic compounds. In the vicinity of construction (wells 1W, 4W, 5W and 7W) the average zinc concentration of .94 mg/l, was below the 1.48 mg/l monthly average zinc limit. The average concentration of copper in the construction area, .28 mg/l, was also below the monthly average limit of 2.07 mg/l. It should be noted that EPA's effluent discharge limits are based on the "best available technology" for treatment of wastewater before discharge. The discharge of potentially contaminated ground water to local surface water would only be required for a short period of time at the proposed brig expansion site. Based on these guidelines, it can be inferred that the short-term discharge of contaminants to surface waters may be permissible. The appropriate regulatory agencies would have to make this determination.

Discharge of waters to HRSD is an alternative to direct surface water discharge. The average pollutant levels for inorganics are less than the HRSD industrial discharge limits shown in Table 4. Permission from HRSD for this discharge would be required.

Buried Containers

The site investigation showed evidence that metal objects, scrap metal, and construction debris will be encountered during construction. Well drilling operations encountered many buried metal fragments. A large amount of surface debris was also seen at the site. The majority of this material is believed to be inert and will not create a health or environmental problem. The possibility that dangerous materials will be exposed during construction does exist. Historical records indicate drums, tanks and other containers of hazardous waste may have been

disposed of at the landfill site. All construction activities should be conducted in such a manner so as to insure that hazardous situations for workers (i.e. containers rupturing, high concentration spill, explosion) are minimized. Procedures should be developed for handling sealed and leaking drums, contaminated soils and debris during construction. Safety protocols should be developed and included in the design specifications which address hazardous working conditions that may be encountered or created by construction activities.

Gas Production and Release

An investigation was conducted to determine the existence, production and release of gases at the site. The tests included the determination of levels of volatile organic gases, hydrogen sulfide, methane, combustible gas and oxygen deficiencies. Methane was the only gas found in measurable concentrations. Concentrations found were generally assumed to be levels due to natural organic degradation. One high methane reading at location B-8 should be investigated further to identify the source. A sewer pipe has been sited as a potential source. No gas production was observed during 24-hour tests performed at each monitoring station. Based on limited sampling, methane should not pose a problem during construction or operation of new facilities in the areas monitored for gases. A periodic gas monitoring program is recommended as an insurance measure both during and after construction of new facilities and for the existing facilities.

RECOMMENDATIONS

Potential concerns with regard to the proposed brig construction have been identified based on evaluation of the data collected during the site investigation. These concerns include pumping of pollutants to surface waters during dewatering activities, possible excavation of sealed drums containing hazardous materials, and excavation of ruptured or leaking drums resulting in localized high concentration spills or explosion. These issues are not of a nature which should cancel the planned expansion but all must be addressed prior to any construction activities on-site.

It is recommended that a safety program be developed which addresses the potential problems related to construction and facility operations. This program should be made part of the design documents prepared for the brig expansion to insure that the contractors bidding the construction project are aware of the potential problems that may arise and the measures required to alleviate them.

A safety coordinator should be designated by the Naval Facilities Engineering Command to develop, implement, and insure compliance with the safety program. Specifically, the safety coordinator should be responsible for:

- o Development of a safety program which addresses the potential construction problems.
- o Implementation of the program to insure the recommended safety measures are taken.
- o Monitor the contractor's work to insure he is in compliance with all safety protocols developed.
- o Make decisions concerning the level of caution to be taken, based on field testing and observations.
- o Be aware of health and environmental concerns and be prepared to delay or stop the work if situations so dictate.

The safety program should include both general safety protocols and specific measures which address each problem discussed earlier. It is recommended that the safety program address the following:

1) General safety requirements and gas and water monitoring to be conducted during construction.

2) Safety equipment, including protective clothing, respirators, etc., which may be required during construction if questionable materials or gas are encountered.

3) Contingency plans in the event that a minor or major emergency arises.

The safety program should address both worker safety to avoid direct contact with hazardous materials and environmental safety to avoid aquatic life deterioration in connection with dewatering and excavating activities as discussed below.

During dewatering activities, the potential exists for adverse environmental effects due to discharge of pollutants into surface waters. The options for discharge of water associated with dewatering activities are:

- o Direct discharge to surface water
- o Discharge to HRSD

Direct discharge to surface water should be monitored for both organic and inorganic pollutants. Quick turn around of sample results would be required to assure that the discharge does not create localized problems in surface waters. The discharge should be checked visually for color changes and odors on a frequent basis. Discharge to HRSD would require that prior permission be obtained.

An alternative to dewatering would be to design the facilities and/or use construction methods which eliminate the need to dewater.

Table 8

Summary of Potential Construction Problems and Recommendations

Condition	Potential Problem	Recommendations
Ground Water Contamination	Pollute Surface Water During Construction	- Discharge to surface water and monitor (or) - Discharge to HRSD and monitor (or) - Design facilities to avoid dewatering activities
Buried Sealed Containers	Unknown Hazardous Waste; Unknown Origin	- Identify - Implement handling safety procedures - Provide isolated storage - Arrange for safe disposal
Ruptured Containers; Contaminated Soils or Debris	Unknown Hazardous Waste; Unknown Origin	- Implement handling safety procedures - Provide impermeably lined and covered storage area - Conduct EP Toxicity Test - Arrange for safe disposal
Possible Exposure of Toxic Chemicals to Workers	Possible Release of Chemicals or Gases	- Develop and implement safety and contingency programs as part of design documents - Have a safety coordinator on-site to assess and respond to problems encountered or created by construction activities

APPENDIX A

MAGNETOMETER SURVEY REPORT

NBN-00039-3.08-06/01/84

INTERNATIONAL EXPLORATION, INC.

577 SACKETTSFORD ROAD
WARMINSTER, PA 18974-1398
215 - 598-7137
TWX: 510-667-2606

November 3, 1983

Mr. Richard Smith
Malcolm Pirnie, Inc.
301 Hiden Blvd.
Newport News, VA 23606

Dear Rich:

A magnetomter survey was conducted at Camp Allen, Norfolk, Virginia during the period of October 26-27, 1983. The general area of the survey is located over a former landfill in which debris was reportedly deposited beginning in the early 1940's. The material contained in this site is reported to consist of scrap metal, construction debris, and possibly drummed material. The areas surveyed were in the vicinity of the proposed facility expansion, and the test boring locations established by Malcolm Pirnie, Inc. The intent of the survey was to locate areas exhibiting strong magnetic anomalies which may be indicative of local concentrations of buried metallic objects.

Magnetic field measurements can be used to locate buried ferromagnetic objects such as munitions, steel containers, steel scrap, etc. This method is based on the fact that an induced magnetization is produced in any magnetic material within the earth's magnetic field. The induced field is superimposed on the earth's magnetic field and, if sufficiently large, can be detected an an anomaly or an aberration in the ambient field. Surveys are normally performed on a uniform grid with spacings determined by the expected size and depth of the objects sought.

The magnetic survey was conducted along a series of traverse lines with measurements obtained at ten-foot intervals along each line. In the area south of the existing buildings (#486 and #484), the traverse lines were arranged in a grid pattern oriented approximately north-south (Lines 0-37 - Figure 1). Additional traverses were positioned north and east of the existing buildings in the vicinity of test boring locations (Lines 40-47 - Figure 1).

This survey was performed using a Geometrics G-856 Proton Precession magnetometer. This magnetometer has no moving parts and is capable of producing an absolute and relatively high resolution measurement of the earth's magnetic field. However, several operational restrictions exist and may be of concern under special field conditions. First, the proton precession signal is sharply degraded in the presence of a large magnetic field gradient (greater than 200 gammas per foot). Also, the signal amplitude from the sensor is on the order of microvolts and must be measured to an accuracy of 0.04 Hz of the precession frequency of several thousand Hz. This small signal can be rendered immeasurable by the effects of nearby alternating current electrical power sources. For these two reasons, the results of a magnetic survey can be severely biased by the presence of large masses of buried metal, or the interference due to adjacent power sources, buried utilities and buildings.

The results of the survey are depicted in Figures 2 thru 8. The two areas where a grid was established are shown in Figures 2, 3 and 4. Portions of traverse lines exhibiting strong magnetic anomalies due to metallic debris or interference from external sources are delineated in plan view. Figures 5 thru 8 are traverse lines obtained in the vicinity of test borings outside the area of the proposed facility expansion.

Significant problems due to interference from external sources (i.e., power lines, buried utilities, communications equipment on the base) were encountered during the course of the survey. One area, located at a distance from the suspected interference sources, exhibited consistent readings on the order of the area's ambient magnetic field; therefore, indicating proper instrument operation. The amplitude of many of the anomalies recorded in the survey areas were atypical and therefore inconclusive as to whether they represent induced magnetism in metallic masses or are a reflection of total interference masking actual conditions.

During the course of the survey, significant variations occurred in the instrument readings. Several of the traverse lines were rerun at different times of the day in an attempt to determine the causes of these variations. Readings were obtained at a fixed monitoring location during the course of each day to identify diurnal changes in the earth's magnetic field. The diurnal fluctuations were minimal and could not be the cause of the high variability of the instrument readings. A comparison of the profiles for individual tra-

verse lines where instrument readings were obtained at different times of the day indicated trends; however, they too were inconclusive.

As a result of the suspected interference sources, we are unable to conclusively relate specific anomalies to causative bodies, but the data never-the-less establishes the fact that a considerable amount of buried metal exists at the site. It is our belief that the entire area contains massive amounts of metallic debris. Observations of materials exposed on the surface of the site would appear to substantiate this.

A detailed grid of closely spaced measurement points was established at several of the test boring locations north of the existing building #483. The data collected at these points indicated anomalies in the vicinity; however, a preferred direction in which to relocate the borings was not obvious. We believe that obstructions may be encountered at many of the boring locations; however, we are reluctant to offer preferred boring locations due to the suspected interference sources biasing our data.

If you have any questions regarding this report, please contact us immediately.

Very truly yours,

INTERNATIONAL EXPLORATION, INC.

Richard V. Sheehan (TK)

Richard V. Sheehan
Manager
Engineering Geology

RVS:mmn

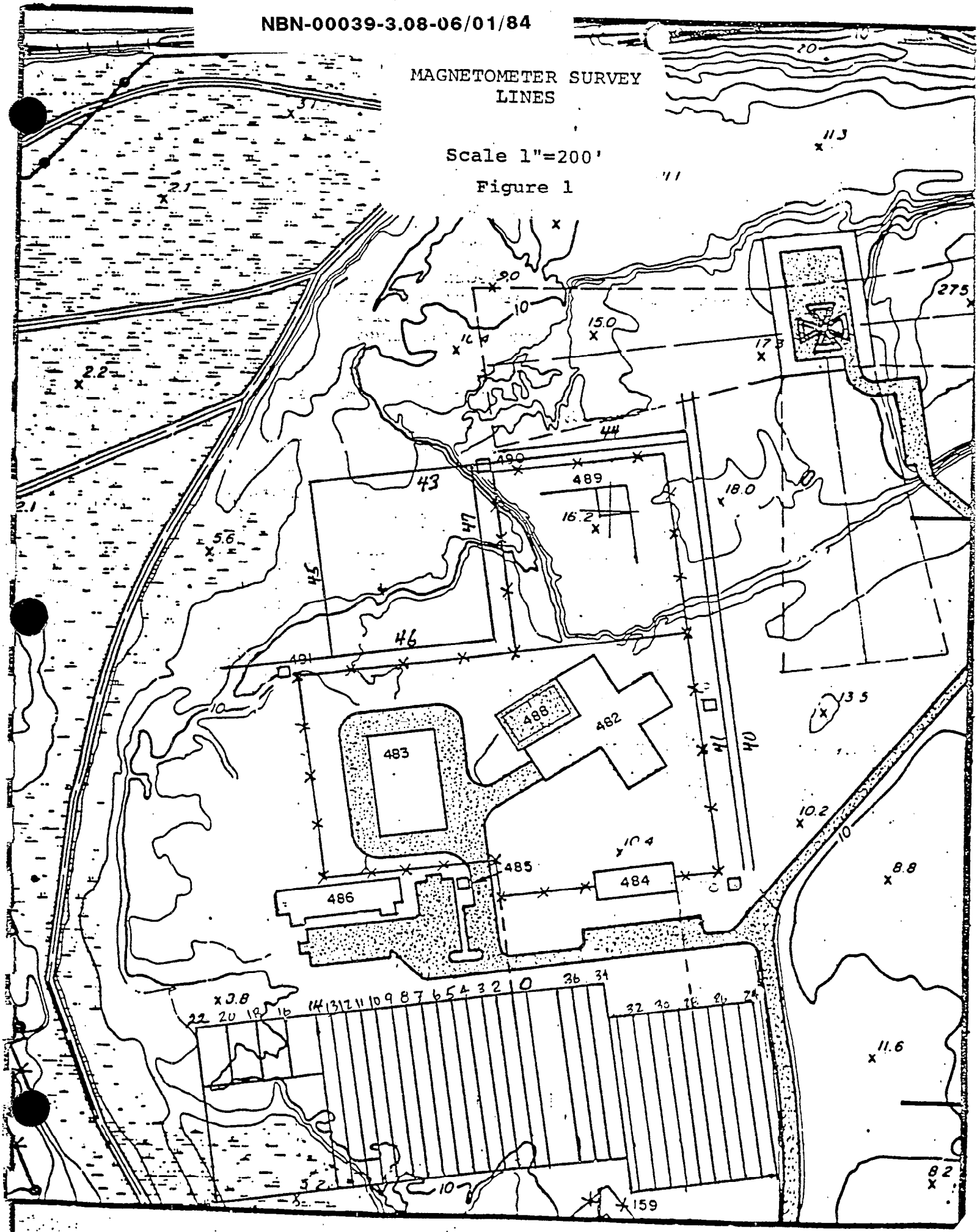
Enc.

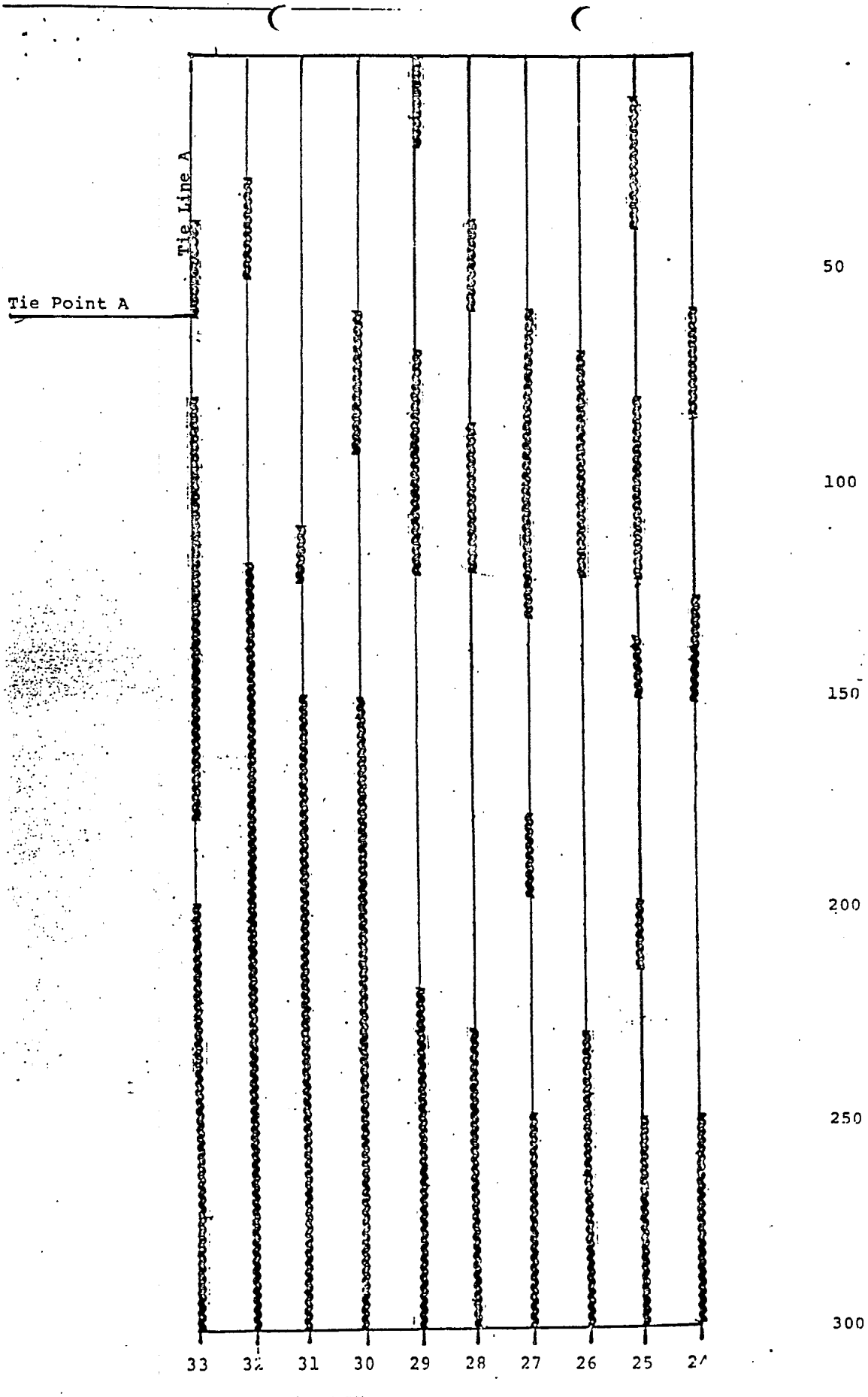
NBN-00039-3.08-06/01/84

MAGNETOMETER SURVEY
LINES

Scale 1"=200'

Figure 1




Tie Line A
Tie Point A
50
100
150
200
250
300
33
32
31
30
29
28
27
26
25
24
ANOMALY -

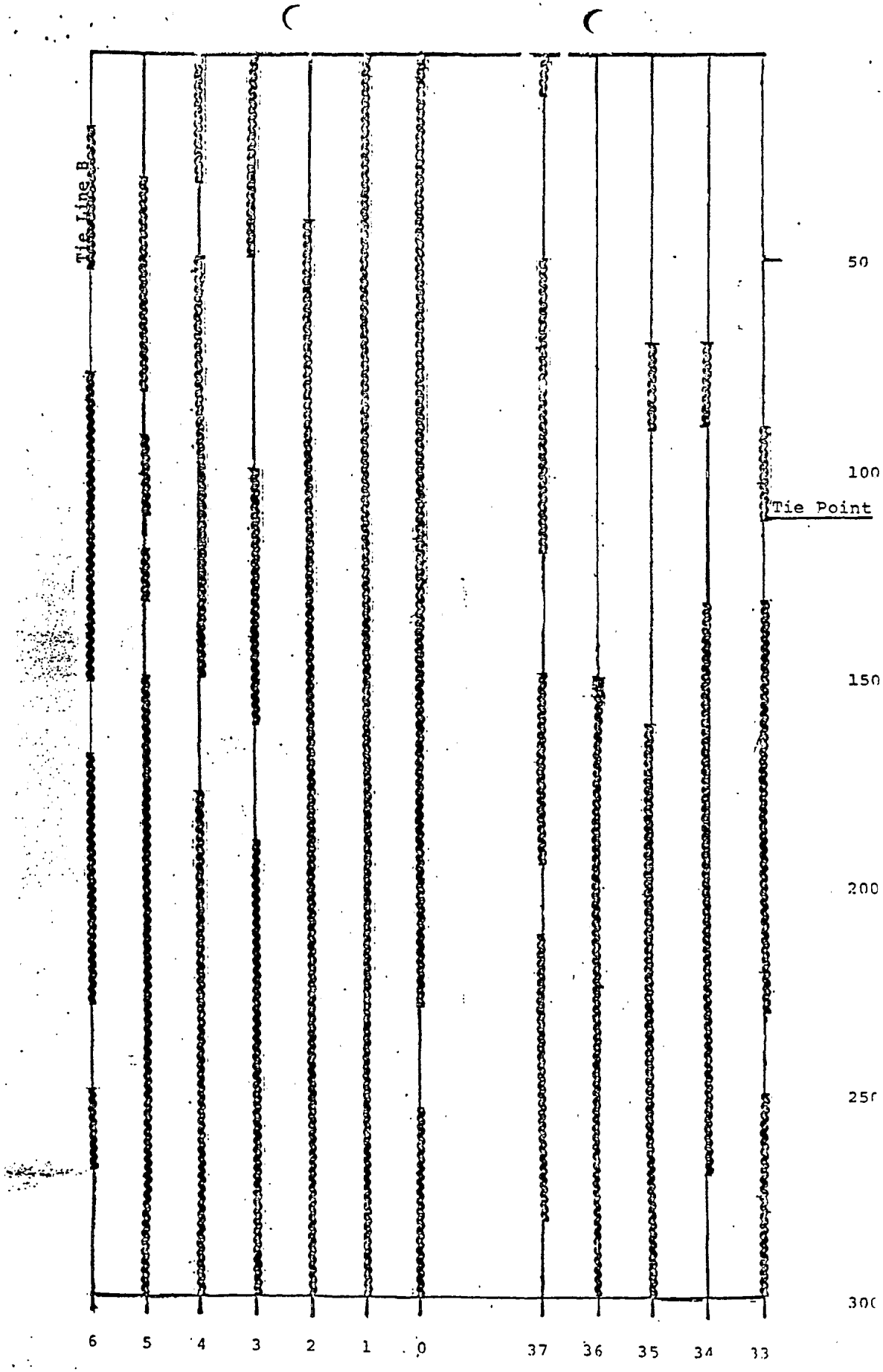

Tie Line Base
50
100
Tie Point
150
200
250
300
6
5
4
3
2
1
0
37
36
35
34
33
ANOMALY -

Figure 3

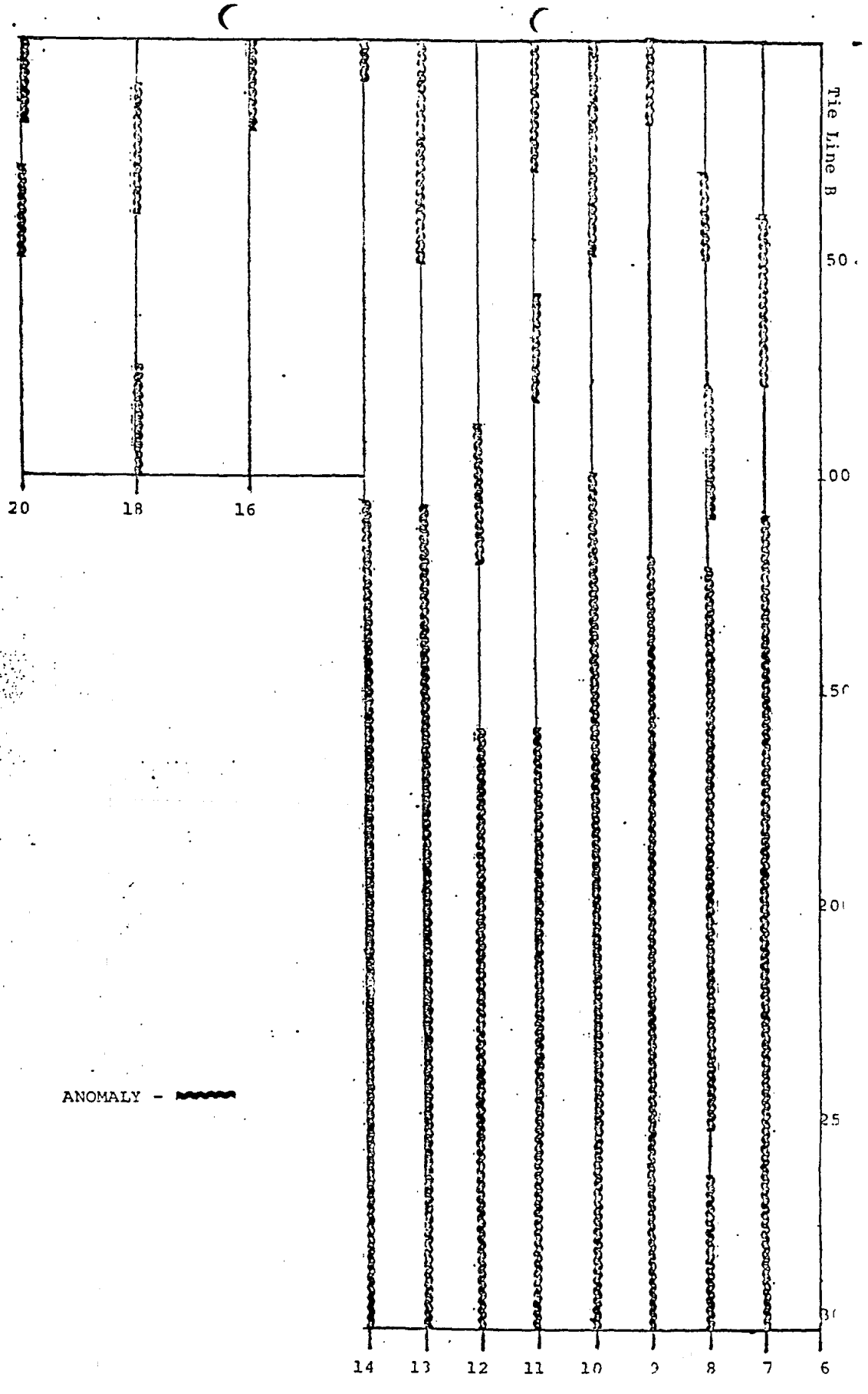


Figure 4

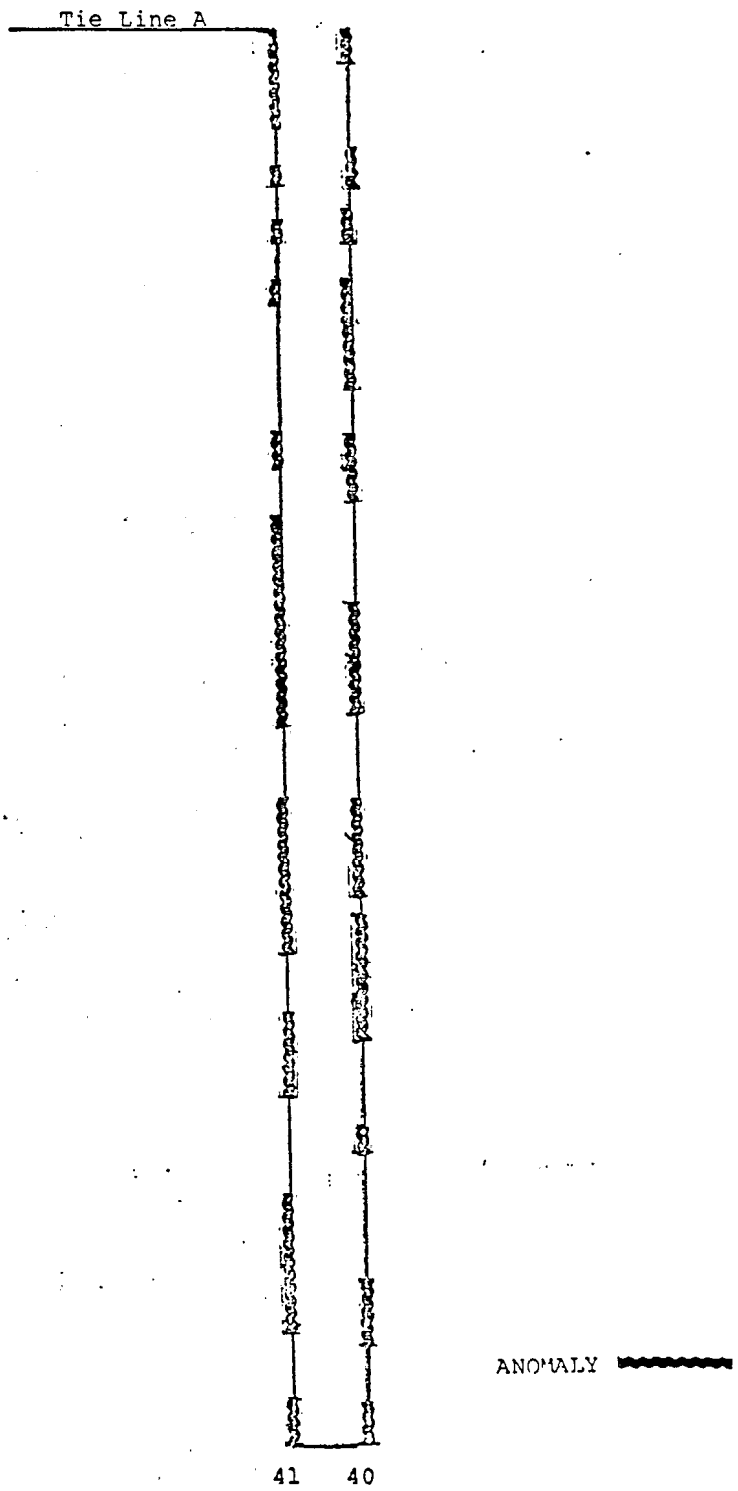


Figure 5

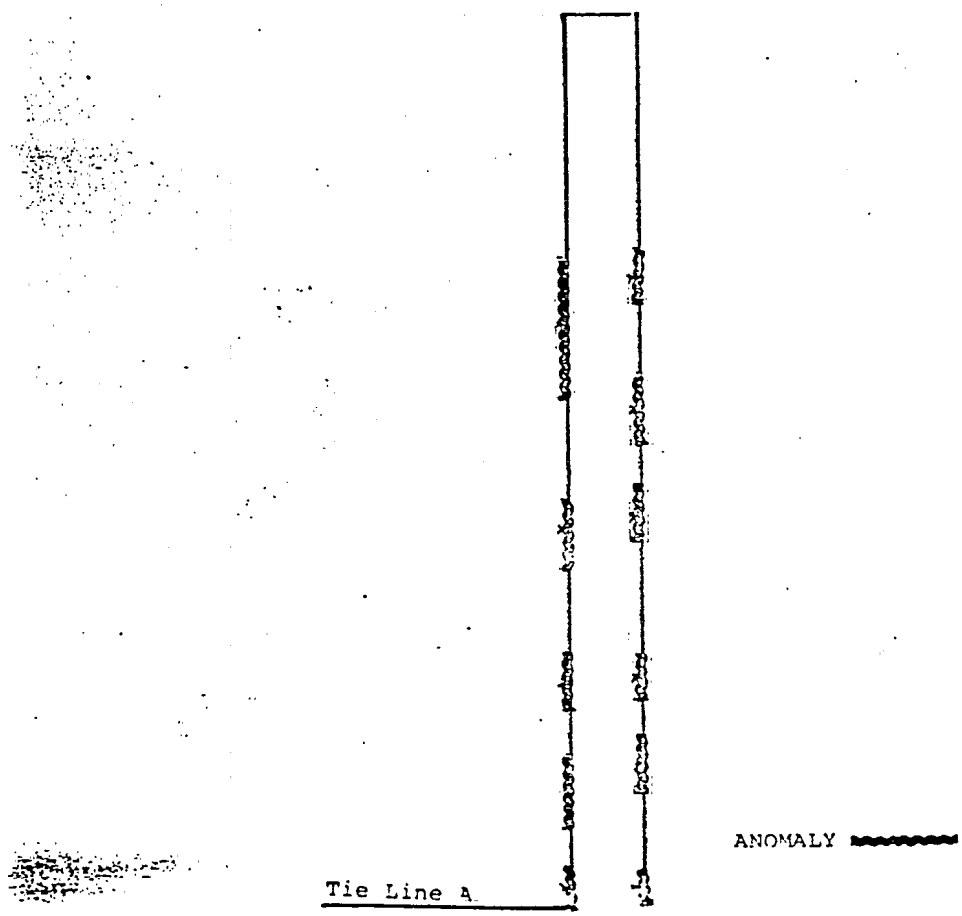


Figure 6

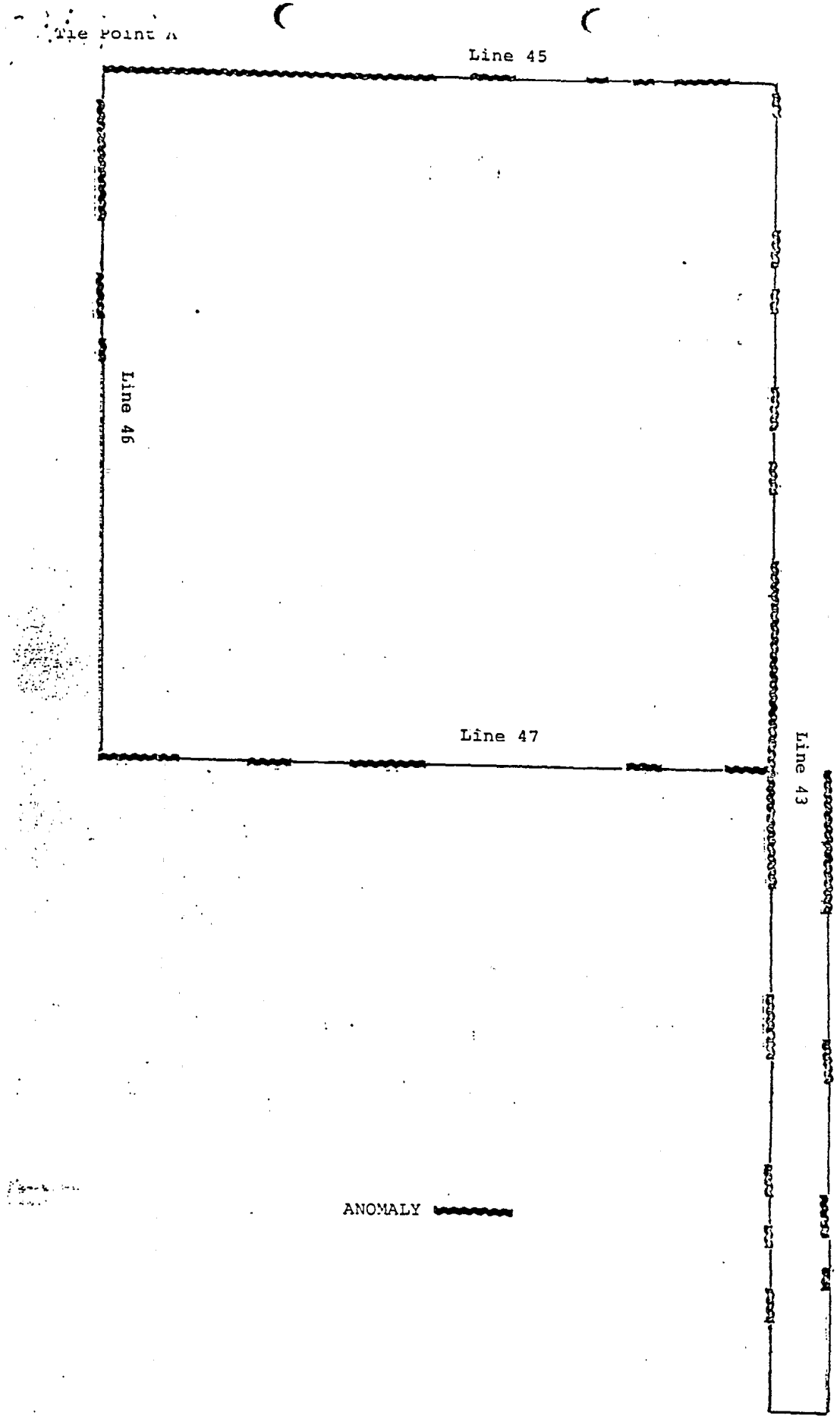
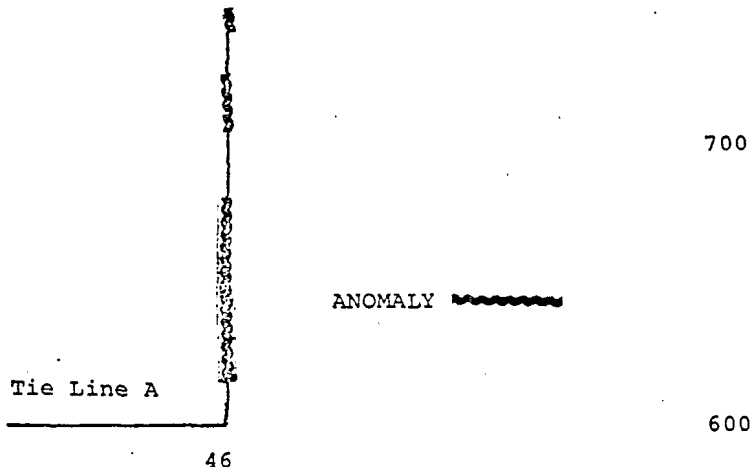


Figure 7

Figure 8



APPENDIX B

TEST BORING LOGS

NBN-00039-3.08-06/01/84

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Virginia

BORING NO. B-1W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/14/83 DATE COMPLETED 11/14/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ____ HRS.

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	1-5 1-8	Dark brown silt with gravel	S-1
4	8-5 4-3	Brown silt with traces of clay	S-2
6	5-4 3-3	Brown silt with traces of clay	S-3
	3-3		
10	4-3 2-2 2-5	Light brown silty sand - Wet	S-4 S-5
12	3-4 5-4	Light brown silty sand - Wet	S-6
14	5-5 6-5	Light brown silty sand - Wet	S-7
16	5-9 10-10	Light brown silty sand - Wet	S-8
18	6-6 4-5	Light brown silty sand - Wet	S-9
20	7-6 8-8	Light brown silty sand - Wet	S-10
22	5-8 9-11	Light brown silty sand - Wet	S-11
24	9-9 11-19	Light brown silty sand - Wet	S-12
26		Bottom of boring 24.0'	
28		Screen 24' - 4'	
30		Stand Pipe 4' - 0'	
32		Stick-up 3'	
		Sand 25' - 3'	
36		Bentonite 3' - 2'	
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-2 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/83 DATE COMPLETED 11/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 6' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	2-8 18-22	Fill material - tan silty sand with gravels of concrete & slag - Medium to fine grain sand	S-1
4	5-5 7-11	Light brown sandy silt with some clay properties	S-2
6	4-5 9-10	Light brown sandy silt	S-3
	2-4 5-7	Light brown silty sand - Wet - Medium to fine grain	S-4
10	3-4 5-5	Light brown sand with silt - Saturated - Medium to fine grain	S-5
12	1-1 3-4	Light brown sand with silt - Saturated - Medium to fine grain	S-6
14	7-5 8-7	Light brown sand with silt - Saturated - Medium to fine grain	S-7
16	7-7 8-9	Light brown sand with silt - Saturated - Medium to fine grain	S-8
18	5-8 11-11	Light brown sand with silt - Saturated - Medium to fine grain	S-9
20	7-13 10-19	Light brown silty sand, pebble in matrix - Wet	S-10
22	13-14 15-16	Light brown to light gray sand with silt - Medium to fine grain - Wet	S-11
24	12-12 14-18	Light gray to light brown sand with silt, pebbles in matrix - Saturated	S-12
26		Bottom of boring 24.0'	
28			
30		Below surface 7'2" Stick up 2'10"	
32			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Virginia

BORING NO. B-3 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/83 DATE COMPLETED 11/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ____ HRS.

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
2	7-8 5-5	Light brown sandy silt - Moist	S-1
4	3-4 5-5	Light brown silt with sand - Moist	S-2
6	4-5 4-5	Light brown silty sand - Moist	S-3
8	2-2 4-3	Light brown sand with silt - Wet - Medium to fine grain	S-4
10	2-4 5-5	Light brown sand with silt - Saturated - Medium to fine grain	S-5
12	4-4 4-5	Light brown sand with silt - Saturated - Medium to fine grain	S-6
14	7-7 6-8	Light brown silty sand - Wet - Medium to fine grain	S-7
16	5-5 9-10	Light brown silty sand - Saturated - Medium to fine grain	S-8
18	12-12 10-12	Light brown silty sand - Saturated - Medium to fine grain	S-9
20	10-10 11-12	Light brown silty sand - Saturated - Medium to fine grain	S-10
22	10-12 13-25	Mottled gray & light brown sand with silt - Wet - Medium to fine grain	S-11
24	10-12 8-10	Mottled gray and light brown sand with silt - Wet Medium to fine grain	S-12
26		Bottom of boring 24.0'	
28		Below surface 7'0" Stick up 3'0"	
30			
32			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Virginia

BORING NO. B-4W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/83 DATE COMPLETED 11/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 9' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
2	5-7 11-15	Dark brown fill, sand silt with pebbles and concrete	S-1
4	25-8 11-13	Dark brown fill, sand silt with pebbles and concrete	S-2
6	23-12 11-8	Dark brown fill, sand silt with pebbles and concrete	S-3
8	5-4 4-5	Olive gray silty clay with organics, Moist	S-4
	5-7 12-15	Mottled brown to gray silty sand with pebbles, Wet	S-5
12	10-8 7-7	Gray silty sand, medium to fine grain - Wet	S-6
14	4-7 8-18	Gray silty sand, medium to fine grain - Wet	S-7
16	--14	Mottled gray & brown silty sand, medium to fine grain - Wet	S-8
18	12-12 12-12	Light brown silty sand, fine grained - Wet	S-9
20	8-8 13-17	Light brown silty sand, fine grained - Wet	S-10
22	30-30 35-32	Light brown & yellow brown silty sand, fine grain - Wet	S-11
24	12-14 20-24	Light brown & yellow brown silty sand, fine grain - Wet with pebbles in matrix	S-12
26		Bottom of boring 24.0'	
28		Screen 24'2" - 2'2" Stand Pipe 2'2" - 0 Stick-up 2'0" Sand 25' - 3' Bentonite 3' - 2'	
30			
32			
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Va.

BORING NO. B5W TYPE DRILL Acker Th CLIENT Malcolm Pirnie

DATE STARTED 11/83 DATE COMPLETED 11/83 DRILLER P.Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 20' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0	6-100	Dark brown fill sandy silt with pebbles and concrete	S-1
2	49-157		
	6-10	Dark brown fill sandy silt with pebbles and concrete	S-2
4	14-8		
	10-23	Dark brown fill sandy silt with pebbles and concrete	S-3
6	70-5		
	85-40	Dark brown sill sand silt with pebbles and concrete	S-4
	61-20		
10	94-100/0"	No Sample	
	1-1	Olive gray silty clay, moist with trace of organics & sand	S-6
12	1-0		
	1-1	Olive gray silty clay, moist with trace of organics & sand	S-7
14	1-1		
	2-2	Olive gray silty clay, moist with trace of organics & sand	S-8
16	2-1		
	2-1	Olive gray silty clay, moist with trace of organics, sand & pebbles	S-9
18	1-1		
	2-1	Olive gray silty clay, moist with trace of organics, sand & pebbles	S-10
20	2-1		
	2-1	Olive gray silty clay with trace of organics, sand and pebbles - Wet	S-11
22	2-1		
	1-1	Olive gray silty clay with trace of organics, sand and pebbles - Wet	S-12
24	1-1		
	2-2	Olive gray silty clay with trace of organics, sand and pebbles - Wet	S-13
26	2-1		
28		Bottom of boring 26.0'	
30		Screen 22'7" - 2'7"	
		Stand Pipe 2'7" - 0	
32		Stick-up +2'5"	
		Sand 25' - 3'	
		Bentonite 3' - 2'	
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-6 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/8/83 DATE COMPLETED 11/8/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 10' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
2	7-11 8-7	Brown and black sandy silt	S-1
4	4-5 5-5	Black silt - Damp	S-2
6	3-1 1-1	Dark gray silty clay - Moist	S-3
	1-2 2-1	Dark gray silty clay - Moist	S-4
10	WOH - PUSH PUSH	Dark gray silty clay - Moist	S-5
12	Wt. of Rod	Dark gray silty clay - Wet	S-6
14	PUSH 2-2	Dark gray silty clay with organics - Wet	S-7
	2-4 4-3	Alternating olive green & dark gray silty sands - Moist	S-8
18	1-3 1-4	Mottled light brown & gray silty sand - Moist - fine grain	S-9
20	10-12 10-9	Mottled light brown & gray silty sand - Saturated - Medium to fine grain	S-10
22	10-10 12-20	Light brown silty sand - Saturated - medium to fine grain	S-11
24	24-30 23-18	Light brown & gray silty sand - Saturated - Medium to fine grain	S-12
26		Bottom of boring 24.0'	
28			
30		Below surface 7'2" Stick up 2'10"	
32			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Virginia

BORING NO. B7W TYPE DRILL Acker Th CLIENT Malcolm Pirnie

DATE STARTED 11/8/83 DATE COMPLETED 11/8/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0	3-3		
2	7-30	Brown sandy silt with concrete & metal fragments	S-1
	13-13		
4	52-65	Brown sandy silt with concrete & metal fragments	S-2
	11-4		
6	7-15	Brown sandy silt with concrete hash	S-3
	6-4		
	6-11	Brown sandy silt with pebbles & concrete, Wet	S-4
	4-7		S-5
10	9-9	Gray sand with silt, medium to fine grain, Wet	
	5-6		
12	7-5	Gray sand with silt, medium to fine grain, Wet	S-6
	3-4		
14	3-5	Light brown silty sand, medium to fine grain, Saturated	S-7
	12-13		
16	15-19	Light brown silty sand, medium to fine grain, Saturated	S-8
	5-5		
18	6-5	Light brown silty sand, medium to fine grain, Saturated	S-9
	5-6		
20	9-15	Light brown silty sand, medium to fine grain, Saturated	S-10
	6-7	Mottled light brown & light gray silty sand,	
22	8-7	Medium to fine grain - Saturated	S-11
	16-25	Mottled light brown & light gray silty sand,	
24	30-35	Medium to fine grain - Saturated	S-12
26		Bottom of boring 24.0'	
		Screen 23'8" - 3'8"	
28		Stand Pipe 3'8" - 0	
		Stick-up 3'4"	
30		Sand 25' - 3'	
		Bentonite 3' - 2'	
32			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

NBN-00039-3.08-06/01/84

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Virginia

BORING NO. B-8 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/12/83 DATE COMPLETED 11/12/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 8' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
2	8-20 56-14	Brown sandy silt with organics, glass & pebbles	S-1
4	1-6 4-3	No sample	S-2
6	3-3 3-2	No sample	S-3
	4-4 4-5	Brown sandy silt with organics and gravel - Moist	S-4
10	3-4 5-5	Light brown silty sand - Wet	S-5
12	4-3 4-3	Light brown silty sand - Wet	S-6
14	5-5 5-6	Light brown silty sand - Wet	S-7
16	5-7 8-10	Light brown silty sand - Wet	S-8
18	6-6 9-12	Light brown sandy silt - Wet	S-9
20	11-8 9-9	Light brown sandy silt - wet	S-10
22	11-12 11-9	Light brown silty sand - Wet	S-11
24	9-11 9-11	Light brown silty sand - Wet	S-12
26		Bottom of boring 24.0'	
28		Below surface 6'9"	
30		Stick up 3'3"	
32			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDIFLL (Brig) LOCATION Norfolk, Va.

BORING NO. B-9W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/11/83 DATE COMPLETED 11/11/83 DRILLER P.Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 10' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH -- DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0	4-19	Brown silt with gravel & organics	S-1
2	16-12		
	6-9	Dark brown silt with glass and organics	S-2
4	9-16		
	22-41	No Sample	S-3
6	8-4		
	1-1	Light brown and dark brown sandy silt - Moist	S-4
	2-3		
	5-4	Light brown and light gray silty sand - Moist	S-5
10	3-3		
	5-5	Light gray silty sand - Wet	S-6
12	4-4		
	6-6	Gray silty sand - Wet	S-7
14	5-5		
	6-6	Light gray silty sand - Wet	S-8
16	5-8		
	5-4	Light brown and gray silty sand - Wet	s-9
18	4-5		
	8-7	Light brown and gray silty sand - Wet	S-10
20	6-7		
	4-5	Light brown and gray silty sand - Wet	S-11
22	5-7		
	6-12	Light brown and gray silty sand - Wet	S-12
24	15-14		
26		Bottom of boring 24.0'	
		Screen 22'7" - 2'7"	
28		Stand pipe 2'7" - 0	
		Stick up 2'5"	
30		Sand 23' - 3'	
		Bentonite 3' - 2'	
32			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-10 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/11/83 DATE COMPLETED 11/11/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 10' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2" OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
	3-6		
2	18-27	Dark brown & dark gray silt with organics, pebbles & glass	S-1
	15-11		
4	15-21	Dark gray sandy silt with concrete hash	S-2
	9-5		
6	4-2		S-3
	1-1		
	1-1	Olive gray silty clay with sand lenses	S-4
	1-1		
10	1-2	Olive gray silty clay with sand lenses and gravel	S-5
	9-7		
12	6-6	Gray silty sand - Wet	S-6
	5-5		
14	4-5	Light brown and gray silty sand - Wet	S-7
	6-5		
16	5-5	Light brown and gray silty sand - Wet	S-8
	4-4		
18	4-3	Light brown and gray silty sand - Wet	S-9
	5-3		
20	2-5	Light brown silty sand - Wet	S-10
	11-13		
22	17-11	Light brown silty sand - Wet	S-11
	5-7		
24	6-10	Light brown silty sand - Wet	S-12
26		Bottom of boring 24.0'	
28		Below surface 7'6"	
30		Stick up 2'6"	
32			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

NBN-00039-3.08-06/01/84

Herbert and Associates, Ltd.
TESTING • ENGINEERING • INSPECTING
POST OFFICE BOX 64758 • VIRGINIA BEACH, VA. 23464 • PHONE (804) 420-2797

LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-11W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/11/83 DATE COMPLETED 11/11/83 DRILLER P.Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ____ HRS.

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0	2-3		
2	4-5	Brown silt with organics and pebbles	S-1
4	3-1 0-1	Rope fiber	S-2
6	2-3 8-27	Black silt with slag, gravels	S-3
	7-9 3-3	Dark brown silt - Wet - with concrete hash	S-4
10	3-3 3-3	Brown & olive gray sandy silt (with a bolt)	S-5
12	2-1 1-3	Dark brown silt - Wet - with gravel & coarse sand	S-6
14	5-5 6-6	Light gray silty sand - Saturated	S-7
16	4-5 6-6	Gray silty sand - Saturated	S-8
18	5-7 7-7	Gray to light brown silty sand - Saturated	S-9
20	4-4 3-2	Gray to light brown silty sand - Saturated	S-10
22	2-4 8-9	Light brown sandy silt - Wet	S-11
24	6-8 8-8	Light brown sandy silt - Wet	S-12
26		Bottom of boring 24.0'	
28		Screen 22'4" - 2'4"	
30		Stand pipe 2'4" - 0 Stick up 2'8"	
32		Sand 23' - 3'	
36		Bentonite 3' - 2'	
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

NBN-00039-3.08-06/01/84

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Va.

BORING NO. B-12 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/83 DATE COMPLETED 11/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0	2-14 46-7	Dark brown & dark gray silt with plastic, glass & organics	S-1
2	2-8 1-4	No sample	S-2
4	1-2 4-5	No Sample	S-3
6		No Sample	S-4
8	1-10 73-40	Dark brown silt with gravels, sand & glass	S-5
10	1-2 3-3	Dark brown & dark gray silt with concrete	S-6
12	3-2 3-4	Dark gray & olive green silt - Wet - organic layer	S-7
14	4-3 4-3	Olive gray silt grading to olive green sandy silt - Wet	S-8
16	2-2 2-3	Olive gray & dark gray silt - wet	S-9
18	4-6 7-9	Olive gray & dark gray silt - Wet (piece of wire)	S-10
20	11-9		
22	11-13	Light brown silty sand - Wet	S-11
24	12-13 15-16	Light brown silty sand - Wet	S-12
26		Bottom of boring 24.0'	
28		Below surface 7'0" Stick up 3'0"	
30			
32			
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-13W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/10/83 DATE COMPLETED 10/10/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 8' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0	7-14	Dark brown silt with glass, wood and gravels	S-1
2	15-12		
	10-14	Dark brown silt with glass, wood and gravel	S-2
4	17-23		
	30-89	Dark brown silt with glass, wood, gravel and metal	S-3
6	68-80		
	50-94	Dark brown silt with glass, wood, gravel and metal	S-4
	86-32		
	-9	Dark brown silt with glass, wood and gravels - Wet	S-5
10	8-7		
	8-6	no sample	S-6
12	5-4		
	2-2	Dark gray to gray silty clay - Moist	S-7
14	1-1		
	PUSH	Dark gray to gray silty clay with organics - moist	S-8
16	P-2		
	P-2	Gray silty clay with organics - Moist	S-9
18	2-2		
	2-3		
20	5-8	Gray silty sand - Wet	S-10
	13-4	Gray alternating silty sand and silty clay - Moist	S-11
22	5-5		
	7-12	Gray alternating silty sand and silty clay - Moist	S-12
24	11-14		
26		Bottom of boring 24.0'	
28		Screen 24'3" - 4'3"	
		Standpipe 4'3" - 0	
30		Stick up 2'9"	
		Sand 25' - 3'	
32		Bentonite 3' - 2'	
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-14 TYPE DRILL Acker Th CLIENT Malcolm Pirnie

DATE STARTED 11/10/83 DATE COMPLETED 11/10/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 8' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	3-6 2-2	Black & dark brown silt with organics & glass	S-1
4	2-2 2-2	Black silt with metal fragment	S-2
6	1-2 1-1	Black silt with organics, wet	S-3
8	1-1 2-3	Olive gray clayey silt with organics & shell hash, Damp	S-4
10	4-3 2-1	Olive gray clayey silt with dense layers of shell hash, wet	S-5
12	1-1 1-1	Dark brown sandy silt with organics, saturated	S-6
14	1-1 0-1	Dark brown sandy silt with organics, glass & pebbles, Wet	S-7
16	1-1 2-4	Dark brown sandy silt with organics, glass & pebbles, Wet	S-8
18	9-12 12-7	Light gray sand with silt - wet	S-9
20	5-5 5-5	Light gray sand with silt - wet	S-10
22	5-8 7-7	Light brown silty sand - Wet	S-11
24	5-4 5-9	Light brown silty sand - Wet	S-12
26		Bottom of boring 24.0'	
28		Below surface 6'10" Stick up 3'2"	
30			
32			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-15W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/9/83 DATE COMPLETED 11/9/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 10' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	8-16 24-37	Brown silt with gravel, concrete, sand & organics	S-1
4	19-7 8-9	Brown silt with gravel, concrete, sand & organics	S-2
6	5-5 5-5	Gray & brown sandy silt - Moist	S-3
10	1-2 2-1 1-1 1-1	Brown silt with gravels Gray silt with organics - Moist	S-4 S-5
12	PUSH	Gray silt with organics - Moist	S-6
14	2-1 2-2	Gray silt with organics - Moist	S-7
16	2-3 2-3	Gray silt with organics - Moist	S-8
18	3-2 3-2	Gray silt with organics - Moist	S-9
20	8-16 24-38	Light gray silty sand - Wet - fine grain	S-10
22	25-26 21-20	Light gray silty sand - Saturated - fine grain	S-11
24	14-16 16-14	Light brown silty sand - Saturated - fine grain	S-12
26		Bottom of boring 24.0'	
28		Screen 24'3" - 4'3"	
30		Standpipe 4'3" - 0	
32		Stick up 2'9"	
		Sand 25' - 3'	
		Bentonite 3' - 2'	
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Va.

BORING NO. B-16W TYPE DRILL Acker III CLIENT Malcolm Pirnie

DATE STARTED 11/9/83 DATE COMPLETED 11/9/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
2	4-6 2-7	Dark brown silt with gravels, concrete & organics	S-1
4	4-4 12-15	Dark gray silt with organics & shells - Moist	S-2
6	5-2 1-1	Dark brown silt - moist	S-3
	1-0 1-0	Dark brown silt - Wet	S-4
10	1-0 1-0	Dark brown silt - Wet	S-5
	1-1		S-6
12	1-6	Gray silty sand - Wet - Medium to fine grain	
14	10-12 12-10	Gray to light gray silty sand - Wet - Medium to fine grain	S-7
16	8-7 5-5	Gray to light gray silty sand - Wet - Medium to fine grain	S-8
18	6-9 10-9	Gray to light brown silty sand - Wet - Medium to fine grain	S-9
20	5-8 9-10	Light brown silty sand, fine grain - Wet	S-10
22	10-10 6-7	Light brown & gray silty sand, fine grain - Wet	S-11
24	2-3 3-4	Mottled light brown, gray & dark brown silty clay - Wet	S-12
26		Bottom of boring 24.0'	
28		Screen 24'4" - 4'4" Stand pipe 4'4" - 0 Stick up 2'8"	
30		Sand 25' - 3'	
32		Bentonite 3' - 2'	
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-17W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/9/83 DATE COMPLETED 11/9/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 8' AFTER ____ HRS ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0	4-12	Dark brown fill material, sandy silt - Concrete, pebbles & metal	S-1
2	8-20		
	12-14	No sample	S-2
4	14-14		
		Concrete	S-3
6	6-12		
	2-2	Olive green sandy silt with metal & pebbles - Moist	S-4
	1-2		
10	2-1	Olive green sandy silt - Wet	S-5
	1-1	Olive gray silty clay with organics & sand	S-6
12	1-1		
	1-2	Piece of slag blocked spoon opening	S-7
14	1-1		
	4-4	Olive gray silty clay - Moist	S-8
16	3-3		
	3-2	Olive gray silty clay with organics & sand - Moist	S-9
18	3-2		
	4-3	Dark gray silt with sand & organics - Moist	S-10
20	2-2		
	3-3		S-11
22	7-3	Dark gray sandy silt - Moist	
	5-3	Mottled dark gray, light brown & gray sandy silt	S-12
24	3-6		
26		Bottom of boring 24.0'	
28		Screen 23'8" - 3'8"	
		Standpipe 3'8" - 0	
30		Stick up 3'4"	
		Sand 24' - 3'	
32		Bentonite 3' - 2'	
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-18 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/9/83 DATE COMPLETED 11/9/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 8' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	7-100 15-20	Dark brown silt with organics, glass, pebbles & cement	S-1
4	8-9 4-5	Dark brown silt with pebbles - Dry	S-2
6	4-6 5-7	Dark brown clayey silt with sand - Damp	S-3
8	3-5 6-4	Light brown silty sand - Moist	S-4
10	7-5 6-4	Brown silty sand - Wet - fine grain	S-5
12	3-5 4-5	Light brown silty sand - Wet - fine grain	S-6
14	6-6 5-5	Light gray silty sand - Wet - fine grain	S-7
16	2-3 5-6	Light brown silty sand - Wet - fine grain	S-8
18	5-5 6-6	Light brown silty sand - Wet - fine grain	S-9
20	2-3 5-5	Light brown silty sand - Wet - fine grain	S-10
22	8-8 8-6	Light brown silty sand - Wet - fine grain	S-11
24	8-2 4-8	Light brown silty sand - Wet - fine grain	S-12
26		Bottom of boring 24.0'	
28			
30		Below surface 7'6" Stick up 2'6"	
32			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-19 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/9/83 DATE COMPLETED 11/9/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 10' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
	12-20 18-28	Dark gray fill material, sandy silt with concrete, Medium to fine grain sand	S-1
	11-5 5-5	Dark gray sandy silt, fine grain - Damp	S-2
	3-2 3-2	Dark gray silt with trace sands - Damp	S-3
	3-2 4-3	Dark gray silt with trace sands - Damp	S-4
	2-1 0-1	Alternating layer of dark gray silt and yellow-green silty sand	S-5
	PUSH	Dark gray silt with sand - Wet	S-6
	PUSH	Olive gray clayey silt - Wet	S-7
	PUSH	Olive gray clayey silt - Wet	S-8
	PUSH	Olive gray clayey silt - Wet	S-9
	PUSH	Olive gray clayey silt with organics - Wet	S-10
	PUSH 1-3	Gray sandy silt with pebbles - Wet	S-11
	3-2 2-1	Gray sandy silt with pebbles - Wet	S-12
	2-2 2-2	Gray silty sand - Wet - Medium to fine grain	S-13
		Bottom of boring 26.0'	
		Below surface 7'3" Stick up 2'9"	

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-20W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/14/83 DATE COMPLETED 11/14/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 5' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
2	2-7 9-9	Dark gray silt with organics	S-1
4	8-5 4-5	Tan & dark gray silt	S-2
6	4-3 2-3	Dark gray silt - Wet	S-3
8	1-0 1-0	Dark gray silt - Wet	S-4
10	1-1 1-0	Dark gray clayey silt - Wet	S-5
12	PUSH	Dark gray silty clay	S-6
14	PUSH	Dark gray silty clay	S-7
16	PUSH	Dark gray silty clay with organics	S-8
18	PUSH	Dark gray silty clay	S-9
20	PUSH	Dark gray silty clay	S-10
22	PUSH	Dark gray silty clay	S-11
24	PUSH	Dark gray silty clay	S-12
26	PUSH	Dark gray silty clay	S-13
28		Bottom of boring 26.0'	
30		Screen 22'2" - 2'2" Standpipe 2'2" - 0 Stick up 2'10"	
32		Sand 23' - 3' Bentonite 3' - 2'	
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

APPENDIX C

PRIORITY POLLUTANT ANALYSIS RESULTS

COMPLETE WATER QUALITY RESULTS
PRIORITY POLLUTANT ANALYSIS

VOLATILE ORGANICS	DETECTION LIMIT (UG/L)	1W-01 (UG/L)	4W-01 (UG/L)	5W-01 (UG/L)	7W-01 (UG/L)	9W-01 (UG/L)	11W-01 (UG/L)	13W-01 (UG/L)	15W-01 (UG/L)	16W-01 (UG/L)	17W-01 (UG/L)	20W (UG
CHLOROMETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	I
VINYL CHLORIDE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	20.0	BDL	2
CHLORETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	I
BROMOMETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	I
ACROLEIN	100	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	I
ACRYLONITRILE	100	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	I
METHYLENE CHLORIDE	10	BDL	BDL	BDL	BDL	14.0	BDL	BDL	BDL	BDL	BDL	I
TRICHLOROFLUOROMETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	E
1,1-DICHLOROETHYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	E
1,1-DICHLORETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	E
TRANS-1,2-DICHLOROETHYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	460
CHLOROFORM	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10.0	BDL	BDL	E
1,2-DICHLOROETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	E
1,1,1-TRICHLOROETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	E
CARBON TETRACHLORIDE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	E
BROMODICHLOROMETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	E
1,2-DICHLOROPROPANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	E
TRANS-1,2-DICHLOROPROPENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	E
TRICHLOROETHYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	110.0	BDL	5600
BENZENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	380
CIS-1,3-DICHLOROPROPENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,2-TRICHLOROETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIBROMOCHLOROMETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BROMOFORM	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,2,2-TETRACHLOROETHYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	12.0	BDL	BDL
1,1,2,2-TETRACHLOROETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	18000
CHLOROBENZENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLBENZENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2-CHLOROETHYL VINYL ETHER	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
O-XYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
M-XYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
P-XYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	

* DETECTION LIMIT DIFFERENT FROM SHOWN VALUES

COMPLETE WATER QUALITY RESULTS
PRIORITY POLLUTANT ANALYSIS

BASE-NEUTRAL EXTRACTABLE ORGANICS	DETECTION LIMIT (UG/L)	1W-01 (UG/L)	4W-01 (UG/L)	5W-01 (UG/L)	7W-01 (UG/L)	9W-01 (UG/L)	11W-01 (UG/L)	13W-01 (UG/L)	15W-01 (UG/L)	16W-01 (UG/L)	17W-01 (UG/L)	20W-01 (UG/L)
N-NITROSODIMETHYLAMINE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BIS(2-CHLOROETHYL)ETHER	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
1,3-DICHLOROBENZENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
1,4-DICHLOROBENZENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
1,2-DICHLOROBENZENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
BIS(2-CHLOROISOPROPYL)ETHER	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
HEXACHLORETHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
N-NITROSODI-N-PROPYLAMINE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
NITROBENZENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
ISOPHORONE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
BIS(2-CHLOROETHOXY)METHANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
1,2,4-TRICHLOROBENZENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
NAPHTHALENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
HEXACHLOROBUTADIENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
HEXACHLOROCYCLOPENTADIENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
2-CHLORONAPHTHALENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
DIMETHYLPHTHALATE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
ACENAPHTHYLENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
2,6-DINITROTOLUENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
ACENAPHTHENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
2,4-DINITROTOLUENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
DIETHYLPHTHALATE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
FLUORENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
4-CHLOROPHENYL PHENYL ETHER	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIPHENYLAMINE(N-NITROSO)	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DIPHENYLHYDRAZINE(AZOBENZENE)	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4-BROMOPHENYL PHENYL ETHER	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HEXACHLOROBENZENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PHENANTHRENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ANTHRACENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DI-N-BUTYLPHTHALATE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FLUORANTHENE	10	BDL	BDL	BDL	BDL	BDL	BDL	10.0	BDL	BDL	BDL	BDL
BENZIDINE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BUTYLBENZYLPHTHALATE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BENZO(A)ANTHRACENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
3,3'-DICHLOROBENZIDINE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHRYSENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BIS(2-ETHYLHEXYL)PHTHALATE	10	450(1)	BDL	BDL	BDL	BDL	BDL	22.0	16.0	BDL	BDL	BDL
DI-N-OCTYLPHTHALATE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BENZO(B)FLUORANTHENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BENZO(K)FLUORANTHENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BENZO(A)PYRENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
INDENO(1,2,3-C,D)PYRENE	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIBENZO(A,H)ANTHRACENE	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BENZO(G,H,I)PERYLENE	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

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COMPLETE WATER QUALITY RESULTS
PRIORITY POLLUTANT ANALYSIS

PESTICIDES/PCB'S	DETECTION LIMIT (UG/L)	1W-01 (UG/L)	4W-01 (UG/L)	5W-01 (UG/L)	7W-01 (UG/L)	9W-01 (UG/L)	11W-01 (UG/L)	13W-01 (UG/L)	15W-01 (UG/L)	16W-01 (UG/L)	17W-01 (UG/L)	20W-01 (UG/L)
ALDRIN	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ALPHA-BHC	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BETA-BHC	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
GAMMA-BHC	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DELTA-BHC	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLORDANE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4,4'-DDT	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4,4'-DDE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4,4'-DDD	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIELDRIN	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ALPHA-ENDOSULFAN	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
BETA-ENDOSULFAN	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ENDOSULFAN SULFATE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ENDRIN	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ENDRIN ALDEHYDE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HEPTACHLOR	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HEPTACHLOR EPOXIDE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-1242	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-1254	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-1221	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-1232	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-1248	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-1260	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-1016	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOXAPHENE	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

COMPLETE WATER QUALITY RESULTS
PRIORITY POLLUTANT ANALYSIS

ACID EXTRACTABLE ORGANICS	DETECTION LIMIT (UG/L)	1W-01 (UG/L)	4W-01 (UG/L)	5W-01 (UG/L)	7W-01 (UG/L)	9W-01 (UG/L)	11W-01 (UG/L)	13W-01 (UG/L)	15W-01 (UG/L)	16W-01 (UG/L)	17W-01 (UG/L)	20W (UG
PHENOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5
2-CHLOROPHENOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
2-NITROPHENOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
2,4-DIMETHYLPHENOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1
2,4-DICHLOROPHENOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
P-CHLORO-M-CRESOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
2,4,6-TRICHLOROPHENOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
2,4-DINITROPHENOL	250	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
4-NITROPHENOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
4,6-DINITRO-O-CRESOL	250	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
PENTACHLOROPHENOL	25	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
INORGANICS PRIORITY POLLUTANTS	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/L)	(MG/
ANTIMONY, TOTAL	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
ARSENIC, TOTAL	0.05	BDL	0.45	0.13	0.10	0.45	0.13	0.65	0.10	1.40	0.30	0.
BERYLLIUM, TOTAL	0.02	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	BDL	
CADMIUM, TOTAL	0.02	BDL	0.02	0.02	BDL	0.02	0.04	0.15	0.02	0.04	0.04	0.
CHROMIUM, TOTAL	0.10	BDL	0.11	0.10	0.55	0.13	0.10	0.36	0.10	0.20	0.43	BDL
COPPER, TOTAL	0.10	BDL	0.50	0.42	BDL	0.15	0.64	6.10	0.75	0.72	0.44	0.13
LEAD, TOTAL	0.20	0.25	0.10	0.67	BDL	0.50	1.00	5.90	0.80	0.83	1.20	0.27
MERCURY, TOTAL	0.0002	BDL	0.0007	0.0003	BDL	BDL	BDL	0.0005	BDL	BDL	BDL	BDL
NICKEL, TOTAL	0.10	BDL	BDL	BDL	BDL	0.10	BDL	0.60	0.11	0.24	0.10	BDL
SELENIUM, TOTAL	0.05	BDL	BDL	0.06	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
SILVER, TOTAL	0.06	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
THALLIUM, TOTAL	0.05	0.10	0.20	BDL	BDL	BDL	0.24	0.50	0.20	0.10	0.22	BDL
ZINC, TOTAL	0.02	0.23	1.50	1.90	0.12	0.00	2.50	15.00	1.60	1.20	5.40	0.57
CYANIDE, TOTAL	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.09
PHENOLS, TOTAL	0.01	BDL	0.01	0.02	BDL	0.01	0.03	BDL	0.03	0.06	0.01	BDL

* DETECTION LIMIT DIFFERENT FROM SHOWN VALUES