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Remedial Investigation Burgess Brothers Superfund Site Woodford and Bennington Vermont

Burgess Brothers Steering Committee

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O'BRIEN & GERE
ENGINEERS, INC.

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DISCLAIMER

This document is a DRAFT document prepared by the Settling Parties pursuant to a government administrative order which has not received final acceptance from the U.S. Environmental Protection Agency. The opinions, findings, and conclusions expressed are those of the authors and not those of the U.S. Environmental Protection Agency or the Vermont Department of Environmental Conservation.

Executive Summary

Background

The Burgess Brothers Superfund Site (Site), located in the towns of Woodford and Bennington, Vermont, has been the subject of investigation since 1984 under the oversight of the Vermont Department of Environmental Conservation (VTDEC) and, more recently, the United States Environmental Protection Agency (USEPA). The property is currently used by Burgess Brothers, Inc., a family-owned business which conducts kame sand and gravel mining and metal salvage operations at the Site.

In March 1989 the Burgess Brothers Site was placed on the National Priorities List (NPL) as a Superfund Site, which lead to the initiation of a Remedial Investigation/ Feasibility Study (RI/FS). The eventual goal of the RI/FS is to collect data sufficient for the completion of a risk assessment and to then select a remedy to address the Site contamination.

The focus of the investigation is a two to three acre section of the sixty acre property. This area consists of a Landfill Area, Soil Staging Area, Former Lagoon Area located at the southern end of the Landfill Area, a Marshy Area at the base of the Landfill Area and an area referred to as the "Bend in the Road" along the north west edge of the access road (Figure 1B). There are a number of drainage swales and intermittent streams that discharge into an unnamed stream which flows along the base of the Landfill Area and into Barney Brook. East of the Landfill Area, across the unnamed stream, is a Hillside Area which was also included in this investigation.

The Landfill Area accepted primarily municipal-type refuse such as wood, newspaper, steel, cardboard and cinders. Disposal of wastes, now considered to be hazardous, reportedly occurred in a lagoon at the Site beginning in approximately 1967-1968, when wastes were accepted from a Union Carbide plant located in Bennington.

Additionally, hazardous wastes have been identified in other areas of the Site, including the Marshy Area, the Soil Staging Area and the Landfill Area. The wastes that were disposed at the Former Lagoon Area include lead plater wastes, lead plater sludge, battery processing waste, and waste

solvents. The wastes were disposed in an unlined bermed pit (the Former Lagoon Area). This pit was excavated into kame sand in this area. Kame sand is defined as a mound or irregular ridge of stratified sand and gravel deposited by glacial meltwater at the margin of the glacier. (*Dictionary of Geological Terms*, AGI, 1984)

RI Objectives

As presented in Section 1 of the Statement Of Work (SOW), the objectives of the RI are to:

1. Define the source(s), nature, extent, and distribution of contaminants released.

2. Provide sufficient information to identify and quantify potential exposure pathways.

3. Provide sufficient information to assess the risks to human health and the environment.

4. Provide sufficient information to evaluate remedial alternatives, conceptually design remedial actions, select a remedy, and issue a record of decision.

As presented in Section 2 of the SOW, the scoping of the RI/FS was performed to establish that the Settling Parties:

1. Understand the objectives of the RI/FS.

2. Develop procedures to meet the RI/FS objectives, including those for field activities.

3. Initiate the identification of federal or state Applicable or Relevant and Appropriate Requirements (ARARs) that will provide criteria for remedy selection at the Site.

4. Assemble and evaluate existing data, identify data gaps, and resolve inconsistencies.

5. Develop a conceptual understanding of the Site based on the evaluation of existing data.

Previous Investigations

Sampling and analytical programs at the Site were conducted periodically between 1985 and 1989 by contractors for Eveready Battery Company

(Eveready) and the USEPA. These programs identified volatile organic compounds (VOCs) in downgradient wells west of the unnamed stream, metals in the Former Lagoon Area, and VOCs in surface water samples adjacent to the landfill. On March 31, 1989, the Site was placed on the NPL as a Superfund Site.

A Limited Field Investigation (LFI) was performed during December 1991 and January 1992. The LFI consisted of an investigation of agency and facility records, files, and aerial photographs to detail past activities at the Site. Also, descriptions of wells, water supplies, and potential wetlands areas were developed. Site conditions were further characterized through a ground-penetrating radar (GPR) survey, air quality surveys, soil vapor screening, metals screening, and well testing.

Based on the results of the LFI, a Work Plan for a Phase 1A RI Initial Site Characterization was developed. The Work Plan described an investigation program to more fully define the nature and extent of contamination and ground water flow dynamics at the Site. Investigation activities included a seismic refraction survey, additional soil gas sampling, installation of test pits, air monitoring, installation of monitoring wells, an ecological assessment, and the development of a topographic map. In addition, the Phase 1A RI included sampling and analysis of surface and subsurface soils, surface water, sediments, leachate/seeps, and ground water (from shallow kame sand, till and weathered and competent bedrock zones).

The Phase 1A RI program was performed in accordance with the RI Work Plan. The results of this investigation were reported in O'Brien & Gere Engineers, Inc. January 1994 Initial Site Characterization Report (ISCR). In accordance with the SOW, a Phase 1B RI was developed to address the data gaps exposed in the Phase 1A RI. The conditionally approved February 1994 Phase 1B RI Work Plan was prepared based on the results of the Phase 1A RI program. The Phase 1B RI activities were performed in early 1994.

Between the Phase 1A and 1B activities, two interim sampling programs were conducted in November 1993 and February 1994 to expand the database relative to seasonal fluctuations of surface water, sediments and ground water systems. This document incorporates the results of the Phase 1A RI, Interim Monitoring and Phase 1B RI programs.

Field Investigations

The following investigations were performed to evaluate the effects of the Former Lagoon Area and Landfill Area on air, surface water, surface and

subsurface soils, ground water, and ecology at the Site:

Geophysical Surveys. Geophysical surveys conducted at the Site included: ground penetrating radar during the LFI; seismic refraction survey during the Phase 1A; and electromagnetic survey during the Phase 1B. In addition seismic, magnetometer, and gravity surveys were performed prior to the LFI in 1988. The objective of these surveys was to identify subsurface geologic structures, constituent plumes, and landfill materials.

Soil Vapor Surveys. Two soil vapor surveys were performed during the RI. An initial survey was performed during the LFI to evaluate the areal distribution of subsurface VOCs in the vicinity of the Former Lagoon Area. A second survey was performed during the Phase 1A RI to evaluate the distribution of VOCs in the Hillside Area, tentatively identify chemical composition of subsurface VOCs, and further evaluate VOCs detected at the Soil Staging Area.

Surface Soil Sampling. Shallow surface soils were collected during the LFI to evaluate VOCs in the Marshy Area and Hillside Area. Additional samples were collected during the Phase 1A and Phase 1B RI to evaluate the migration of constituents from the Former Lagoon and Landfill Areas to the Marshy Area and to evaluate potential for ingestion and possible contact exposure for human or ecological receptors.

Soil Boring/Monitoring Well Installations. Sixty soil borings were performed to facilitate ground water monitoring well installation and/or characterize subsurface soils. Monitoring wells were installed in the shallow kame sand, ablation till, shallow and deep weathered bedrock, and competent bedrock to characterize constituents within the various water bearing zones.

Test Pit Installations. Test pitting programs were performed during the Phase 1A and Phase 1B RI field programs. Six test pits were performed during the Phase 1A RI to evaluate the location of the northern perimeter of the landfill. In addition ten test pits were performed along the Bend in the Road to evaluate if plater sludge had been deposited in this area. Test pitting performed during the Phase 1B RI consisted of fourteen test pits for the purpose of defining the landfill (northeast corner) and Former Lagoon Area boundaries and to evaluate EM anomalies.

Surface Water and Sediment Sampling. Surface water and sediment sampling was performed during the Phase 1A RI and Interim Sampling program. The purpose of this program was to evaluate the effects of the

Former Lagoon Area and Landfill Area on the surface water and sediment quality in the drainage swales, the unnamed stream and in Barney Brook.

Leachate Sampling. Leachate seep sampling was performed along the toe of the landfill during the Phase 1A RI field program. The objective of this effort was to characterize the constituents in the leachate and to evaluate the potential impact on surface water and sediments.

Air Quality Study. An air quality assessment was performed during the Phase 1A RI field program. The objective of this program was to evaluate whether Site-related residues are being transported from the Site via air transport.

Ecological Assessment. An ecological assessment was completed at the Site during the Phase 1A RI program. The objectives of this program included: identifying major terrestrial and aquatic habitants and associated wildlife, identifying exposure point contaminant concentrations in the affected media; and qualitatively evaluating the risk to exposed resident wildlife species.

Development of the Conceptual Site Model

A Conceptual Site Model (CSM) for the Site was developed as part of the Phase 1A RI Work Plan. The CSM was based on background information about Site operations as well as previous investigations at the Site, and the LFI. The CSM in the RI Work Plan reflected the information known about the Site at that time, and it was envisioned that the CSM would be periodically refined to incorporate new information. This RI Report incorporates the findings of the Phase 1A/Phase 1B RI field investigations and Interim Sampling efforts, which provided supplemental information on Site conditions and seasonal fluctuations.

Conceptual Site Model - Source Areas

Historical information and analytical data collected to date indicate that the primary source of concentrated volatile and inorganic contaminants is the Former Lagoon Area, located in the southern end of the Landfill Area.

Phase 1A and Phase 1B RI findings are consistent with the known use of the Former Lagoon Area for the disposal of sludges from battery production wastes and spent solvents. Identified contaminants in the lagoons are metals, such as lead, chromium, and nickel, as well as VOCs, such as trichloroethene (TCE), tetrachloroethene (PCE), and dichloroethene (DCE), polychlorinated biphenyls (PCBs) and semi-volatile constituents. Some

indications of free-phase organic constituents were found in the lagoon sludges.

The Marshy Area soils exhibited organic and inorganic residues most likely as a result of migration primarily through the ground water pathway to this area. Some migration may also have occurred through seeps. The data suggest that concentrations decrease away from the Former Lagoon Area boundary into the Marshy Area toward the unnamed stream. Additionally, VOC residues in shallow soils are lower than that in shallow ground water in this area indicating that soils are not the source material in this area. As such, it is hypothesized that a "release" of these materials did not occur in the Marshy Area. Instead, source materials for these residues most likely originated from the Former Lagoon Area.

Other sources of impacts in the landfill include construction/ demolition and some industrial wastes (batteries, solvents) in the northeast section, the east-central section, and the western section near the Woodford/Bennington town line. These sources have contributed solvents and metals such as lead, nickel, zinc, and mercury to shallow ground water beneath the landfill and Marshy Area and surface water/leachate seeps. The concentrations of materials are about three orders of magnitude lower than the Former Lagoon Area with the exception of mercury detected in the northeast section of the Landfill Area.

Another more localized area of volatile organic impacts was identified in the tank salvaging area (near the Soil Staging Area and well number W-07). This area was identified based on the presence of VOCs in the soil gas and low levels of VOCs, in some soil and ground water samples. The distribution of VOCs and petroleum residues is centered around the W-07 location with lower concentrations in shallow soils around it. The Hillside Area, the Bend in the Road and the area West of the Landfill were identified not to be areas of significant concern (i.e., source areas).

The nature and extent of surface water/sediment impacts has been characterized, and the constituent levels in the unnamed stream and Barney Brook have been assessed. VOCs were present in the surface water samples from Marshy Area drainage swales and from the unnamed stream, and were not detected in the samples from Barney Brook. Metals (aluminum, chromium, nickel and zinc) were present in the sediment samples from the Marshy Area drainage swales, and were not present in the samples from the unnamed stream. Therefore, the extent of VOC impact appears to be limited to the Marshy Area drainage swales around the landfill and the unnamed stream near the landfill, while the extent of metals impact is within the Marshy Area drainage swales.

Site Hydrogeology

The kame sand in which the landfill was constructed is lens shaped and lies on a layer of glacial till which is continuous across the Site. The upper portion of the till sequence referred to as ablation till is about 2.5 to 15 feet thick across the Site. This grades into a much denser lodgement till that continues to the top of weathered bedrock at a thickness of 35 to 75 feet. The total till thickness is 45 to 90 feet.

The till layer is underlain by the weathered bedrock sequence, which was found to be from 180 to 360 feet thick across the Site. A comparison of inorganic materials in ground water in the Marshy Area also suggests a decrease below the ablation till. The inorganic concentrations will be further evaluated using a "low-flow purging and sampling technique as part of the Long Term Monitoring Program (LTMP).

The competent bedrock, which is mapped as Cheshire Quartzite, underlies the weathered bedrock at a depth of 230 to 412 feet.

The top of the ablation and lodgement till surfaces suggest that the "surface" of the two till zones slopes to the south and southeast beneath the Landfill Area into the Marshy Area. The kame sand is situated generally in this depression. Another small depression in the ablation till surface was found west of the landfill, but is not believed to affect constituent migration since very little VOCs were found in ground water in this area. The shallow ground water potentiometric data in the area indicate that the horizontal flow direction is primarily south southeast into the Marshy Area. The depression in the till surface together with hydraulic flow conditions beneath the Former Lagoon Area and Marshy Area indicate that potential free or dissolved phase contaminant residues from the Former Lagoon Area will migrate from below the two lagoon cells in the kame sand and ablation till layers to the Marshy Area. Free phase product (dense/light non-aqueous phase liquid) was not encountered during this Remedial Investigation; however, sludge material was encountered in the Former Lagoon Area that exhibited some incorporated organic liquids. Subsurface investigations indicate that this sludge is a minor part of the Former Lagoon Area fill volume and is relatively immobile.

Vertical gradients measured in the Marshy Area indicate an upward flow of ground water from the landfill, with subsequent discharge into the unnamed stream. Ground water quality data indicate that the opposite side of the unnamed stream is largely unimpacted and that the stream appears to be the discharge boundary for shallow ground water.

A contour map of potentiometric levels in the upper part of the weathered bedrock sequence near the Marshy Area suggests that the sandy layers screened by these wells may be hydraulically connected and ground water in this unit flows to the west and southwest. On a more regional scale, it appears that the sandy layers are probably not hydraulically connected due to the significant clay thicknesses.

Typically, the vertical hydraulic conductivity value in layered units of low conductivity can be much lower than the horizontal value. Due to the poor sorting of the till and the high compaction (low effective porosity), the rate of impacted ground water movement vertically through the till and weathered bedrock is probably very slow. However, it is noted that fractures, if present in the lodgement till and/or weathered (schist) bedrock, could enhance the migration of solutes through these aquitards of typically low hydraulic conductivity. Most impacted ground water in the upper ablation till appears to be influenced by upward hydraulic potentials with discharge into the kame sand and the surface water of the unnamed stream.

Potentiometric levels in the competent bedrock wells indicated the potential for ground water in this unit to flow westerly under very shallow gradients. Vertical gradients between the weathered and the competent bedrock are not pronounced. The ground water in the competent bedrock is probably recharged from topographically higher areas to the east where bedrock is exposed at ground surface.

Project Status

The Burgess Brothers Superfund Site Steering Committee and USEPA-Region I are currently proceeding under USEPA's Superfund Accelerated Clean-up Model (SACM) program. The Steering Committee has submitted an Engineering Evaluation/Cost Analysis (EE/CA) for source control measures which meet response action objectives outlined by the USEPA.

Ground water impacts at the Site will be addressed following completion of a health-based risk assessment to be performed by the USEPA. Data from the RI conducted at the Site will be used in performing the risk assessment.

Developing and Screening of Remedial Action Alternatives

Preliminary alternatives for remediation of Site ground water were developed and screened, based on the data compiled during performance of the RI. The objective of the Alternatives Evaluation was to develop a range of remedial options for management of migration measures that protect human health and the environment, based on available information and

standards such as Standards, Criteria and Guidelines and Applicable or Relevant and Appropriate Requirements.

The results of the Alternatives Evaluation are summarized in a separately bound report entitled Alternatives Evaluation - Ground Water, August 1994 by O'Brien & Gere Engineers, Inc. This report relates to the management of ground water migration measures, while source control measures are being separately addressed under the SACM program.

Conclusions

In accordance with the RI Work Plan for the Site, the objectives of the Phase 1A, 1B activities and interim sampling were to:

1. Define the source(s), nature, extent, and distribution of contaminants released.

2. Provide sufficient information to identify and quantify potential exposure pathways.

3. Provide sufficient information to assess the risks to human health and the environment.

4. Provide sufficient information to evaluate remedial alternatives, conceptually design remedial actions, select a remedy, and issue a record of decision.

The six areas identified within the Study Area as being suspected or confirmed source areas included:

- Bend in the Road
- Hillside Area
- Soil Staging Area
- Landfill Area
- Former Lagoon Area
- Marshy Area

The following summarizes the findings concerning these areas:

Bend In The Road. This area is located in the northwest corner of the Site across from the current sand quarry and was a suspected area of lead disposal. The area was used for staging of automobiles and various industrial machinery. A test pitting program was conducted in this area that included PID testing and analysis of soil samples for metals. Metal

concentrations were found to be within one order of magnitude of background. Only lead approached an order of magnitude above the background level. The source of lead in this sample is not known, but it is speculated that residues from old cars stored in this area prior to salvaging might be the source. No evidence of or concentrated waste materials were observed.

Hillside Area. This area is located along a logging road on the slope of Harmon Hill east of the Marshy Area and across from the Landfill Area. Due to the logging operations, this area was suspected of containing potential low level volatiles or petroleum residues. Sampling of soil vapor, soil and ground water media indicated minor amounts of petroleum based residues were evident. Data suggest a small localized surface impact associated with machinery may have been the source of this release.

Soil Staging Area. This area is located just north of the landfill in the vicinity of the loam staging area. Historical information has indicated that fuel tanks were stored, cleaned, and salvaged in this area. This area was suspected of containing petroleum-based residues and solvents. Sampling of soil vapor, soil and ground water media indicated petroleum residues in the near surface soils and shallow ground water system. Data indicate that petroleum and solvent residues were limited primarily to the area in proximity of well cluster W-07. Other lower concentrations of these residues were detected in a diffuse pattern around this point in shallow soils (0 to 2 feet).

Landfill Area. The landfill is bounded to the north by the access road, the west by the Bennington/Woodford town lines, and to the east and south by the Marshy Area. The landfill includes the Former Lagoon Area on its southern periphery and also includes areas where drums were suspected to have been buried (west side) and an area where industrial waste including batteries, sludge and construction/ demolition waste was suspected to have been buried (east-central area). Sampling and analysis of soil vapor, soil, ground water, and seeps indicated metals (lead, nickel, zinc, and in some cases mercury) associated with disposal of construction/demolition waste and some industrial waste in the northeast, east central, and western landfill portions. Volatiles at levels lower than in the Former Lagoon Area were found in these areas. These disposal areas were found incorporated in the landfill matrix of municipal waste.

Former Lagoon Area. The Former Lagoon Area is located along the southern edge of the landfill. Disposal of waste materials into this Former Lagoon Area consisted of lead plater wastes, lead plater sludge, battery processing waste, and waste solvents. The wastes were disposed of into two

unlined bermed cells. Cell 1 is the older of the two and is currently filled in with municipal type waste and thus not visible at grade. Industrial type waste identified at the bottom of the lagoon consisted of white pasty sludge, electrical components and VOC contaminated kame sand cover. Lagoon Cell 2 located to the south of Lagoon Cell 1 is larger and partially filled in at grade. This lagoon contains industrial sludge waste and contaminated municipal waste. The northern portion of this lagoon was comprised chiefly of municipal type fill and VOC contaminated kame sand material. Residues from the lagoon have migrated into the underlying kame sand and ablation till and then into the adjoining Marshy Area.

Marshy Area. The Marshy Area is located to the east and southeast of the landfill. This area has been designated as a regulated wetland and includes a system of surface water drainage (the unnamed stream system). Due to the slope of topography and hydraulic ground water flow potentials, residues from the lagoon cells and landfill have migrated into the Marshy Area and then into the receiving stream system. Contamination appears to be confined to the kame sand and ablation till units in this area. Migration of residues has occurred downstream a short distance in the unnamed stream, with concentrations observed further downstream in Barney Brook. Carbon disulfide was detected in SW-05, and acetone was detected in SW-06. Polynuclear aromatic hydrocarbons were detected in SED-05. The concentrations of contaminants in both soil and ground water decrease from the Former Lagoon Area toward the Marshy Area, indicating the source of contaminants in the Marshy Area is most likely the Former Lagoon Area. VOC residues in shallow soils are lower than that in shallow ground water in the Marshy Area indicating the VOC contaminants in the soil matrix have been adsorbed from the ground water by the soil particles. The Marshy Area, therefore, is not considered a source area for release of contaminants to ground water based on current data. Leachability testing of the Marshy Area soils was not performed under this investigation, therefore, the impact of residual VOCs in the soil on future ground water cannot be quantified. Without significant changes in soil/ground water chemistry, the desorption of contaminants to the aqueous phase would be unlikely. However, it is likely that due to the saturated conditions that exist in this area for much of the year, the soil and ground water would need to be treated as a contiguous unit.

Future Activities

Due to the potential that unfiltered inorganic analyses of ground water have been influenced by entrained sediments in the samples, additional ground water sampling will be performed. This sampling will utilize low flow rate sample collection procedures to minimize entrained sediments. It is

acknowledged that due to sediment impacts, comparison of inorganic results against existing background ground water quality data, as well as to regulatory standards, may result in an inaccurate portrait of inorganic contamination in the ground water. Following completion of low flow rate sampling of the Site wells, a supplement to the RI Report will be prepared to incorporate the results and conclusions of the modified ground water sampling methods.

Health and environmental impacts of Site ground water will be evaluated by a risk assessment to be performed by USEPA. Data from this RI Report will be utilized to perform the risk assessment.

1. Introduction

In August 1991, the U.S. Environmental Protection Agency (USEPA) and the Burgess Brothers Superfund Site Steering Committee entered into a Consent Order, effective September 4, 1991, for a Remedial Investigation and Feasibility Study (RI/FS) of the Burgess Brothers Superfund Site (Site) located in the towns of Bennington and Woodford, Vermont. During December 1991 and January 1992, O'Brien & Gere Engineers, Inc. (O'Brien & Gere) performed a Limited Field Investigation (LFI) at the Site pursuant to the LFI Work Plan approved by USEPA in November 1991. The purpose of the LFI was to produce a focused Work Plan for the RI/FS. The results of the LFI were summarized in the September 1992 Limited Field Investigation Results Report.

Based on the results of the LFI, a Work Plan for a Phase 1A RI Initial Site Characterization was developed, and was conditionally-approved by USEPA September 1, 1992. The Work Plan described an investigation program to more fully define the nature and extent of contamination and ground water flow dynamics at the Burgess Brothers Superfund Site. Investigation activities included a seismic refraction survey, additional soil gas sampling, installation of test pits, air monitoring, installation of monitoring wells, an ecological assessment, and the development of a topographic map. In addition, the Phase 1A RI included sampling and analysis of surface and subsurface soils, surface water, sediments, leachate/seeps, and ground water (from kame sand, ablation till, and weathered and competent bedrock zones).

The Phase 1A RI program was performed in accordance with the RI Work Plan. The results of this investigation are reported in O'Brien & Gere Engineers, Inc. January 1994 Initial Site Characterization Report (ISCR). The ISCR for the Phase 1A RI described the findings of the activities performed in accordance with the RI Work

Plan. Based upon developments during its implementation, modifications to the RI Work Plan were made during the course of the field program. These modifications were addressed within the ISCR report under the sections discussing the specific media or investigative technique affected.

In accordance with the Statement of Work (SOW), a Phase 1B RI was developed to address the data gaps exposed in the Phase 1A RI investigation. The February 1994 Phase 1B RI Work Plan was prepared based upon the results of the Phase 1A RI program.

The Phase 1B RI activities were performed in early 1994. Between the Phase 1A and 1B activities, two interim sampling programs were conducted in November 1993 and February 1994 to expand the database relative to seasonal fluctuations of surface water, sediments and ground water systems. This document incorporates the results of the Phase 1A RI, Interim Monitoring and Phase 1B programs.

1.1. Site Background

Description

The Site is located about two miles due east of the City of Bennington, Vermont, in the towns of Bennington and Woodford. The privately owned landfill situated on the western slope of Harmon Hill is part of a sixty-acre plot owned by Clyde Burgess, Jr., and operated by Burgess Brothers, Inc. (Burgess Brothers). Site location map is included as Figure 1A, and a Site plan is depicted in Figure 1B.

The Phase 1A and Phase 1B RI programs focused on an approximate two to three acre area located in the northeastern section of the property, adjacent to the Green Mountain National Forest. This area includes a former Landfill Area and a Former Lagoon Area. The portion of the Landfill Area formerly used as an unlined lagoon disposal area has been partially backfilled, cleared, graded and seeded. A depression is still observable in the southern end of the Former Lagoon Area. An unnamed stream flows adjacent to the southeast side of the Landfill Area and joins Barney Brook approximately 1,200 feet from the Landfill Area. In addition, there are a number of drainage swales and intermittent streams that periodically discharge into the unnamed stream and Barney Brook.

Throughout this RI document and particularly in those sections discussing the media investigated, several areas within the study area are frequently referenced. These areas have been given designations for the purpose of this investigation. To facilitate review and to assist with the reader's understanding of the study area these areas are shown on Figure 1B and are listed below:

1. **Former Lagoon Area** - The area immediately south of the Landfill Area, east of the town line and north of the Marshy Area. The area is the general proximity of the two Former Lagoon Areas which reportedly received lead plater sludge. Although organics have been identified in this area, no known record of the type of waste being disposed of in this area has been documented.

2. **Landfill Area** - This area runs along the town line to the top of slope to the east and north/south from the Soil Staging Area to the Former Lagoon Area, respectively. This area reportedly had been the site for disposal of various materials as presented in the History subsection of this chapter.

3. **Soil Staging Area** - An area to the north of the Site bounded on the north by U.S. Forest Service property and on the south by the Landfill Area. It includes an area where at one time fuel tanks were salvaged.

4. **Bend in the Road** - An area where the access road bends from north to east when entering the Site. Based on the review of historical aerial photographs which indicated that pits may have existed in this area, the USEPA requested investigations be extended to this area to verify that no lead plater sludge had been disposed in this area.

5. **Marshy Area** - An area east, south and downhill of the Former Lagoon Area where the ground surface is saturated for a majority of the year. Previous investigations have identified contamination in this area.

6. **Hillside Area** - An uphill area east and southeast of the Landfill Area.

7. **West of Landfill Area** - An area west and southwest of the Landfill Area.

History

A review of agency records, Burgess Brothers files, and aerial photographs was conducted as part of the LFI. Agencies contacted as part of the record review included the Town of Bennington Department of Health, Town of Bennington Town Listers, Town of Bennington Planning Board/Building Department, the Town of Woodford Clerk's Office, and the Bennington Fire Department. The agency, the individual contacted, and the date of contact are listed below:

- Department of Health - Town of Bennington, Vermont
  Contact: Mr. Steven Juszczyk, Mr. Louis Gilbert
  Date: December 10, 1991

- Town Listers - Town of Bennington, Vermont
  Contact: Department Secretary
  Date: December 10, 1991

- Planning Board/Building Department - Town of Bennington, Vermont
  Contact: Board/Department Secretary
  Date: December 10, 1991

- Town Clerk's Office - Town of Woodford, Vermont
  Contact: Ms. Eileen O'Neil
  Date: December 10, 1993

- Bennington Fire Department - Town of Bennington Vermont
  Contact: Chief Mark Sawyer, Chief Albert Slokum
  Date: December 1, 1991

No records concerning historical site activity at the Site were discovered during the agency contacts.

O'Brien & Gere reviewed the records of invoices and log books of Burgess Brothers to collect information regarding activities conducted by Burgess Brothers and materials that may exist on the Site. Available records reviewed dated from 1967 to the late 1980s.

The records indicated that the majority of jobs conducted by Burgess Brothers involved general demolition of buildings and removal of debris. Other jobs included clean-up of oil spills and removal of underground and above ground tanks. Burgess Brothers jobs were conducted for both large and small industries as well as private individuals. Burgess Brothers had many different clients, but had a few repeat clients such as Stanley Tools, Ben Mont, and Union Carbide Corporation's Bennington plant (currently owned by Eveready Battery Company). Burgess Brothers records do not indicate the exact materials disposed of at Burgess Brothers' property, but test pits installed in the Landfill Area during the RI indicated the presence of typical municipal-type refuse, such as wood, newspaper, steel, cardboard, and cinders. There is no documentation that would tend to indicate whether or not the materials that were disposed would have been classified as hazardous waste under the Resource Conservation and Recovery Act (RCRA) as promulgated in 1976.

O'Brien & Gere reviewed aerial photographs of the Site dated from 1942 to 1989 to obtain information about historical site use. Mining activities appeared to be limited to the kame sand pit and the clearings west and

southwest. Other areas of activity appear to be limited to the Landfill Area and the clearings immediately west and east, which later became part of the Landfill Area. Boundaries of the Former Landfill Area as identified by test pitting are shown on Figure 2.

In order to develop as complete a history of disposal at the Site as possible, as requested by USEPA, the Burgess Brothers Steering Committee interviewed present and former Union Carbide employees and long-time Burgess Brothers employees, as well as reviewed such records as are available regarding waste generation and disposal at the Site. This investigation also included a review of records regarding the operation of Union Carbide's Plant 2 facility located in Bennington, which was the source of the lead sludge disposed at the Site. This review was conducted to attempt to verify the date when disposal of lead sludge began and to provide details as to quantity and method of disposal. A discussion of those interviews and the results of that records search follows.

A package containing affidavits of long-term employees of Burgess Brothers regarding site history was submitted to USEPA on June 15, 1992. These employees recall that the Site had been used as a source of kame sand and gravel dating back to the 1940s. Beginning in the late 1960s, at which time the existing road was built, the Site had been used as a metal salvage facility, and as a disposal area for construction debris, metals, sludges, and liquid wastes. The affidavit package stated that there was no evidence, indication or recollection of lead plater sludge being disposed of on the Burgess Brothers property anywhere other than at the Former Lagoon Area.

The production of Reserve Energizer batteries for proximity fuses for the United States Government at Union Carbide's Bennington Plant 2 facility began in 1956. While USEPA personnel stated that early reports indicated that the disposal of approximately one 55-
gallon drum per week of lead plater sludge at the Site began in 1956, later investigation by Eveready during the development of the RI Work Plan indicated that no material came from Union Carbide to the Site until approximately 1967/1968 when disposal began at the Landfill/Former Lagoon Area (Affidavit package, June 15, 1992).

In September 1957, the Government terminated Union Carbide's existing battery contracts and Plant 2 production of government batteries was significantly reduced. The Government did not begin contracting again for Reserve Energizer batteries until 1967/1968. After the Government terminated Union Carbide's contracts in 1957, the Plant 2 facility at Bennington was essentially in a "standby" status, producing only very small amounts of batteries often on an experimental or developmental basis.

Because of the very low levels of lead battery production during this period, Union Carbide's generation of lead plater waste or sludge was either very low or non-existent. Based on interviews with Union Carbide employees, it appears that sludge generated prior to the commencement of disposal at the Site was sold by Union Carbide.

Additionally, it is the recollection of long-time Burgess Brothers employees that all of the liquid waste and sludge from Union Carbide went into the lagoons and that the access road to the Former Lagoon Area was not built until some time between 1965 and 1968; hence, it is their belief that no Union Carbide wastes came onto the Site prior to that time. The first lagoon was filled in 1972 or 1973, and a second lagoon was constructed adjacent to the original lagoon's southern edge. Battery processing waste was disposed of in the lagoon through October, 1976.

From 1971 to 1976, bulk wastewater was transported to the Site by Church Septic Tank Company, a local contractor. The specific sources of the Church Septic Tank Company wastewater from 1971 to 1976 are unknown. Containerized battery wastes and waste solvents were transported to the Site primarily by the Haddad Company (local), with occasional shipments by Burgess Brothers, and very infrequent shipments by Union Carbide. Deliveries of containerized battery waste and waste solvents to the Landfill Area were made approximately twice per month.

Spent solvents (tetrachloroethane and trichloroethylene) in 55-gallon drums and boxed battery wastes (wooden boxes, approximately 4 feet square containing zinc chloride, ammonium chloride, ammonium hydroxide and acetylene) were loaded into dump trucks and driven to the Landfill Area. Anode gel and manganese dioxide cells (containing zinc and mercury) were also disposed. At the Landfill Area there was a hole (20 feet deep) which had been dug by Burgess Brothers. According to Jim Sauer of Burgess Brothers, this was one of several twenty feet deep holes which were created on the western boundary of the Landfill Area, and were subsequently filled in with waste from 1971 to 1976. In general, the drums were rolled/pushed off the truck into the hole, while most of the boxes of mix were emptied into the hole and the boxes reused. Some of the drums broke during unloading, and some were punctured by the backhoe which covered every load of waste with two to three feet of soil. Waste anode gel (open plastic pails) and scrap miniature alkaline manganese-dioxide batteries were also disposed in the Landfill Area during this period.

In addition to battery manufacturing wastes, Union Carbide also disposed of ten to twelve truckloads of waste personal hygiene products from the

company's discontinued product line. Most of the waste was in the form of small pressurized spray cans. The specific contents are unknown.

Previous Investigations

Various investigative activities have been performed at the Site since 1984 under the oversight of the Vermont Department of Environmental Conservation (VTDEC), Waste Management Division, and USEPA. According to a report from the State of Vermont, titled, Burgess Abandoned Hazardous Waste Disposal Site, Woodford, Vermont, Draft, 1985, investigatory activities began when the State of Vermont, under Section 3012 of the RCRA Act, was developing an inventory of hazardous waste disposal sites. Following EPA review of the necessary Burgess site background information, the EPA indicated the need for further evaluation and investigation of the Site. A chronology of these investigations is presented in Table 2. A summary of these investigations is presented below:

In 1984, VTDEC requested Burgess Brothers initiate an evaluation and monitoring program at the waste disposal Site. Sampling programs were conducted from 1985 to 1989 by contractors for Eveready and for USEPA. These programs were conducted to characterize the potential impact of residues from the Former Lagoon Area to the surrounding environment. These activities included terrain geophysical surveys, soil, and soil gas analyses, as well as surface water, ground water, soil, and leachate sampling. Geraghty & Miller performed soil sampling in 1985, and ground water sampling in 1985 and 1988.

Sampling Programs: 1985. In 1985, Eveready's consultant, Geraghty & Miller, installed eight monitoring wells at the Site, one upgradient of the Former Lagoon Area and the remainder downgradient. Wells installed by Geraghty & Miller included downgradient wells W-02, W-03, W-04 S, W-04 D, W-05, W-06 S, and W-06 D and the upgradient well W-01. The downgradient wells included seven wells in the overburden to characterize shallow subsurface conditions in the Marshy Area adjacent to the Former Lagoon Areas. Of these eight wells, two well nests, each consisting of a deep and shallow well, were installed at the W-04 and W-06 locations. The results of the well installations indicated that ground water occurs in an unconsolidated deposit at depths of less than eight feet below ground surface. Ground water flow was found to be predominantly toward the south and southeast in the shallow overburden south and southeast of the Former Lagoon Area.

Sampling Programs: 1988-1989. On March 31, 1989, the Site was placed on the National Priorities List (NPL) as a Superfund Site, and investigations

were performed by both USEPA (and its contractor, Roy F. Weston, Inc.) and Eveready (and its consultant, Geraghty & Miller). In February of 1989, a USEPA contractor (Roy F. Weston, Inc.) collected surface water samples. Subsequent to this activity, Geraghty & Miller collected ground water and surface water samples in March 1989. In April of 1989, a USEPA contractor (Roy F. Weston, Inc.) conducted a soil gas survey and performed soil sampling. The soil gas survey concentrated on the Former Lagoon Area as well as a Marshy Area downgradient from the Former Lagoon Area. Five soil samples were collected from these areas, selected on the basis of the soil gas survey. These samples were analyzed for volatile organic compounds (VOCs), metals and base neutral/acid extractable compounds. In May 1989, Geraghty & Miller published a report summarizing the 1988 hydrogeologic investigations conducted at the Site.

The April 1989 USEPA investigation (conducted by Roy F. Weston, Inc.) indicated detectable concentrations of trichloroethene (TCE) and tetrachloroethene (also known as perchloroethene, or PCE) in the vicinity of the Former Lagoon Area. Specifically, soil gas samples collected around the known location of the Former Lagoon Area indicated detectable TCE and PCE concentrations in five of eight samples plus the potential presence of other VOCs.

During the April 1989 USEPA investigation, screening of eight soil samples collected from near surface soils in the Marshy Area also indicated concentrations of TCE and PCE in the headspace at concentrations ranging from 1.2 to greater than 40 parts per million by volume (ppmv). Chlorobenzene was also tentatively identified.

Soil analyses conducted as part of USEPA's April 1989 efforts indicated detectable TCE and PCE concentrations of up to 0.1 and 16 mg/kg, respectively, in four of five samples in and adjacent to the Former Lagoon Area. Six soil samples were collected by USEPA and field screened for metals using an x-ray fluorescence detector. Metals including lead, mercury, iron, nickel and zinc were measured in the Former Lagoon Area soils at levels above background concentrations.

Semi-volatile compounds were analyzed in soil samples in the April 1989 USEPA investigations. Analytical results indicated that these compounds were primarily non-detectable. A few compounds (pyrene and fluoranthene) were detected at low concentrations in a soil sample collected from the southern end (toe) of the Landfill Area.

In the March 1989 ground water sampling program conducted by Eveready's consultant, Geraghty & Miller, VOCs were not detected in the upgradient (background) well, well W-01. However, VOCs were detected in the downgradient wells west of the unnamed stream in quantities exceeding 10,000 ug/l (Wells W-02, W-03, W-04 S, W-04 D, W-05, W-06 D). This confirmed results dating back to 1985. The main constituents detected in these downgradient wells included TCE, PCE, dichloroethene (DCE) and vinyl chloride (VC). A shallow and deep well on the eastern side of the unnamed stream (W-06 S, W-06 D) did not contain the VOCs detected in the other wells, and detected in W-06 S and W-06 D in 1985. The samples contained 80 and 22 ug/l of carbon disulfide, respectively, which was not previously identified at the Site.

Five surface water samples were collected at locations corresponding to original Geraghty & Miller locations in February 1989. The original Geraghty and Miller sampling points: SW-01, SW-02, SW-03, SW-04 and SW-05 respectively correspond with O'Brien & Gere sampling points SW-11, SW-12, SW-13, SW-14 and SW-15. See Figure 2 of this report for O'Brien & Gere sampling locations. No VOCs were detected in the location furthest upstream (SW-09), but TCE, PCE, and VC were detected at up to 1,030 ug/l, 733 ug/l, and 224 ug/l, respectively. These concentrations decreased by nearly an order of magnitude from February to March 1989 and may be the result of increased dilution during wetter periods or increased volatilization during periods of higher temperature. Toluene, vinyl chloride, and xylenes were also detected in downstream surface water samples.

Limited Field Investigation: 1991-1992. During December 1991 and January 1992, O'Brien & Gere performed the LFI for the Site pursuant to the LFI Work Plan approved by USEPA in November 1991. The objectives of the LFI were to increase the understanding of the Site in order to produce a focused RI/FS Work Plan, collect data to be used in the establishment of health and safety requirements, and identify potential past disposal locations and their impact on local human and environmental receptors.

Site background activities under the LFI included an investigation of agency records, files, and aerial photographs to detail past activities at the Site. Also, descriptions of wells, water supplies, and potential wetland areas were provided to further characterize the Site's background. A Ground Penetrating Radar (GPR) survey was used to assist in evaluating subsurface features and to facilitate a clearer understanding of the layering in the glacial overburden in and around the Landfill Area.

Site conditions were characterized through air quality surveys, soil vapor screening, metals screening, and well testing. Air quality was investigated using a HNu® photoionization detector for VOCs, a ASP-1 radiation detector for beta and gamma radiation, and an MIT Miniram® for airborne particulates. Air quality surveys did not indicate values above the measured background values. The soil vapor screening survey results verified the results obtained previously by Geraghty & Miller and further defined the area of study for the RI. Chlorinated VOCs, particularly PCE, 1,1,1 TCA and TCE, were the major constituents detected in and around the Former Lagoon Areas, along with the degradation products of these compounds, including 1,1-DCE, and 1,1-DCA. The results of the soil vapor screening program, conducted during the LFI, generally confirmed the distribution of VOCs in the subsurface as delineated in USEPA's 1989 soil gas survey. Chlorinated VOCs, particularly TCE, PCE and toluene, were also detected in the Hillside Area (SS-18, SS-19, SS-20, SS-21, SS-22, SS-23). Screening results from surface and ground water samples exhibited non-detectable concentrations of metals (lead and nickel).

Hydraulic conductivity testing results indicated ground water velocities in the shallow aquifer to be similar to that reported in prior studies. Additionally, ground water flow in the shallow overburden was verified to be in a southerly direction from the Landfill Area toward the unnamed stream. Surface water flow measurements were not collected due to frozen stream conditions. Further evaluations of stream flow were addressed in the Phase 1A RI.

Results of these investigations were presented in the LFI report submitted as part of the RI Work Plan. The Phase 1A RI field investigation was conducted to more fully define the extent of impact at the Site.

Phase 1A RI: 1992-1993. During September 1992 to August 1993, the Phase 1A RI was conducted. The length of the program was extended due to unforeseen drilling conditions which included a dense, bouldery till layer which was difficult to penetrate and a relatively thick weathered bedrock mantle.

The Site hydrogeologic conceptual model was further refined which included various aquifers and aquitards existing in a multi-layered system. The Site geology was found to consist of the kame sand overlying ablation till. This layer is underlain by a dense lodgement till followed by 180 to 360 feet of completely weathered bedrock. Competent bedrock consisted of fresh, unweathered quartzite.

Ground water at the Site was found to exist in the kame sand and till units, hydraulically connected to some degree. Ground water was found in much less quantities in sandy layers of the weathered rock. The connection of ground water in upper units and competent bedrock was limited by the weathered bedrock aquitard. Shallow ground water followed surface topography and discharged to surface water bodies. Deeper ground water flowed westerly parallel to regional topography.

The nature and extent of the source of impacts at the Site was generally characterized by the Phase 1A RI activities. Waste residues included metals (predominantly lead, nickel, and chromium) and VOCs (TCE, PCE, DCE). The primary source appeared to be the Former Lagoon Area. The vertical extent of the source was estimated to be approximately eight feet, and it was believed that the potentially-impacted soils extended downward an additional five feet or so from the base of the Former Lagoon Area to the top of the water table. In addition, soil and ground water concentrations of volatile constituents in and around the Former Lagoon Area indicated the potential existence of an organic dense non-aqueous phase liquid (DNAPL) pool in the Former Lagoon Area.

Based on the visual appearance of subsurface borings, as well as the Phase 1A RI analytical results, the Landfill Area appeared to contain principally municipal-type refuse, and was not believed to be a source of significance. Some localized areas of VOC and metals impacts were found, however, in the Landfill Area outside of the lagoons. There did not appear to be other major sources of impacts at the Site.

There appeared to be a smaller, localized source of petroleum hydrocarbons in the soils north of the access road, near the Soil Staging Area, possibly due to fuel tank salvaging operations conducted in this area.

The nature and extent of ground water impacts was also characterized. The shallow ground water in the Marshy Area contained VOCs and metals, consistent with Site disposal history and findings from the Former Lagoon Area. The horizontal extent of shallow ground water VOC impact was believed to encompass an area of approximately 550 feet by 350 feet. Ground water quality data indicated that the eastern side of the unnamed stream, opposite the Marshy Area, was largely unimpacted, consistent with the hydrogeologic model that the stream is an effective discharge boundary for shallow ground water. The vertical extent to which VOC and metals were present was estimated to be principally to a depth of 15 to 20 feet. Using a bulk porosity of 0.25, the volume of VOC-impacted ground water was estimated to be approximately 962,500 cubic feet (7.2 million gallons). The bulk porosity was chosen based on the site soil characteristics. A more

dilute portion of the VOC plume existed to the south and southwest of the Former Lagoon Area.

The nature and extent of surface water/sediment impact was further characterized. The extent of VOC impact appeared to be limited to the Marshy Area drainage swales and the unnamed stream, while the extent of metals contamination was within the Marshy Area drainage swales. Results of the Phase 1A RI were presented in the ISCR.

Interim Sampling Programs: 1993-1994. Interim sampling of Site surface water and ground water was performed in November 1993 and February 1994. The purpose of these sampling events was to provide additional seasonal information to supplement the database and identify changes in ground water or surface water characteristics following completion of the Phase 1A sampling. Results of these events were submitted to USEPA in January and April 1994, respectively.

1.2. Report Organization

Due to the significant amount of information collected during the RI efforts and the need to present this information in a complete and comprehensive fashion, this RI report has been organized to follow a logical progression and to facilitate review. The format follows both the guidance offered by the SOW for media-specific evaluation and the RI Work Plan sequence offered in Table 3-13 of USEPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (USEPA 1988). Following a discussion of the study area and Site overall characteristics and history (Chapter 2), the media which exist on the Site are addressed by stating the objectives of the investigation, the methods and the results obtained (Chapters 3 and 4). Contaminant fate and transport discussions are presented in Chapter 5. Further actions being performed under the Superfund Accelerated Cleanup Model program or follow-on investigations are identified in Chapter 6. Summaries and conclusions of the investigations are presented in Chapter 7.

1.3 Quality Assurance/Quality Control (QA/QC)

1.3.1 Data Integrity

The analytical data generated for the Phase 1A Investigation, November Interim Sampling Program (NISP), February Interim Sampling Program (FISP), and the Phase 1B Investigation conducted at the Site were evaluated based on QA/QC criteria established by the USEPA Contract Laboratory Program (CLP) and criteria presented in the Quality Assurance Project Plan (QAPP) for these investigations. Validation procedures were based on CLP data validation guidelines developed by the USEPA. A summary of specific QA\QC excursions that resulted in qualification of sample data is presented in the Data Validation Reports, Appendix 1, Section 4.

Validation of the Phase 1A Investigation analytical data indicated that the data quality objectives defined in the QAPP were met and the following sample data were qualified.

- 0.61% and 1.37% of the analytical data were qualified due to excursions from laboratory and field duplicate criteria, respectively
- 1.52% of the analytical data were qualified for excursions from matrix spike sample criteria, including 27 selenium, 14 antimony, 1 4-nitrophenol, and 9 arsenic results which were identified to be unusable
- 0.76% of the analytical data were qualified for excursions from calibration criteria, including 117 2-butanone, 4 acetone, and 9 1,2-dibromo-3-chloropropane results which were identified to be unusable
- 0.55% of the analytical data were qualified for excursions from internal standard recovery criteria, including 150 semivolatile compound results which were identified to be unusable
- 0.40% of the analytical data were qualified for excursions from surrogate recovery criteria, including 61 compounds in sample SED-05-2 which were identified to be unusable
- 1.51% of the data were qualified for holding time excursions
- 2.03% of the data were qualified for blank excursions
- 1.82% of the data were qualified due to sample preservation excursions, including 484 volatile compounds which were identified to be unusable

- data usability or completeness ranged from 96.2% to 100.0% for data collected from the surface water, sediments, and leachate/seep samples for this investigation

Validation of the NISP analytical data indicated that the data quality objectives defined in the QAPP were met and the following sample data were qualified:

- 0.62% of the analytical data indicated that the data quality objectives defined in the QAPP were met and the following sample data were qualified
- 2.18% of the analytical data were qualified for excursions from matrix spike sample criteria, including 8 selenium results which were determined to be unusable
- 0.55% of the analytical data were qualified for excursions from surrogate recovery criteria, including the results for 16 compounds which were determined to be unusable
- 1.54% of the analytical data were qualified for excursions from calibration criteria, including 20 acetone and 20 2-butanone results which were determined to be unusable
- 2.95% of the data were qualified for blank excursions
- data usability or completeness ranged from 96.8% to 100.0% for data collected from the surface water, ground water, and sediment samples for this investigation

Validation of the FISP analytical data indicated that the data quality objectives defined in the QAPP were met and the following sample data were qualified:

- 0.62% of the analytical data were qualified due to excursions from field duplicate sample analysis
- 2.18% of the analytical data were qualified for excursions from matrix spike sample criteria, including 8 selenium results which were identified to be unusable

- 0.55% of the analytical data were qualified for excursions from surrogate recovery criteria, including the results for 16 compounds which were identified to be unusable

- 1.54% of the analytical data were qualified for excursions from calibration criteria, including 20 acetone and 20 2-butanone results which were identified to be unusable

Validation of the FISP analytical data indicated that the data quality objectives defined in the QAPP were met and the following sample data were qualified:

- 0.39% of the analytical data were qualified due to excursions from field duplicate sample analyses

- 2.8% of the analytical data were qualified for excursions from matrix spike sample criteria, including 7 selenium and 4 mercury results identified to be unusable

- 0.24% of the analytical data were qualified for excursions from calibration criteria

- 2.31% and 3.8% of the analytical data were qualified for excursions from holding time and blank criteria, respectively

- data usability or completeness ranged from 99.6% to 100% for data collected from the surface water and ground water samples for this investigation

Validation of the Phase 1B Investigation analytical data indicated that the data quality objectives defined in the QAPP were met and the following sample data were qualified:

- 2.53% of the analytical data were qualified due to excursions from field duplicate sample analyses

- 4.81% of the analytical data were qualified for excursions from matrix spike sample criteria, including 1 endrin aldehyde, 10 selenium, 4 arsenic, and 6 thallium results which were identified to be unusable

- 0.03% of the analytical data were qualified for excursions from reference standard criteria

- 4.71% of the data were qualified for excursions from surrogate recovery criteria
- 0.31% of the data were qualified for excursions from calibration criteria, including 1 2-butanone result which was identified to be unusable
- 1.17% of the data were qualified for excursions from blank criteria
- data usability or completeness, of the data ranged from 98.1% to 100.0% for data collected from subsurface and surface soil samples for this investigation

Overall, the analytical data generated for the Phase 1A Investigation, NISP, FISP and the Phase 1B Investigation conducted at the Site are of sufficient quality to meet the project data quality objectives and may be used for qualitative and quantitative purposes. These uses include, but are not limited to, performance of human health and ecological risk assessments, evaluation of remedial alternatives, and estimation of the nature and extent of contamination.

1.3.2. Field Audit

An on-site field audit was conducted to evaluate the adherence of field activities to the procedures outlined in the QAPP, to identify potential deviations and recommend corrective action procedures. The field audit, along with the laboratory audit described below, are addressed in a report in Appendix 2.

Field practices with respect to ground water sample collection, decontamination of sampling equipment, and calibration of field equipment, as well as record-keeping procedures, sample documentation, and shipping procedures were observed. The sampling procedures described in the QAPP were followed during the field audit.

1.3.3. Laboratory Audit

A laboratory on-site audit was conducted to verify that the systems and procedures described in the QAPP were operational and contributing to the production of accurate, precise, and defensible analytical results. The laboratory audit is addressed together with the field audit described above in Appendix 2.

With minor exceptions, the analytical activities were conducted in accordance with the Work Plan. The issues described in the laboratory audit report do not significantly compromise the integrity or quality of the data.

OBG Laboratories, Inc. was found to have several minor deviations from its acceptable protocols which were not deemed serious enough to hold analysis of samples or require resampling. Corrective actions to remedy these deviations were enacted by December 31, 1993.

2. Physical Characteristics of Study Area

The physical characteristics of the study area were evaluated as a requirement of the SOW to better define and modify the Conceptual Site Model (CSM). The following describes the various components of the Site's physical characteristics.

2.1. Cultural Resources

To obtain information relative to cultural resources in the Bennington area, the Arts Council of the Bennington Chamber of Commerce and the State of Vermont Division of Historical Preservation were contacted concerning historic landmarks, archaeological sites, and architectural resources located at or in the vicinity of the Burgess Brothers Site. Ms. Janice G. Messer, Executive Director of the Bennington Arts Council, indicated that Bennington is generally a historic area with many structures and landmarks associated with Bennington's rich residential, commercial, and cultural history. However, she noted that there are no cultural resources in the immediate vicinity of the Burgess Brothers Site. The following is a list of some historic resources mentioned by Ms. Messer as being important to the character of Bennington:

- **Historic Buildings:** The Park McCullough House, a 35-room victorian mansion in North Bennington; Old First Church, built in 1806 and located in Old Bennington, and the accompanying Revolutionary War graveyard.

- **Historic Bridges:** Three covered bridges, the Silk Road, Paper Mill Village, and Henry Bridges, located off of Route 67A; The Chiselville Bridge on Maple Street in East Arlington.

- **Historic Landmarks:** The Appalachian Trail; The Bennington Monument, commemorating the Battle of Bennington during the Revolutionary War; The Bennington Museum.

In addition, local historian Mr. Bob Madison indicated that Hartwellville Stage Road, a stagecoach road dating from the early days of Vermont statehood, exists near Sucker Pond outside of the Town of Bennington; though, again, this site is a distance from the Burgess Brothers Site.

According to 1990 Census statistics, Bennington, consisting of the Town of Bennington, the Village of North Bennington, and the Village of Old Bennington, had a population of 16,451, (45.9 percent of the population of Bennington County). Ninety-eight percent of the town's population was white, with Asian or Pacific Islanders and Blacks making up a majority of the remaining population. 48 percent of town residents are male, 52 percent female, and the median age is 33 years.

2.2. Sensitive Environments and Ecosystems

On January 6, 1992, a preliminary wetland survey was conducted by O'Brien & Gere Engineers. O'Brien & Gere Engineers also performed a preliminary review for the presence of rare and endangered or threatened species. These investigations, along with additional work to assess the nature and extent of effects of site impacts on nearby ecological resources are presented in Section 2.10.

2.3 Climatology

The State of Vermont is similar to the other New England states in its chief climatic characteristics. These include variability of the weather, large range of temperature (both daily and annual), differences between the same seasons in different years, relatively equable distribution of precipitation throughout the state, and considerable diversity from place to place. The annual mean temperature is 46°F. Temperatures from place to place vary more in the winter than the summer. Vermont's precipitation is evenly distributed through the year. Vermont lies in the region of prevailing westerlies indicating wind from the northwest in winter and from the southwest in the warmer part of the year. Because the rugged topography has a strong influence on the direction of the wind, many areas have prevailing winds paralleling valleys. The yearly averaged mean hourly wind speed for Vermont is 10 miles per hour. Rains of 1 to 2 inches in a

one-hour period can be expected at least once in a 10-year period. Based on National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center, Climate Services Division, and Annual Climatological Summaries for the 13 year period from 1979-1992, average annual rainfall and snowfall totals are 42 inches and 52 inches, respectively. This data was measured at the Pownal, Vermont NOAA weather station. Data summary sheets are found in Appendix 3.

2.4. Topography and Drainage

Physiographically, the area of study is located on the western flank of the Green Mountain Uplands and is bordered to the west by the Central Vermont Valley. The land surface in the area slopes generally westward toward the valley, with local undulations resulting from prior glacial deposition and modern erosional processes from streams and rivers. In the area east of the Site known as Harmon Hill, the land surface was modified predominantly by glacial erosional processes, where shallow bedrock and thin till units have been mapped/the land surface in this area slopes to the west fairly regularly. No portion of the Site is located within the 100 or 500 year flood plains. The topography in the area of study is shown on Figure 3.

Beginning in the Marshy Area at the base of the eastern toe of the Landfill Area and continuing to the west, the land surface was modified by glacial depositional processes. The topography is somewhat more irregular in this area, due to localized occurrences of kame sand deposited along the edge of the retreating glacial ice. A kame sand feature is defined as a lobate accumulation of kame sand fluvially deposited at the edge of a waning section of glacial ice. This deposit in the study area is discontinuous and terminates to the east and west of the Site. Jerris (1991) indicates that other localized ridges and valleys in the area, particularly north of the Site, were formed by erosion of formerly deposited glacial till by modern streams and rivers.

The elevations in the area of study range from 1,500 feet mean sea level (MSL, relative to a USGS Benchmark in Bennington) along the western flanks of Harmon Hill to 1,000 feet near the Burgess Brothers office. In the area surrounding the Landfill Area, the

elevations range from 1,118 feet near the Soil Staging Area north of the Landfill Area to 1,071 feet in the unnamed stream south of the Landfill Area.

The primary drainage conduits in the area of study are the Walloomsac River Roaring Branch and Walloomsac Brook System which flow in a westerly direction north of the Site. Third order streams such as Barney Brook and the Walloomsac River South Stream System located south and southwest of the Site discharge into the Walloomsac River Roaring Branch west of the Site and north of Bennington Center. First order tributary swales drain into these streams and typically form a dendritic pattern along hillsides. A first order tributary swale, referred to as the unnamed stream, flows southerly along the base of the eastern toe of the Landfill Area. This stream is perennial along the base of the landfill and ephemeral upstream of the Landfill Area.

The drainage system around the Site consists of first order drainage streams which flow in a westerly direction down the slope of Harmon Hill toward the Marshy Area toward the toe of the Landfill Area. This network of drainage swales is shown on the Site Plan, Figure 2. The various drainage swales are tributary to the second order unnamed stream which flows southerly along the base of the eastern toe of the Landfill Area. Although the drainage swales have a tendency to be dry during the summer months, the unnamed stream flows throughout a typical year. The unnamed stream flows further southwesterly from the Site a distance of about 1,200 feet to its confluence with Barney Brook.

The direction of precipitation runoff in the area of the Site, as estimated from topographic gradients, is shown on the Drainage Basin Map, Figure 3. Runoff from the Landfill Area is directed radially to the east and south into the Marshy Area. Runoff in the West of the Landfill Area, near the Bennington/Woodford line, is directed westerly.

2.5. Soils

Soil Conservation Survey (SCS) maps for Bennington County were obtained during the LFI. Five main soil units have been delineated by SCS in the study area as shown on the hydrogeological and hydrostratigraphic cross-sections, Figures 4 through 11. These five units were grouped into three categories based on depositional history and recent manmade modifications. The three categories are as follows:

- GP (poorly graded, gravels, gravel-kame sand mixtures, little or no fines) - soil that has been modified due to excavation or filling activities

- 18D (Windsor loamy fine kame sand) - excessively deep, well drained loamy fine kame sand formed in glacio-fluvial environments

- 69B, 67C, 94C (Massena, Georgia, Pittsfield loams) - deep, poorly to well drained stony soils formed in glaciated uplands and glacial till

The areal extent of these surface soil units is shown on the Soil Delineation Map in Figure 11A. The Landfill Area and Soil Quarry Areas were designated as GP on the soil survey map. This area is encircled by the kame sand that was designated as 18D. According to the soil survey map, surrounding areas were formed in glacial till terrains.

Information obtained during the drilling program conducted for the Phase 1A RI appeared to confirm the general nature and surficial boundaries of the above soil units with the following exceptions:

- The shallow near surface soils in the Marshy Area consisted of about 6 to 12 inches of dark brown to black organic rich swamp "muck". This material was typically very soft and contained predominantly silt-sized particles with lesser amounts of kame sand, clay, and organic matter.

- The till layer on Harmon Hill east of the Site contained a high concentration of surface boulders representing talus accumulations from bedrock exposures further up slope.

2.6. Surface Water and Seeps

The surface water drainage system surrounding the study area is shown on the Drainage Basin Map, Figure 3. This surface water system near the Site consists of a network of first order drainage swales located to the east of the Landfill Area. The drainage swales originate on the west slope of Harmon Hill as ground water fed springs and surface water runoff swales in the relatively low permeable soils predominantly derived from glacial till. The upper reaches of these swales are highly dendritic in nature and so were not indicated on the surveyed Site Plan shown in Figure 2. Dendritic is defined as similar to a random branching pattern in the upstream direction. The primary swales designated as Swale 1, 2, and 3 are shown which flow westerly toward the eastern toe of the Landfill Area.

Swales 2 and 3 are confluent and form the second order unnamed stream which flows due south past the eastern toe of the landfill. Swale 1 is confluent about 300 feet further south and southwest near well nest W-09. Surface water flow rates were measured by O'Brien & Gere Engineers personnel during the Phase 1A RI program. The surface water flow in the three swales averages a few gallons per minute (gpm) in the upper reaches. The flow rate measured in the unnamed stream during the months of October/November (dry season) typically ranged from 3 to 59 gpm, with the exception of 220 to 403 gpm recorded during a storm at the end of the period (Nov. 23-25). Flows during the spring runoff season in April ranged from 300 to 1,100 gpm in the same stream. In calculating stream flow data at S-01, the data collected over three-hour increments was averaged and plotted instead of each data point. These three hour averages are shown in Appendix 4. Stream monitoring station locations, designated as S-01 through S-03 are shown on Figure 2.

The surface water in the unnamed stream system is fed by surface runoff and ground water discharge from Harmon Hill and the eastern half of the Landfill Area as interpreted from topographic contours. The runoff on the west side of the Landfill Area has been observed to be minimal due to rapid infiltration into the kame sand in this area.

The surface water in the unnamed stream and other runoff in the area discharges to Barney Brook which flows to the northwest about 1,200 feet west of the Site. Barney Brook is a third order stream. The relationship of the unnamed stream to Barney Brook is shown on Figure 2. Flow rates in S-02 through S-05 were measured by taking velocity readings at selected cross sectional stream locations as described in the Work Plan.

Barney Brook and its tributaries in the vicinity of the Site are Class B waters. In Vermont, Class B waters are high quality waters that have aesthetic value and provide quality habitat for aquatic biota, agricultural uses; and recreation.

Surface water flow measurements were performed using a pygmy meter, a bucket and stop watch or a "time versus travel" method, depending on flow conditions. A pygmy meter was the preferred method, but low flow conditions prevented its use at several of the locations.

At location S-02, a bucket and stop watch was used, because the flow was concentrated into a single low volume stream via a conduit at this point. At the other locations during low flow, a pygmy meter or a "time vs. travel" method was used. The "time vs. travel" method consisted of watching a floating object pass downstream and noting its rate of movement. The

pygmy meter measures stream velocity where appropriate. The pygmy meter consists of a weighted device with a rotating blade to measure velocity. The cross-sectional area of the stream was calculated when using the pygmy meter.

Flow rates in Barney Brook measured during this study ranged from 18 to 407 gpm during the dry season at its upstream location (S-03) to 34 to 403 gpm at its downstream point (S-04) during the same season. Flow rates in this same stream during the wet season ranged from 2,423 to 7,950 gpm at an upstream sampling point to 5,062 to 14,304 gpm at a downstream sampling point.

Barney Brook, in turn, discharges to the Walloomsac River South Branch just east of Bennington Center. Surface water flow rates in this river ranged from 7,000 to 20,000 gpm during the dry season to 40,000 to 50,000 gpm during the wet season.

Dilution rates from the unnamed stream to Barney Brook are about one order of magnitude. Dilution rates from Barney Brook to the Walloomsac River south stream are on the order of 1.5 to 3.

Dilution rates were determined by dividing the volume in the receiving stream by the volume in the contributing stream for a given period.

The dilution rate from the unnamed stream to Barney Brook during dry conditions ranged from about 5:1 to 30:1 times. The dilution rate during wet conditions ranged from about 4:1 to 5:1. The dilution rate from Barney Brook into the Walloomsac River, South Stream during dry conditions ranged from about 40:1 to 125:1. The dilution rate during wet conditions ranged from about 3:1 to 8:1. The higher dilution rates noted during dry conditions are attributable to the greater relative fluctuation of small stream flows in response to precipitation.

Seeps

The eastern slope of the Landfill Area is relatively steep and the discharge of three seeps at the base of the slope was observed in the past. During the course of the Phase 1A RI field program, regular observations were made of the eastern landfill slope to check for the re-emergence of these seeps. Three seeps sampled under this phase were observed at locations similar to those observed by VTDEC as referenced in their correspondence from a trip to the Site by Mr. Tom Moye on February 21, 1984. Further information regarding these seeps is contained in Chapter 3.

Wetlands

Low lying areas adjacent to Swales 1 and 2 are saturated at the surface, creating palustrine (marsh) forested wetlands. The largest of these wetlands occurs approximately 200 feet southeast of the Site. This wetland extends primarily along the eastern bank of Swale 2 (Figure 12).

The presence of wetlands downgradient of the Site was evaluated through a review of U.S. Fish and Wildlife Service (FWS) National Wetland Inventory (NWI) maps (1977) and by delineating wetland boundaries in accordance with current federal methodology. The NWI maps present classifications of wetlands using alphabetical and numerical designations developed by Lewis M. Cowardin (Cowardin et al., 1979) for the FWS which describe hydrologic and vegetative characteristics of the wetland. Figure 12 presents the locations of NWI wetlands within a one-half mile radius of the Site. A review of (NWI) maps for the area indicate that two FWS designated wetlands occur on or adjacent to the Site. However, several wetlands were within a one-half mile radius of the Site. Barney Brook (approximately 1500 feet from the Site at its closest point) is identified as a wetland classified as R30WZ - riverine, upper perennial, open water (unknown bottom), intermittently exposed/permanent. The Walloomsac River, approximately 1,000 feet north (upgradient) of the Site, is also classified as R30WZ. Other wetlands within one-half mile of the Site include: four small, isolated ponds/reservoirs classified as POWZ - palustrine, open water (unknown bottom), intermittently exposed/permanent; three forested wetlands classified PF01Y - palustrine, forested, broad-leaved deciduous, saturated/semi-permanent/seasonal; and one depositional area on the Walloomsac River classified as R3BBC- riverine, upper perennial, beach/bar, seasonal (NWI, 1977).

The NWI maps present wetland boundaries on topographic maps based on FWS wetland criteria established as an indicator of waterfowl production areas. NWI wetlands are not intended for federal regulatory purposes. However, the State of Vermont has designated NWI wetlands (except those classified as R20W, R2BB, R30W, R3BB, L10W, L20W and L2BB), as Class Two - significant wetlands, that are protected by the Vermont Wetland Rules (VWRB, 1990).

Federal wetlands along the main channel and a major tributary to the channel were delineated by a biologist from O'Brien & Gere in accordance with the 1987 ACOE method. Documentation of the wetland boundaries is presented in O'Brien & Gere's Wetland Delineation Report (O'Brien & Gere, 1993) which is presented in Appendix 5.

The wetland boundaries are presented in Figure 13. Using the Cowardin system of classification, the identified wetlands would be classified as PF01Y - palustrine, forested, broad-leaved deciduous, saturated/semi-permanent, seasonal. Wetlands are further discussed in Section 2.10.2.

2.7. Ground Water Occurrence and Local Classification

Ground water occurs in the vicinity of the study area in the various geologic units previously mentioned. Ground water is used for consumptive purposes in private residential wells and in spring fed systems such as Ryder Spring located south of the study area. The ground water table was encountered throughout the area investigated at depths ranging from 18 feet below ground surface to ground surface. In general, the ground water table was shallowest in the Marshy Area at the southeastern toe of the Landfill Area. The depths to ground water increased to depths of several feet below grade along the Hillside Area east of the Landfill Area and undisturbed areas West of the Landfill Area, where topography is locally higher. Depths to the ground water table were deepest beneath the central part of the landfill and loam staging area immediately north and west of the landfill at well nest W-08. In this area where topography was locally higher, depths to ground water ranged from 7 to 18 feet.

A review of water table elevations collected from the shallow wells installed in various layers indicates that a zone of continuous saturation , the water table, occurs across the study area. The shallow ground water zone was also observed in the kame sand around the Landfill Area and was observed in glacial till on the Hillside Area east of the Site where the kame sand pinches out (See Figure 11A). The Hillside Area is probably transitional between a recharge area to the east and the discharge area in the Marshy Area.

Local Ground Water Classification

According to Chapter 12 of Vermont's Environmental Protection Regulations (ground water protection rules and strategy), September 29, 1988, ground water standards are based upon the classification of the ground water. Ground water in Vermont is classified as Class III unless reclassified by the Environmental Conservation Secretary of VTDEC. Ground water at the Burgess Brothers Superfund Site is not known to have been reclassified, and is therefore currently classified as Class III which is defined as: "Suitable as a source of water for individual domestic water

supply, irrigation, agricultural use and general industrial and commercial use."

Class I or II classifications are suitable for public supplies and are aquifers currently in use as such or have a high probability for such use. Class IV is defined as not suitable as a source of potable water but suitable for some agricultural, industrial, or commercial use.

2.8. Regional Hydrogeology

2.8.1. Regional Geologic Conditions

The regional geologic conditions in the area of study were described in a report entitled *Hydrogeology of the Bennington and Shaftsbury Area, Vermont* by R.M. Jerris, (Williams College Department of Geology, June 1991). The description of the regional geology has been excerpted from this report, with some modifications incorporated from conditions observed at the Site.

Physiography

Two primary physiographic regions have been identified in the area of study: the Green Mountain uplands, and the Central Vermont Valley regions. The Site is located on the border of these two regions.

Structural Geology

The resistant rocks of the Green Mountain uplands consist of Precambrian and Cambrian age schists, gneisses, and quartzites. The lower elevation Vermont Valley region to the west of the Site is underlain by comparatively weaker Cambrian and Ordovician age, meta-sedimentary rocks including dolomite, quartzite, limestone, marble, and slate.

The crystalline metamorphosed and igneous rocks of the Precambrian sequence in the Green Mountain Anticlinorium plunge beneath the younger Cambrian and Ordovician age sequences to the west.

The Precambrian Mount Holly Gneisses and the Cambrian Age Mendon formation are exposed east of Bennington along the west flank of the Green Mountain Anticlinorium. Other formations which overly the Mendon formation are the Cheshire and Monkton quartzites. These formations are predominantly thickly bedded quartzites and dolomitic sandstones.

Structurally, an overturned syncline exists in the study area from tectonic events which places the Precambrian gneisses on top of the younger Cheshire and Mendon formations. The weathered bedrock sequence which appeared to contain relict folded bands and garnets similar to the metamorphic grade of the Precambrian gneisses may represent the weathered Mount Holly formation. The competent bedrock represents either the Cheshire quartzite or the Monkton dolomitic sandstone.

A weathered bedrock layer termed "ocher" was discussed in Jerris' report as existing in some areas beneath the glacial sediments. According to Jerris' report, the yellow-orange ocher layer was penetrated by some borings researched in his area of study. This ocher layer was found beneath the till layer, and represented the remnants of a completely weathered gneiss or schist bedrock unit that overlies the fresh, unweathered quartzite. Jerris indicated that the till layer also rested directly on relatively fresh limestone or marble in some areas, indicating that the weathered bedrock is discontinuous in the area.

MacFadyen (1956) suggested that there is a southeast-northwest strike slip fault south of the Site. Some previously active thrust faults have also been mapped south and north of the Site. The geophysical report by Zonge in 1988 indicated a potential fault trending northeast-southwest across the Landfill Area. This suspected fault zone was not confirmed from data collected in this study. Based on available data there does not appear to be a Holocene age fault within 61 meters of the Site as discussed under the requirements of the Solid Waste Disposal Act.

Glacial Geology

During the Pleistocene Epoch, the region was buried many times by advances of an ice sheet of continental proportions. Late Pleistocene rivers and streams have reworked the glaciated topography, eroding and depositing sediment to create the present landscape. A large percentage of the area is covered by glacial sediments. Till deposits on the mountain slopes are scattered and thin. The valley proper is filled by a thick till blanket, large recessional valley moraines, and outwash.

The glacial sediments have been deposited in valleys, which have been deeply incised in the bedrock surface. The most notable feature in the buried valleys is the presence of glacio-fluvial kame sand and gravel beneath the till layer. The till layer is continuous to the valley walls and continues part way up the slopes. A thick till blanket up to 300 feet exists in the valley below an elevation of 1,200 feet. Above this elevation, the till

thickness decreases substantially and becomes "scattered and thin" according to Jerris' report.

As further discussed in Section 2.9 - Site Hydrogeology, the till layer was found to be continuous across the Site at a thickness of 45 to 90 feet. The completely weathered bedrock layer beneath the till was also found to be continuous at a thickness of 180 to 360 feet across the Site. This weathered bedrock layer was much thicker than was originally anticipated.

In certain areas, alluvial kame sand has been mapped along major drainage features. Extensive stream terraces of kame sand have been mapped along the length of the Walloomsac River. One such terrace is located in the sand quarry area north of the Landfill Area. Since the elevation of this terrace is significantly above the current course of the Walloomsac River Roaring Branch and Walloomsac Brook systems, most of the deposition occurred during late glacial or early post-glacial time before significant downcutting occurred. Because of this deposition, which was probably in contact with glacial ice remnants, this deposit has been termed a kame sand in previous reports.

2.8.2. Regional Ground Water Aquifers

Jerris identified three primary aquifer systems in the area: unconfined kame sand and gravel aquifers, confined kame sand and gravel aquifers, and bedrock aquifers. These aquifers and associated recharge areas were shown on Plate VII of Jerris' report. Approximately 73 percent of the wells in his study area tapped water resources in the bedrock aquifer systems. Well records were also provided by VTDEC which were used in this evaluation with Jerris' information and are contained in Appendix 6. Most bedrock wells have been developed in the carbonate rocks located in the Vermont Valley province west of the study area. Bedrock wells providing the best yields ranged in depth from 100 to 300 feet. The Morgan Spring water supply in the center of Bennington is developed in carbonate rocks. Recharge to the bedrock aquifer occurs primarily on the hillsides, where the till layer is thin and bedrock fracture systems are exposed to precipitation. A competent bedrock recharge area was indicated by Jerris to occur in the study area east of the Site on Harmon Hill.

The second primary aquifer system indicated by Jerris exists in kame sand and gravel confined beneath a thick layer of till. These deposits are located in the deepest portions of the paleo-bedrock valleys, such as the Vermont Valley west of the study area, but these aquifers are discontinuous and

confined to the structural valleys. Recharge to these aquifers is also primarily from the fractured bedrock recharge areas mentioned above.

The third aquifer identified in the area by Jerris exists in the saturated portion of localized unconfined kame sand and gravel deposits exposed at the ground surface. Only 3.5 percent of the wells in Jerris' study area produced from these deposits. They represent terrace deposits along major drainage systems such as the Walloomsac River. Recharge enters these systems primarily from direct infiltration of precipitation. A "low recharge area" as defined by Jerris for this kame sand occurs along the Walloomsac River Roaring Branch northwest of the study area. No recharge areas for kame sand were mapped in the study area. Due to the lenticular nature of the kame sand in the study area, it is not contiguous to mapped kame sand aquifers along the Walloomsac River Roaring Branch.

The till and weathered bedrock units were not identified as aquifers in Jerris' report and are typically unsuitable for private or public water supply development, due to their low hydraulic conductivities and yield to wells.

2.9. Site Hydrogeology

The hydrogeologic conditions at the Site were investigated through the installation of monitoring wells and subsequent measuring of surface and ground water levels through the course of the Phase 1A and Phase 1B RI programs. The following provides a summary of the Site hydrogeologic conditions based upon data gathered to date.

2.9.1. Site Geology

The geologic units identified beneath the Site are depicted on the hydrogeologic and hydrostratigraphic cross sections in Figures 5 through 11. The geologic units identified in the study area were grouped according to similar characteristics and consisted of the following, listed in order of increasing depth from the ground surface:

1. Surficial swamp deposits and humic materials in undisturbed areas, and landfill cover materials in disturbed areas.

2. Miscellaneous paper, wood, and municipal trash fill in landfilled areas.

3. Kame sand and ablation till in undisturbed areas.

4. Lodgement till beneath the ablation till.

5. Completely weathered schistose or gneissic bedrock termed "ocher" which was found in most of the study area except in higher elevations near the Burgess rock quarry where fresh unweathered bedrock was found. The Burgess rock quarry is located approximately 1,250 feet south southeast of the Landfill Area and is at an elevation approximately 350 feet higher than the Landfill Area (1,600 feet).

6. Unweathered competent quartzitic bedrock (Chesire Formation) found at significant depths in the study area.

Prior to landfilling, the area apparently contained a terraced, kame sand that formed a discontinuous ridgeline along the western slope of Harmon Hill at an elevation of about 1,100 feet. This discontinuous kame sand feature was deposited on top of an ablation till layer, which was laid down in this area during retreat of the latest glacial ice sheet. The sand quarry located north of the Landfill Area at about the same elevation was established in the thickest part of the kame sand and at its topographically highest point where the water table is deepest. The kame sand becomes thinner and the water table closer to ground surface radially from this area.

There is some evidence of small, localized blocks of "flow till" in the kame sand as was noted in the sand quarry and drilling of W-07 S1 well in the Phase 1A RI program. This indicates that the kame sand was deposited during the latest stages of the retreating glacial ice as blocks of dirty ice were dislodged into the kame sand.

The fill material was apparently placed in an excavated portion of the kame sand ridge south of the access road and Soil Staging Area on the Site. The kame sand was apparently excavated to a depth close to the water table and filling proceeded. A contour map depicting the extent and thickness of fill material developed from both Phase 1A RI and Phase 1B RI investigations is shown on Figure 14.

Drilling and test pitting information indicates that most of the landfilled materials consist of burnt paper, plastic, municipal trash, cement blocks and appliances, mixed with native kame sand that was used for cover material. Occasional lenses of darker cinders and charcoal-like material were noted that contained petroleum-type odors (TP-19 test pit).

The landfilled materials were unsaturated except at SBW-21 where the lower 2.5 feet of fill was found to be saturated. In the southern half of the Landfill Area, in the area referred to as the Former Lagoon Area, a topographic depression exists measuring 40 by 60 feet. This depression is believed to represent the southern most lagoon that was not completely backfilled. Another older lagoon exists just to the north. Borings conducted in this area were found to contain alternating layers of fine grained sludge-like material and kame sand cover. At this location, the depth of these materials was found to be 8 to 10 feet below the top of the depressed lagoon surface. Test pits conducted in the Phase 1B RI program identified the boundaries of the two Former Lagoon Area cells, The boundaries of the lagoons are shown on Figure 15.

An ablation till layer was observed beneath the kame sand throughout the Site. This layer is transitional from the looser, more sorted kame sand above to the more dense, less sorted lodgement till below. The ablation till layer, observed at each soil boring fully penetrating the kame sand, was characterized as medium compact fine sandy silt with embedded gravel and ranged in thickness from 4 to 18 feet.

A depression in the ablation till surface was noted in the Marshy Area which likely influences shallow ground water/constituent migration from the Landfill Area to the southeast. Another smaller depression was noted west of the landfill near W-08, but is not believed to affect migration of constituents in the landfill because it is located west of where most contamination has been found in the lagoons. A top of ablation till map is included as Figure 40.

The ablation till layer was underlain by a much denser lodgement till unit that was deposited during the advancing phase of the latest glacial ice sheet. The lodgement till was found to be continuous across the Site and ranged in thickness from approximately 35 to 75 feet. A depression in the lodgement till was found in the Marshy Area similar to the ablation till. Additionally, a small depression in the lodgement till was noted west of the Landfill, similar to the ablation till. This is not believed to affect the migration of contaminants, similar to the ablation till for the reason stated above. The most notable feature of this unit was the degree of compaction and the inclusion of frequent boulders and cobbles, which made drilling extremely difficult. The till layer was reasonably uniform in composition with occasional sandier lenses particularly at its base such as that observed at well nest W-07. The till descriptions can be found in the boring log and well construction diagrams in Appendix 7. A top of lodgement till contour map is included as Figure 41.

Beneath the lodgement till, the weathered bedrock layer was encountered across the Site. The weathered bedrock layer was found in each of the deeper soil borings conducted at the Site at depths of 56 to 112 feet below grade. The apparent thickness of this layer ranged from 180 to 360 feet before fresh, competent bedrock was encountered. The depth of the competent bedrock ranged from 230 to 412 feet below grade. This layer commonly referred to as "ocher" by drillers and quarry workers, also is mentioned by Jerris in his report. The "ocher" consisted predominantly of silty clay to clay with occasional seams of kaolinite clay and fine grained weathered quartz sandstone. A weathered bedrock surface contour map is included as Figure 39.

The ocher deposit contained some relict banding or layering, frequently folded to high angles. Some small micro-shear zones were also recognized which indicated brittle deformation in more lithified layers of the unit, most of the formation however, consisted of more plastic clay which was observed to be deformed in a ductile fashion as layers were observed to be folded rather than sheared.

Occasional sandier zones were recognized in this layer that yielded locally higher amounts of ground water. These sandier zones were typically loose and consisted of subangular medium to fine quartz sand-size particles and probably represented weathered arkosic sandstone or quartzite.

The sandier zones were commonly several feet to tens of feet thick and were encountered at somewhat similar depths in each boring. The horizontal continuity of the sandy zones is uncertain, due to the primary structure of the unit which was deformed to high angles. The significance of this observation is that although some zones of locally higher permeability, (sandy zones, and micro-fractures) were observed in this unit, the weathered bedrock should function hydraulically in a manner similar to that of a very stiff, plastic silty clay.

The formation of the ocher deposit is believed to have resulted from shearing of a weaker unit in the rock mass during deformation which allowed for significant weathering to occur by percolating rainwater through the crumpled gneiss or schist.

The lodgement till and weathered bedrock layers probably function as major aquitards beneath the Site, inhibiting downward migration of contamination from source areas.

The fracture fabric and secondary permeability of the competent bedrock was evaluated by observing bedrock cores obtained after encountering

competent bedrock at W-01 B, W-01 DI, W-04 B, W-09 B and W-08 B. The quartzite was characterized as massive to thickly bedded with frequent fractures at angles ranging from horizontal to steeply dipping and vertical. Some fractures were interpreted to have resulted from the coring process; but it appears that about 75 percent of the fractures were naturally occurring, due to the presence of iron staining or weathering along the fracture planes. Other solution weathering, healing of fractures by calcite, and quartz recrystallization was observed. Rock Quality Designation (RQD) values calculated at W-01 B ranged from 20 to 40 percent. RQDs were not calculated at other competent bedrock borings due to poor core recoveries, resulting from the use of smaller diameter AV core barrels which were necessary due to the depth of these borings.

Since oriented cores were not collected, no fracture orientation could be delineated; the fracture dips ranged from horizontal to steeply dipping. The strike of fracture planes in the outcrop in the Burgess quarry was northeast-southwest and dipping primarily at high angles with some cross-cutting fractures.

2.9.2. Site Ground Water Flow Conditions

During the RI, monitoring wells were installed in the five main hydrostratigraphic units identified in the study area. The well designations, specifications, ground water elevations and other pertinent data are presented on Table 4. The hydrostratigraphic units screened by wells in this program were the following, beginning with the shallowest and continuing to the deepest wells:

- landfill materials
- kame sand
- ablation till
- weathered bedrock sequence
- competent bedrock

* Wells were not installed in the lodgement till sequence.

Table 4 describes wells screening the following units: the water table in the landfill materials (SBW wells and WTP-12), kame sand (W-S1 series), ablation till (W-T series), the shallow intermediate sandy zone in the weathered bedrock (W-SI series), the deep intermediate sandy zone in the weathered bedrock (W-DI series), and the competent bedrock (W-B series).

Ground Water Elevation Monitoring

A total of ten rounds of ground water elevations were collected from wells in the study area from the period of March, 1993 to July, 1994. Water levels collected in each round were measured within a 24-hour period. The ground water elevations were collected during the scheduled Phase 1A RI surface and ground water monitoring programs, the interim sampling programs and the Phase 1B RI program. Because some rounds were collected prior to installation of all wells, some of the rounds contain only a partial set of wells.

Ground water elevation and surface water elevation rounds from shallow water table wells in the Marshy Area are summarized on Table 5A (Marshy Area: Stream Elevation Data, Low Flow Conditions), Table 5B (Marshy Area: Stream Elevation Data, High Flow Conditions) and Table 6 (Marshy Area Stream and Ground Water Elevation Data). Data from the three piezometers (P-01 through P-03) installed to a depth of 3 to 4 feet below the bed of the unnamed stream, and surface water levels in the stream at these points, were included on Figures 16 and 17 to assess the hydraulic relationship of shallow ground water to surface water in the Marshy Area. In addition Phase 1A RI and newly acquired Phase 1B RI elevation data of surface water and ground water were summarized on Table 6 and graphed on Figure 18.

Select ground water data from shallow zones and surface water levels were plotted on Site maps for the rounds collected in April 1993, June 1993 and July 1994. These depict shallow ground water flow conditions and relationship to surface water and contour maps representing dry and wet season conditions, are presented on Figures 16, 17 and 19.

An evaluation of ground water flow in the kame sand and ablation till units was also made from the July 1994 data which indicated similar flow direction to that depicted on Figures 16, 17 and 19. Therefore, no maps were prepared for these dates. The similarities in horizontal ground water flow direction and the hydraulic conductivity values for these two units indicated that they are hydraulically connected.

Ground Water Flow - Shallow System

Ground water flow conditions in the shallow system (kame sand and ablation till) as interpreted from data in the Phase 1A and Phase 1B RI studies were quite similar during wet and dry seasons. As would be expected in a shallow ground water flow system exposed to atmospheric pressure, flow directions were similar to topographic gradients. Ground water was convergent from the Hillside Area and the Landfill Area toward the Marshy Area. This flow pattern is similar to that discussed by Geraghty

and Miller in previous reports. Information from the most recent observations collected in July 1994 indicated that the kame sand became unsaturated west of the landfill as evidenced in well W-26 T. The kame sand was saturated to some degree at W-08 S1 closer to the landfill. In the Hillside Area east of the landfill (W-23 T and W-24 T) no kame sand was found. This information confirmed that the saturated kame sand is lens shaped and centered in the area of the landfill.

It is important to note that during periods monitored, the landfill materials in the Former Lagoon Area were unsaturated. This was evidenced by the absence of ground water in two wells, (SBW-15, and SBW-20) installed to the base of landfill materials in this area, (see Table 4). Additionally, ground water in newly installed well W-TP-12 occurred in the kame sand below the southern most lagoon cell. Based on this data, it is assumed that the ground water will not impact landfilled materials, however, the occurrence of ground water below or within landfill materials will be further evaluated as part of the Long Term Monitoring Plan (LTMP) for the Site.

Shallow ground water in kame sand and ablation till moves in a semi-radial fashion from the Landfill Area from a divide just west of the landfill primarily toward the Marshy Area to the southeast. There is some component of flow to the southwest on the western side of the divide. The ground water divide identified during the Phase 1B RI study is located west of the landfill. These flow paths are likely influenced by local topography in the area. Ground water flow in the kame sand and ablation till are essentially acting as one unit. The hydraulic connection between the kame sand and ablation till is evidenced by the same horizontal flow patterns (Figures 17 and 20), similar overall head distribution, and similar hydraulic conductivities.

Ground Water Recharge/Discharge to Streams

During the Phase 1A RI field program comparison of water level data in the shallow ground water system to that beneath the stream bed and that occurring in the stream, suggests that the unnamed stream is gaining flow at P-01 and P-02 locations, and is losing to ground water further upstream at P-03. The section where the stream is losing to ground water is probably localized, since inferred ground water flow contours around the Marshy Area are convex in the upstream directions, suggesting ground water discharge to surface water.

During the Phase 1B RI field program additional water level data of ground water beneath stream bed and surface water was collected at each of the

piezometers (P-01, P-02, P-03) once a week for a period of four weeks. Ground water and surface water elevation data collected during the Phase 1A and Phase 1B RI field programs have been summarized on Table 6.

A review of these data suggests that the unnamed stream is primarily a stream gaining flow during the early spring and fall seasons and then changes to a losing stream during late spring and summer. This change from gaining to losing flow conditions is likely due to the lower amounts of rainfall percolation (recharge) during this time as ground water levels decrease. Based on the limited amount of late spring/early summer data, it is likely that the unnamed stream is a losing stream during the majority of summer months. Conditions may fluctuate greatly based on the intensity and duration of precipitation recharge.

Ground Water Flow - Shallow Intermediate System

Ground water elevations collected on June 1993 and July 1994 at the SI wells installed in the upper portion of the weathered bedrock layer were contoured, as shown on Figures 21 and 22. The water level in W-07 SI was not contoured because the screened interval was 30 feet higher than the mean water elevations of the other SI wells. Contours developed from water levels collected on June 21, 1993 near the Marshy Area indicate a potential for ground water in this zone to flow toward the west-southwest, parallel to regional topography. These data suggest a possible connection between sandy zones in wells W-04 SI, W-25 SI, and W-09 SI near the Marshy Area. The actual hydraulic connections of the sandy zones in the weathered bedrock are not fully understood. Based on the geologic interpretations, these zones may be connected and will be further evaluated based on data obtained during the LTMP.

Ground Water Flow - Deep Intermediate System

A new DI well (W-01 DI) was installed in the Phase 1B RI program. Ground water levels measured in the DI wells installed in the lower portion of the weathered bedrock during the Phase 1A RI Program are presented on Figure 23 for June 1993. No contours were developed for the four DI wells, since the sandy layers screened by the wells do not appear to be hydraulically connected. The median screen interval is similar for wells W-07 and W-25 DI, but the hydraulic head differential is about 173 feet. (The water level for this well was checked and the drilling log reviewed to evaluate if the screen may be clogged. Information did not indicate that different conditions were encountered or different procedures were employed.) Although wells W-25 DI and W-04 DI are reasonably close horizontally, the median screen interval differs by about 30 feet.

Water level measurements collected suggest, with reasonable confidence, that these sandier zones are not hydraulically connected, based on a hydraulic head difference of approximately 9 feet over a horizontal distance of 165 feet. Measurement of connectivity will continue to be further evaluated, during the LTMP.

Observations of the nature of bedding in cores collected from the weathered bedrock sequence indicates that bedding is highly folded with some layers truncated by minor relict faults or slip planes. Additionally, the weathered quartzitic sand layer thicknesses were relatively minor compared to the thickness of the stiff low permeable clay and silty clay which make up the bulk of the unit. These observations would suggest that the sandier layers, are for the most part, discontinuous in the weathered bedrock over appreciable distances. As a result, the ground water flow potential between the saturated weathered quartzite sand lenses is controlled by the extent of the sandy layer and the degree of saturation and permeability of the surrounding clay. The permeability of the clay may be affected by secondary micro-fractures discussed above.

Ground Water Flow - Competent Bedrock

Ground water elevations measured in the competent bedrock wells are shown on Figure 24 for June 1993. The bedrock wells were installed in the upper 60 feet of the competent bedrock. Since the top of the bedrock varied across the Site, the screen interval elevation of the bedrock wells also varied. The median screen interval elevation at wells W-09 B and W-04 B was from 633 to 636 feet, (MSL) respectively. The median screen interval at W-0l B was 806 feet, and was 686 feet in W-08 B. The measured potentiometric heads in the bedrock wells were generally within 1 to 2 ft, as shown on Table 4. Hydraulic gradient direction from these data indicated a shallow gradient toward the west. Ground water potentiometric head data for DI and B wells was evaluated for the July 1994 round. This data again indicated similar conditions to the June 1993 data and so was not depicted on maps. Based upon westerly hydraulic gradients in this competent bedrock unit and flow contours in the shallow weathered bedrock, it is reasonable to assume that flow in the competent bedrock is in a general westerly direction parallel to regional topographic gradients in the area. These conditions will be further evaluated during the LTMP.

Vertical Flow Potentials

(Deep Units)

A comparison of ground water elevations in well nests was made in order to assess vertical hydraulic potentials between the primary hydrostratigraphic units. Table 7 depicts ground water elevations in well

nests W-01, W-04, W-08, and W-09 for the measuring rounds conducted on June 21, July 7, and July 27, 1993; November, 1993; February, 1994; and July, 1994. Vertical hydraulic potentials interpreted from potentiometric levels in well nests W-01, W-08 and W-09 were predominantly downward from the kame sand to the weathered bedrock and to the competent bedrock. In well nest W-04 located in the Marshy Area, hydraulic gradients were mostly downward as well from the kame sand to the shallow weathered bedrock zone and from the weathered bedrock to the competent bedrock. Although the potential exists for a component of vertically downward ground water movement, actual ground water movement may be very slow due to the significant thickness of stiff to very stiff, low permeability clay in the weathered bedrock sequence.

(Shallow Units)
Shallow ground water in kame sand and ablation till from the Hillside Area and the eastern half of the Landfill Area discharges to the unnamed stream system and the Marshy Area, during the spring and fall months. This is evidenced by the upward hydraulic flow potential from the shallow ground water system to the stream.

Additionally, vertically upward flow potentials were measured from the upper ablation till layer to the kame sand consistently throughout the program at well nest W-03/W-03 T. The potentiometric heads in the shallow till well W-03 T were higher than the shallow kame sand well W-03 ranging from 0.5 to almost 1 foot. Additionally, hydraulically upward flow potentials were also observed at well nests W-06/W-06 D, W-04 S/W-04 D and W-22 S1/W-22 T installed in the kame sand and ablation till in the Marshy Area. This is important in that it indicates a predominantly upward potential for ground water movement in the kame sand and ablation till beneath the Marshy Area.

Data collected on one instance during the late spring 1994 suggest that a downward hydraulic flow potential exists from the stream to shallow ground water system during the late spring and summer months.

Deeper Ground Water Discharge Boundaries
Ground water in the till and weathered bedrock west of the Landfill Area may discharge to Barney Brook farther west and southwest of the Site. The shallow ground water flow west of the Landfill Area as interpreted from new wells W-26 T and W-27 S1/W-27 T is toward Barney Brook (See Figure 17). Ground water in the deeper competent bedrock which is recharged in topographically higher areas with thin or no till accumulations may ultimately discharge to the Walloomsac River system in the Bennington Valley area farther west, as suggested by Jerris and by Wagner,

Heindel, and Noyes, Inc. in their report of the Morgan Spring contamination study dated July 31, 1985.

Ground Water Flow Rates

An evaluation of the advective ground water velocity was made for the shallow hydrostratographic units observed at the Site. These units included the kame sand and ablation till layers in which all shallow wells were installed outside the Landfill Area. The evaluation of ground water flow velocities was made for this system because it was the sequence in which most ground water contamination has been identified. Observations of soil cores collected from both the ablation till and the kame sand indicated that the boundary between these units is gradational in the Marshy Area. "Gradational" indicates that grain size distribution and density gradually changed over several feet from typical kame sand to more "till like" material. The gradation may have occurred from fluvial disruption of the looser till surface during deposition of kame sand. The contact was more abrupt below the Lagoon Area.

Hydraulic Conductivity Data Summary

Hydraulic conductivity test results from the shallow wells are presented on Appendix 8. An evaluation of the hydraulic conductivity test data and a more detailed discussion of results may be found in Chapter 3.

The arithmetic mean hydraulic conductivity was calculated for wells installed in:

- the ablation till sequence (W-03 T, W-04 T, W-22 T, W-24 T, W-26 T, W-27 T) *
- the Marshy Area kame sand (W-02, W-03, W-04 D, W-05, W-06 S, W-06 D, W-11 S1, W-12 S1, W-22 S1)
- area around the Landfill Area in kame sand (W-07 S1, W-08 S1, W-09 S1, W-25 S1, W-01 S1 or SBW-13, W-27 S1, W-TP-12)
- the landfill materials (SBW-10, SBW-21)

The mean hydraulic conductivities in feet per day for these units is shown below:

ablation till (K) = 0.05 feet/day
Marshy Area kame sand (K) = 0.19 feet/day
area around landfill kame sand (K) = 0.12 feet/day

landfill materials (K) = 0.10 feet/day

(*) Well W-23 T was not included in the calculation because its value was one order of magnitude higher than the remainder of the data set and was not located in an area of concern.

The range of values distributed around these averages was fairly uniform by about an order of magnitude. The similarities in K values for the shallow units indicate that they will likely function as one hydrologic unit. The saturated kame sand layer, however is lens shaped and pinches out east and west of the study area. Based upon an extrapolation of available geologic data, the saturated kame sand may continue to the south for some short distance parallel to the unnamed stream. The soil conservation survey map presented in the LFI depicted a termination of the kame sand to the south of the Site.

The hydraulic conductivity in the ablation till is about an order of magnitude lower than the kame sand. This information together with upward hydraulic flow potentials in this layer would tend to limit downward migration of waste residues from the kame sand above.

Ground Water Velocity Calculations

Estimates of horizontal advective ground water velocity (V_H) were made for the shallow units using Darcy's formula and estimates of porosity. The formula is expressed as:

$V_H = KI/N$

Where:

K = Hydraulic Conductivity in feet per day (ft/day)
I = Hydraulic Gradient in foot per foot (ft/ft)
N = Porosity *

* The effective porosity or specific yield was actually used for the sand since this is the portion of the aquifer through which most ground water moves. Effective porosity for kame sand aquifers has been shown to be reasonably close to total porosity. (Ground Water Pollution & Hydrology, Cleary R.W., Miller P.W., Binder, G.F. 1985, pp. 2-9)

To calculate V_H for the shallow kame sand ground water system, the average K for the Marshy Area wells and wells West of the Landfill was used, since these are the chief zones in which contaminants may migrate some distance from the Landfill Area. Using an average K of 0.15 feet/day, a porosity estimate (N) of 0.20, for fine grained kame sand (Groundwater

and Wells, Driscoll, F.G., p.67), and a hydraulic gradient (I) range of 0.12 to 0.035 (Figures 17 through 21), the V_H was calculated to range from 0.09 to 0.026 feet/day. These values are most sensitive to the range in hydraulic gradient, which is greater beneath steeper slopes along the eastern side of the Landfill Area than in the Marshy Area. Since the saturated kame sand is lens shaped, this velocity would be limited to an area around the landfill.

The V_H for the ablation till was calculated using a K of 0.05 feet/day, an average porosity of 0.17 for glacial till (Groundwater and Wells, Driscoll), and a gradient of 0.06 feet/foot. The V_H was calculated to be 0.02 feet/day, which is similar to that for the kame sand.

Since the weathered quartzite sand zones in the shallow intermediate wells (SI wells) may be hydraulically connected, a calculation of V_H was made for this zone. The mean K value of 0.19 feet/day was used from the slug test data. A hydraulic gradient of 0.026 feet/foot was used from Figure 20, and an effective porosity of 0.3 was used for the sand lenses. ("Ground Water Pumping Tests", Walton, W.C., 1988, Table C4). A V_H of 0.016 feet/day was calculated for the sandy zones, but may be lower if the zones are not effectively interconnected.

The V_H was not estimated for the wells installed in the deep weathered bedrock due to uncertainties regarding the continuity of saturated sand layers and the fact that volatile constituents, which are most mobile in ground water systems, were not detected in these wells. Likewise, volatile constituents were not detected in competent bedrock wells.

2.10. Qualitative Ecological Assessment

2.10.1. Objectives and Methods

This part of the chapter presents a Phase I Qualitative Ecological Assessment (EA) for the Burgess Brothers Superfund Site. The EA was performed based on:

- an O'Brien & Gere Site visit conducted on June 8-10, 1992
- information obtained from Vermont regulatory agencies
- technical/scientific literature

The EA was carried out in a phased approach.

The Phase I EA was performed in accordance with *Risk Assessment Guidance for Superfund Volume II Environmental Evaluation Manual* (USEPA, 1989a) and *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference* (USEPA, 1989b). Based on these documents, the objectives of the Phase I EA were to:

- Identify the major terrestrial and aquatic habitats, and their associated wildlife inhabitants, that are potentially affected by Site contaminant releases.
- Identify the exposure point contaminant concentrations in the affected media.
- Qualitatively evaluate the risk to exposed resident wildlife species.

O'Brien & Gere designed this EA, and its associated field elements, to collect the information necessary to meet the objectives of the Phase I EA. However, based on the Work Plan, this Phase I EA focused on the identification of potential wildlife receptors based on physical covertypes of the Site and vicinity and the wildlife habitat quality of those covertypes (USEPA, 1992). USEPA will perform the identification of compounds of concern, the determination of exposure point concentrations, and the evaluation of wildlife exposure pathways in the Baseline Risk Assessment.

To collect the necessary information for completion of the Phase I EA, the following three tasks were performed:

- Cover-Type Analysis
- Wildlife Receptor Evaluation
- Wildlife Habitat Quality Evaluation

The scope and results of these three tasks are presented in the following sections.

2.10.2. Cover-Type Analysis

The objective of the Cover Analysis is to describe the physical setting of the Site and vicinity and to identify the major vegetative communities and their distribution within one-half mile of the Site. The one-half mile radius was

selected for this Site because it is a practical size that incorporates the major covertypes in the vicinity of the Site. The covertype map (Figure 25) presents the relative sizes and locations of each identified covertype. The covertype map was prepared based on information extracted from existing maps, literature review, aerial and general photograph review, and a qualitative vegetative census performed during the June 1992 Site visit. Terrestrial and aquatic habitats were mapped and classified according to a conventional classification scheme for eastern forests (Sutton and Sutton, 1988). Approximate acreage of each covertype are presented in Table 8.

Site and Study Area Description

The Site consists of an inactive Landfill Area and a Former Lagoon Area which is currently partially filled (Figure 2). The landfill has been graded and is naturally re-vegetating with scrub growth. The lagoon was dry at the time of the Site visit. The Site is located on a south-facing slope that terminates at Barney Brook, a permanent surface water body. Several drainage ways intermittently flow down the hillside. One main perennial channel flows past the Site and receives landfill leachate. A primary tributary to the main channel converges with the main perennial channel in a wetland area approximately 300 feet downstream of the landfill.

Ecological covertypes were identified for areas within one-half mile of the Site (the Study Area). Three main terrestrial covertypes were identified in the Study Area: Mixed Deciduous Forest, Palustrine Wetlands, and Cultural Areas. Aquatic habitats of the Study Area include drainage ways along the mountainside and Barney Brook. Barney Brook is tributary to the Walloomsac River, a large river at the northern base of the Burgess hill, at a point approximately one mile downstream of the Site. The Walloomsac River habitat is not evaluated in this assessment because of its distance (1,500 feet) from the Site. The physical features of each covertype or aquatic community are described as follows.

Terrestrial Cover Types

Mixed Deciduous Forest. The majority of the land immediately surrounding the Site is Mixed Deciduous Forest. Observed dominant species in this covertype are listed in Table 9. Dominant trees in this stand are approximately 10 to 14 inches in diameter indicating they are approximately 40 to 60 years old. The majority of the canopy is closed resulting in a limited shrub layer. Understory saplings consist of oak, ash, and beech. The herbaceous layer varied with the degree of canopy closure but was primarily dominated by a variety of ferns.

Forested areas north and east of the Burgess property are part of the Green Mountain National Forest (GMNF) which is owned and managed by the U.S. Forest Service (USFS). GMNF covers approximately 340,000 acres in southwestern Vermont. Most of GMNF was purchased as forestland, but forested areas were planted by the Forest Service with preferred tree species (Forrest, 1993). The portion of GMNF just north of the Site was planted with Scotch Pine (*Pinus sylvestris*) and currently supports mature red maple and beech trees as well. Although ground cover is sparse, a well developed sapling understory exists, dominated by striped maple (*Acer pensylvanicum*), red maple, beech, yellow birch (*Betula alleghaniensis*) and ash.

Cultural Areas. Cultural covertypes are areas that have been modified or developed for human use. The cultural covertypes of the Study Area include landfills, borrow areas, buildings/residences/barns, mowed lawns, and roadways (including an oval horse track). Qualitative vegetative surveys were not conducted in this covertype.

Wetland Cover Types

Several drainages descend the hillside upgradient of the Site and converge into a single main channel that runs adjacent to the Landfill Area and discharges to Barney Brook, approximately 750 feet downstream of the Site. Low lying areas adjacent to the main channel and one of the larger drainage ways are saturated at the surface, creating palustrine (marsh) forested wetlands. The largest of these wetlands occurs approximately 200 feet southeast of the Site. This wetland extends primarily along the eastern bank of the main channel and up the main drainage way that converges with the main channel downgradient of this point (Figure 13). Wetlands of the main drainageway are separated from the wetlands of the main channel by a topographic divide that delays co-mingling of the water flows from these areas until downgradient of the Landfill Area.

The wetland map (Figure 13) presents the locations of the areas used to document the soil, vegetative, and hydrologic characteristics of the wetland and upland areas of the Site. Since the "Routine" method of wetland delineation was used, documentation areas were established either when one of the indicator characteristics significantly changed or to document a specific boundary line. The vegetation and hydrology of the identified wetland areas was relatively uniform. Therefore, frequent documentation of field characteristics was not necessary. Numerous additional soil evaluations, which were not documented, were performed to refine the wetland/upland boundary line in the field. The boundary line was flagged in the field with sequentially numbered surveyors tape. Each flag was

placed in sight of the previous flag. Distances between flags varied depending upon the density and height of the vegetation.

At the time of the Site visit, these palustrine wetlands were saturated to the surface by surficial water descending from higher elevations. A main water channel meanders through the wetland. Wetland vegetation consists of similar tree species as in the mixed deciduous forest, but with a more open canopy. Saplings, shrubs, sedges, grasses, and several fern species are abundant. Table 10 is a list of the dominant vegetation observed in the wetlands.

State Wetlands. The presence of wetlands downgradient of the Site was evaluated through a review of FWS National Wetland Inventory (NWI) maps (1977) and by delineating wetland boundaries in accordance with current federal methodology. The NWI maps present classifications of wetlands using alphabetical and numerical designations developed by Lewis M. Cowardin (Cowardin etal., 1979) for the FWS which describe hydrologic and vegetative characteristics of the wetland. Figure 12 presents the locations of NWI wetlands within a one-half mile radius of the Site. A review of the NWI maps for the area indicate that no FWS designated wetlands occur on or adjacent to the Site. However, several wetlands were identified within a one-half mile radius of the Site. Barney Brook (approximately 1500 feet from the Site at its closest point) is identified as a wetland classified as R30WZ - riverine, upper perennial, open water (unknown bottom), intermittently exposed/permanent. The Walloomsac River, approximately 1,000 feet north (upgradient) of the Site, is also classified as R3OWZ. Other wetlands within one-half mile of the Site include: four small, isolated ponds/reservoirs classified as POWZ - palustrine, open water (unknown bottom), intermittently exposed/permanent; three forested wetlands classified PFO1Y - palustrine, forested, broad-leaved deciduous, saturated/semipermanent /seasonal; and one depositional area on the Walloomsac River classified as R3BBC- riverine, upper perennial, beach/bar, seasonal (NWI, 1977).

The NWI maps present wetland boundaries on topographic maps based on FWS wetland criteria established as an indicator of waterfowl production areas. NWI wetlands are not intended for federal regulatory purposes. However, the State of Vermont has designated NWI wetlands (except those classified as R2OW, R2BB, R3OW, R3BB, L1OW, L2OW, and L2BB), as Class Two -significant wetlands, that are protected by the Vermont Wetland Rules (VWRB, 1990).

Federal Wetlands. Wetlands are defined and regulated on the federal level by the US Army Corps of Engineers (ACOE) and USEPA. Jurisdictional wetlands require the presence of hydric soils, a dominance of hydrophytic vegetation, and wetland hydrology. Wetland boundaries are currently identified through the evaluation of wetland criteria developed by ACOE (Environmental Laboratory, 1987). The wetlands along the main channel and a major tributary to the channel were delineated by a biologist from O'Brien & Gere in accordance with the 1987 ACOE method. Documentation of the wetland boundaries is presented in O'Brien & Gere's Wetland Delineation Report (O'Brien & Gere, 1993) which is presented in Appendix 5. The wetland boundaries are presented in Figure 13. Using the Cowardin system of classification, the identified wetlands would be classified as PFO1Y - palustrine, forested, broad-leaved deciduous, saturated/semipermanent, seasonal.

Wetland Quality. The quality of a wetland is determined through an analysis of its functions and values. The functions and values of the wetlands potentially impacted by the Burgess Brothers landfill were evaluated using the Wetland Evaluation Technique (WET) developed by Paul Adamus (1987) for the ACOE. WET evaluates the functions and values of wetlands based on their physical, chemical, and biological characteristics. The WET analysis is presented in Appendix 9. Table 11 presents the relative rankings for each evaluated criteria.

The results of the WET analysis indicate that the wetland area has the opportunity to provide functions that are important to society; however, it is not very effective at performing these functions. Overall, the wetland area is not important as a wildlife habitat nor does it provide any unique services for society.

Surface Waters

Numerous drainage ways exist along the steep upgradient areas of the Site that discharge into the main channel adjacent to the Site (Figure 25). Most of these drainage ways are shallow (less than 2 inches) or dry and narrowly (less than 3 feet) channelized into straight, pool-less, runs. The substrate of these drainage ways is primarily rocks, gravel and fine kame sands. Very little vegetation or decaying organic material are present.

The main channel adjacent to the landfill partly originates from a depression, ranging between 5 and 30 feet below landfill grade, between the landfill and a topographic rise of approximately 10 feet (Figure 13). The channel in this depression is generally shallow (less than 1 inch) and wide (approximately 10 feet) barely flowing over a gentle (approximately 10%) slope. The rocks, boulders, and detritus of the substrate, as well as the

water, are orange colored. The orange-colored substrate of the main channel stream most likely resulted from landfill leachate creating a feeder stream upgradient of the area described in the text. At the end of the topographic divide opposite the landfill, a 2-inch deep, 3 feet wide drainage way with clear water enters the main channel, approximately near the middle of the landfill (Figure 13). This tributary has little flow over a substrate of rocks, boulders, and detritus (decomposing organic material).

The primary tributary to the main channel enters the main channel downstream of the landfill. This tributary averages approximately 3 feet in width and 3 inches in depth, with clear water and a clear substrate of rocks, boulders, and detritus. The flow rate of this tributary near the main channel is less than 1 foot per second (fps), also due to gradual relief changes. The steeper topography upstream in this tributary results in a flow rate of approximately 1 fps over a substrate of rocks, gravel and kame sands. Average water depth was 1 inch through a 4 foot wide channel in the upstream areas.

The primary tributary and main channel converge in a low lying area to create a wetland. In this wetland, the main channel averages 4 to 6 inches in depth with pools up to 18 inches deep. Average width is approximately 4 feet with a substrate of fine gravel, boulders, and detritus. The water is clear from this stretch of the channel to its confluence with Barney Brook.

The main channel remains channelized as the slope increases towards Barney Brook, approximately 750 feet downstream of the Site. In the vicinity of the access road, Barney Brook is approximately 8 feet wide with an average depth of 4 inches. The brook alternates with riffles and pools of up to 8 inches in depth. The approximate flow rate is 1 fps over a substrate of kame sands, cobbles, rocks, and boulders. Algae was noted growing in the substrate.

Water quality measurements were collected from surface waters in the vicinity of the Site as part of surface water sampling activities conducted as part of the RI. Temperature, specific conductance, dissolved oxygen, and pH information for the surface waters is summarized in Table 12.

2.10.3. Wildlife Receptor Evaluation

The objective of this task is to identify wildlife species that inhabit the Site and vicinity that could potentially be exposed to site-related compounds. Ecological receptors were identified through the performance of a Site visit and literature review. Resident and transient fish or wildlife species that frequent the Site or adjacent areas were identified based on actual sightings, observations of wildlife indicators such as nesting places, burrows, tracks, scat or browse, or audible indicators such as bird songs. Typical wildlife residents of the identified covertypes were identified from available literature.

Special Resources

Potential ecological receptors include special resources such as:

- environmentally sensitive areas
- significant habitats
- rare, threatened or endangered species (RTE)
- regulated wetlands
- streams
- lakes
- wild and scenic rivers

The objective of this task is to identify special resources in the vicinity (within one-half mile) of the Site. Special resources were identified through contact with Vermont Department of Fish and Wildlife (VFWD) personnel and review of the NWI maps. Wetlands in the vicinity of the Site were identified and discussed previously in this report.

Rare, Threatened, or Endangered Species. Information regarding the presence of RTE wildlife species in the vicinity of the Site was provided by VDFW Nongame and Natural Heritage Program (NNHP). According to NNHP, "There are no known occurrences of exemplary natural communities or rare, threatened, or endangered animals or plants within one half mile of the site." (Marshall, 1992). Regional VDFW personnel did not identify any critical wildlife habitats on the Site, but revealed a historic anecdotal account of a bobcat (*Lynx rufus*) den site approximately one-half mile southeast of the Site (Marshall, 1992). VDFW considered it possible, but unlikely, that the forested wetland areas adjacent to the Site could provide spring feeding habitat for black bear (*Ursus americanus*). Habitat protection may be required under state law if bear use of the Site is documented (Marshall, 1992). According to Jim Sauer, (Vice President of Burgess Brothers, Inc. and local resident) black bear have not been observed in the vicinity of the Site.

Terrestrial Habitat Receptors. With the exception of bird species, direct animal sightings were limited during the O'Brien & Gere Site visit. Several transects were walked during a three-day site visit in the summer to identify breeding birds, terrestrial mammals, amphibians, and reptiles. Wildlife species observed in the vicinity of the Site are summarized in Table 13. Typical wildlife inhabitants of the identified covertypes, as identified in the literature, are summarized in Table 14.

It is acknowledged that migrating warblers may have been missed due to the timing of the receptor survey. However, migratory warblers would not be subjected to the chronic exposures used in the estimation of risk, but could be subjected to acute exposure. Resident avian species would have longer exposures and therefore should be used to estimate chronic, as well as acute, exposures to avian species.

Waterfowl sightings were reported by Jim Sauer (Burgess Brothers) in ponded areas of Barney Brook. There is no suitable waterfowl habitat in the wetland area discussed in the WET analysis.

Aquatic Habitat Receptors

Typical wildlife inhabitants of palustrine habitats are presented in Table 15. Observations or acquired information regarding actual study area inhabitants are discussed in the following subsections.

Macroinvertebrates

Palustrine habitats were surveyed for macroinvertebrates using USEPA kick net sampling techniques (USEPA, 1989c). The invertebrate evaluation was performed as follows:

- in the main channel, upgradient of the landfill
- in the main channel, wetland #2
- in the main channel of wetland #3
- in the main channel, downstream of wetlands

Table 16 summarizes the observed macroinvertebrates at each location. Figure 13 presents the invertebrate sampling locations. Macroinvertebrates were counted in a 10 square foot section of each water body, representing different substrate habitats. The survey was performed to identify aquatic receptors of the drainage swales. Sufficient quantities of

macroinvertebrates were not collected for statistical analysis of potential population effects.

As presented in the Work Plan, the EA was designed in a phased approach to evaluate the potential for exposure prior to collecting detailed information about potential receptors. The main channel upstream of the landfill and the wetland #3 sample locations are indicative of areas unaffected by the landfill. These areas were represented by four invertebrate orders. Areas adjacent or downgradient of the landfill were represented by three orders. Although more invertebrates were collected in upgradient sample locations, the substrate composition was different which made comparison between locations of little value. The invertebrate sampling locations upstream and downstream of the site were located in steeply sloped portions of the stream with primarily cobble bottoms. Wetland #2 invertebrates were sampled from a silty, vegetated flat. The substrate in the area of invertebrate sampling in Wetland #3 was a mixture of cobble, gravel sand and silt on a moderate slope. Differences in invertebrate community structure are likely related to the different habitats sampled. As previously noted, invertebrate samples were collected to characterize invertebrate receptors, so a variety of habitats were sampled. Therefore, conclusions regarding potential invertebrate community impacts associated with landfill releases are inappropriate.

Fish

Four fish of approximately 3 inches in length were observed in the main channel in a short (10 feet), shallow (4 inches) stretch of predominantly sandy substrate between the landfill and Barney Brook. Attempts to collect the fish with dip nets for identification were unsuccessful. Based on the habitat, observed slow swimming speed, and briefly observed appearance, these fish were likely of the minnow family. Another fish was observed in a relatively deep (18 inches) pool that undercut a large boulder. A brief glimpse of this approximately 3-inch long, dark backed fish rapidly darting into the cover afforded by the boulder, and the habitat utilized by the fish, indicates it may have been of the trout family.

The VDFW and the Bennington State Fish Hatchery provided additional information on fish species potentially present in surface waters in the vicinity of the Site. Barney Brook is stocked yearly with between 100 and 300 brook trout (*Salvelinus fontinalis*), throughout its length, for recreational fishing (Snow, 1993). Brook trout also naturally reproduce in the Brook. Native brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) are other game species that may also occur in Barney Brook and may spawn in small tributaries if sufficient water flow and depth exist and no physical blockages are present (Callum, 1993).

Nongame fish that are likely to exist in Barney Brook and tributaries include blacknose dace (*Rhinichthys atratulus*), longnose dace (*Rhinichthys cataractae*), and sculpin (*Cottus* sp.)(Callum, 1993). Population data on native fish species in Barney Brook are not available.

2.10.4. Wildlife Habitat Quality Evaluation

The objective of the habitat quality evaluation is to use the information gathered during previous tasks to evaluate the ability of covertypes within one-half mile of the Site to provide the life sustaining requirements of the identified ecological receptors. High quality habitat provides sufficient size and resource to support either ecologically or economically important single species, or a diverse ecological community. Low quality habitat lacks sufficient size or resource to support important species or diverse communities. The quality of the identified covertypes in the vicinity of the Site is discussed in the following subsections.

Terrestrial Cover Types

The transition forest covertype is considered a high quality habitat for a variety of wildlife species. The oak and beech trees of the canopy and understory provide high quality habitat for canopy and ground mast feeding species such as gray squirrel (*Sciurus carolinensis*), turkey (*Meleagris gallopavo*) and deer (*Odocoileus virginianus*) as well as providing cover and shelter. The food (birch catkins) and roosting areas (scotch pine) of this covertype also provide a good habitat for ruffed grouse (*Bonasa umbellus*). The mixed hardwoods also provide preferred habitat for blue jay, scarlet tanager, rose-breasted grosbeak, and rufous-sided towhee. Water is abundant throughout the vicinity of the Site for drinking. The absence of abundant quantities of berry producing vegetation, consumable landfilled materials, and suitable den sites coupled with the proximity to human activity results in a low quality habitat for the black bear in this covertype. Mammals that prefer the mixed covertype include flying squirrel, white-footed mouse, and gray fox.

Palustrine Wetlands

The wetland areas in the vicinity of the Site lack sufficient water depth and food sources to attract aquatic furbearers such as beaver (*Castor canadensis*), and muskrat (*Ondatra zibethica*), and waterfowl such as the wood duck (*Aix sponsa*). Vegetation browsers such as the white-tailed deer would find sufficient food, cover, and water in this covertype to consider this a good quality habitat. The absence of berry producing vegetation would limit the attractiveness of this covertype for the black bear. This

covertype appears to be suitable for a variety of reptiles, amphibians, and small mammals, but few species were observed during the Site visit. Spring peeper prefer this shallow palustrine system. Common yellowthroat, and swamp sparrow also select this habitat. An abundance of small mammals as a food source could also make this covertype attractive to mammalian predators such as mink (*Mustela vison*). The palustrine wetland provides a high quality habitat for opossum, water shrew, short-tailed shrew, star-nosed mole, and cottontail.

Surface Waters

The majority of the drainage ways in the vicinity of the Site are not high quality aquatic habitats. The shallow water depths - low, intermittent flows, absence of submerged and emergent vegetation, and small macroinvertebrate populations do not provide the habitat requirements of economically important fish species. Depending on the amount of rainfall in the spring and summer, most of the drainage ways in the vicinity of the Site are dry during the summer months. Barney Brook is the highest quality aquatic habitat of the surface waters in the vicinity of the Site. The physical characteristics of the Brook, with alternating pools, riffles, and runs provide good habitat for trout species. The presence of macroinvertebrates and forage species fed upon by trout, such as dace, provide a good food source for the trout population. The presence of trout and other fish species provide food sources for aquatic furbearers such as mink and piscivorous birds such as the great blue heron (*Ardea herodias*). The shallow water depths and absence of emergent vegetation in the vicinity of the Site limit use of the Brook by beaver and duck.

2.10.5. Qualitative Wildlife Exposure Evaluation

This EA has identified wildlife species that inhabit, or are likely to inhabit, the Study Area. Exposures to site-related compounds could occur to the wildlife receptors via dermal contact and ingestion. Dermal contact exposures could occur to terrestrial wildlife that traverse areas with surficial contamination. Aquatic biota could be exposed to site-related compounds expressed in surface waters.

Ingestion exposures to site-related compounds could also occur to terrestrial and aquatic receptors. Terrestrial wildlife could be exposed via ingestion of contaminated water, soil, vegetation or lower food chain organisms, potentially resulting in bioaccumulation of contaminants through the food chain. Aquatic organisms could bioconcentrate contaminants via uptake from the ambient water or through the consumption of contaminated sediments, macroinvertebrates, vegetation, or contaminated forage fish.

The effects on particular wildlife species of exposures to site-related compounds is a function of the exposure concentrations, the duration of the exposure, and the sensitivity of the exposed species. USEPA has indicated that it will use the site-related compound concentrations detected in surface water, sediments, and soils to evaluate exposure point concentrations and model exposures to indicator wildlife species to determine if a potential for unacceptable risk exists for the Site.

The primary exposure pathway of significance for the Site is related to landfill leachate entering the surface waters in the main channel of the wetland downstream of the Site and which ultimately discharge to Barney Brook. No economically or socially important ecological receptors were identified in the main channel or wetlands to the point of confluence with Barney Brook. However, aquatic invertebrate communities inhabiting Site surface waters as well as amphibians and reptiles could be influenced by exposure to site-related compounds. Barney Brook contains environmentally sensitive trout species which are of economic and recreational importance to the community.

In addition to potential impacts to wildlife, site-related compounds could also have an effect on wetland areas by stressing vegetation or reducing the wetlands functions or values. Results of the WET analysis indicate that the wetland areas currently are not important as wildlife habitat nor do they represent a unique cultural or social resource. However, the WET methodology is biased towards fish and waterfowl, for the evaluation of the wetland wildlife habitat value. Although the WET analysis concluded that the wetlands provided low value for wildlife diversity, site wetlands provide habitat for a variety of semi-aquatic amphibians and reptiles.

Wetlands are protected at the state level under Title 10 V.S.A., Chapter 37, Section 905 (7-9). State wetland regulations allow certain uses of wetlands that would not have an undue, adverse impact on a protected function of a significant wetland. At the federal level, wetlands are regulated by ACOE and the USEPA under Section 404 of the Clean Water Act. Federal wetland regulations do not allow the release or deposition of chemicals into waters of the United States which are defined to include wetlands.

2.11. Current and Future Land Uses

The following information regarding the current and future land use of the Site and vicinity was provided by Jim Sauer. Burgess Brothers personnel and clients visit areas adjacent to the Site as part of their business activities, specifically the sale of topsoil. As soil is needed, Burgess personnel operate earth moving machinery to obtain the required type and quantity of soil and deliver it to the client either at the facility or elsewhere. Business is expected to continue as usual in the foreseeable future.

Areas adjacent to the Site are also used for recreational purposes. Portions of the facility are used for skeet shooting and as a pistol range by individuals and organizations. Hunters also utilize areas of the property for big game and small game hunting. Off-road vehicles such as three-wheelers utilize trails which cross portions of the property.

According to the 1990 US Census, the population of Woodford, Vermont grew 5.4% between 1980 and 1990 to 331 residents. The estimated population for the year 2000 is between 352 and 379. However, according to officials from the Bennington County Regional Commission, population growth since 1990 has not increased as steadily as was expected.

Bennington, Vermont is the state's fourth largest town with the 1990 population totalling 16,451 (1990 US Census). The projected population for the year 2000 as estimated by the Vermont Office of Policy Research and Coordination is in the range of 17,643 to 18,851.

Information gathered from the Bennington County Regional Commission indicated the Town of Woodford has several areas zoned for residential use with the majority of the town's land designated as forests. A very small portion of the land is used for commercial use. The town of Bennington includes a densely populated urban area surrounded by a large rural area, according to the Town of Bennington, Office of the Town Manager. In the center of the urban area is Downtown which serves as the central business district. The urban area outside of Downtown is comprised of residential, commercial, industrial and institutional uses. In recent years, commercial uses have grown significantly in the urban area. The rural areas to the north, northeast, southeast and west of the urban area are mainly used for agriculture, but also for some industrial, institutional and commercial uses including an electronics firm, schools, churches, inns and restaurants. The rural areas have also experienced substantial residential development in the past few years. According to Town of Bennington Zoning Officials, the rural area along Burgess Road is expected to see rapid residential growth in

the next five to ten years. The new residents will be served by the public water lines which are currently being upgraded.

Water is supplied to the residents in the Town of Woodford by privately owned wells. The majority of the people living in the Town of Bennington are served by the Bennington Water Department.

The population not served by the Water Department receives their water from privately owned wells. The Bolles Brook Reservoir System is used to serve most of Bennington. Morgan Spring serves as a secondary water source to the area. The spring is fed by groundwater discharged from underlying limestone. Ryder Spring is a separate ground water system that serves a small portion of the population. The Ryder Springs water works facility is being replaced with a connection to the Bennington municipal system, a new distribution/storage reservoir and a new transmission and distribution water main.

3. Study Area Investigations

Over the course of the RI, a significant amount of data has been collected from the various investigations performed. Prior to presenting the results of these investigations, to facilitate review, we provide a brief narrative as to how this information is presented. The results of the investigations have been broken down into geologic, hydrogeologic, surface water and sediment, and air quality investigations. These investigations are further subdivided to discuss the components of each investigation (i.e., geophysical surveys, soil vapor surveys, test pit installations, surface soil sampling and soil borings which make up the geologic investigation). To gain a perspective of the phased approach and the information obtained during each of the LFI, Phase 1A, Interim Sampling, and Phase 1B programs, the components are discussed in phases (LFI geophysical surveys, Phase 1A geophysical surveys, etc.).

The information presented in the text has been compiled on several important tables and figures which are referenced throughout this chapter. Tables 17 to 22 (Summary of Detected Parameters), present VOC, SVOC, and PCB concentrations which exceeded detection limits and inorganics above regulatory limits on a media-specific basis. Each of these tables is subdivided into specific areas of the Site (Marshy Area, Hillside Area, etc.), and include a comparison to regulatory limits. In addition, Tables 23 to 33 (Summary of Soil and Ground Water Results) present ranges of concentrations detected for each parameter analyzed on an area-by-area basis. These tables can be used to identify the contaminants of concern in each area of the Site, the range and maximum concentration of each contaminant, and the location of the maximum concentration.

Figures 26 to 31 present surface soil, soil boring, ground water, surface water, sediment and leachate results for organic and inorganic constituents.

3.1. Field Investigations

The following section describes the field investigations that were completed throughout the course of the remedial investigation. This section includes geophysical investigations, soil gas surveys, test pits, soil/sediment sampling, air sampling, and soil boring/well installations.

3.1.1. Site Survey

Sampling points and monitoring wells were surveyed by Foresight Land Services, Inc. (FLS) of Pittsfield, MA. The vertical datum used is the USGS Benchmark, Bennington (Elevation 961.185 feet msl). A level loop was carried to temporary benchmarks at the Site. The horizontal datum was from a plan entitled "Industrial Waste Site", dated May 1979 by Gerald E. Morrissey. The horizontal locations were converted to latitudes and longitudes by a software program in which a prime coordinate value was compared to Northings and Eastings from the Site. Survey data developed by FLS is presented in Appendix 10.

3.1.2. Geophysical Surveys

A series of terrain geophysical surveys was completed over the landfill and surrounding areas during the course of the program. The goal of the surveys was to provide an assessment of the subsurface geology and nature of landfill materials such that borings and wells could be appropriately located. The surveys included Ground Penetrating Radar (GPR) seismic refraction, and an electromagnetic survey. These surveys were intended to supplement previous magnetometer, seismic refraction, and gravity surveys conducted by Zonge Engineering and Research Organization (Zonge) in 1988.

Limited Field Investigation - Ground Penetrating Radar (GPR) Survey

Objective and Methods. The original objective of this survey was to evaluate the boundaries of the landfill, its constituents, and shallow subsurface stratigraphy. The GPR survey is conducted by traversing the study area with a high frequency transmitting and receiving device and evaluating the difference in wave velocities.

Results. The results of this survey were somewhat limited due to signal attenuation. The complete report of the GPR survey conducted by Hager-Richter Geoscience, Inc. (HRG) is presented in the Limited Field

Investigation Report, Burgess Brothers Superfund Site, O'Brien & Gere Engineers, Inc., 1992. For informational purposes, the results of the GPR survey, as reported by HRG, are summarized below.

- The approximate lateral extent of the Landfill Area was defined on the basis of the GPR records. However, the thickness of the landfill could not be evaluated reliably due to attenuation of the signals in the upper silty cap or fill anomalies associated with the landfill. Some anomalous objects were noted in the landfill and are depicted aerially and vertically on maps and cross sections in the report.

- The natural kame sands were interpreted to be relatively flat-lying to the north and west of the landfill. An irregular stratigraphic boundary at a depth of approximately 45 to greater than 50 feet was interpreted on the west side of the landfill which may indicate contact of the kame sand with the stony till or bedrock. Ground water in this area was interpreted to occur at a depth of 20 feet.

- A narrow plateau south of the toe of the landfill was interpreted to consist of undisturbed natural kame sands. The GPR signal was attenuated at a depth of 30 feet, possibly indicating the stony till layer or bedrock. Ground water in this area was interpreted to occur at a depth of 10 to 12 feet.

- The Marshy Area to the southeast of the landfill was interpreted to be characterized by flat-lying, undisturbed sediments with water table near the surface. A stratigraphic boundary at a depth of approximately 12 to 15 feet may represent the stony till layer.

The results of the GPR survey suggested that the till layer dips to the west beneath the kame sand. Based on the depth to the top of till and typical till thicknesses in the area, the depth to bedrock was estimated to range from 20 to 30 feet just east of the landfill to 75 feet immediately west of the landfill. Further west, near the access road to the Site, depths to bedrock were estimated to become shallower (30 to 50 feet) where the kame sand pinches out. No appreciable clay layer was identified in the GPR data. The nature of the landfill materials, kame sand and till thickness was later further defined based on the completion of soil borings and test pits.

Phase 1A RI Geophysical Surveys - Seismic Refraction

Objectives and Methods. Previous geophysical surveys conducted at the Site by Zonge (1988) indicated that the depth to competent bedrock could not be confirmed, but the data suggested a possible fault zone traversing the Site from southwest to northeast. Recommendations from this study

included drilling a pilot bedrock hole and conducting additional gravimetric surveys or conducting a seismic refraction survey to further define the true depth to unweathered bedrock.

A seismic refraction survey was chosen to be conducted around the Landfill Area in this program, based on prior results of a GPR survey conducted in the LFI and a water well record search which suggested that, generally, competent bedrock may lie within 100 feet of the ground surface. The objective of the seismic survey was to delineate a continuous profile of the unweathered competent bedrock surface along four transects surrounding the Landfill Area. The results of the survey were also designed to be used to assess the approximate elevations of the water table, the top of glacial till and competent bedrock surfaces around the Landfill Area.

The seismic refraction survey was conducted in accordance with the procedures outlined in the RI Work Plan, with one exception. A sledgehammer was used as an energy source in place of a Betsy Seisgun. O'Brien & Gere directed HRG to use the sledgehammer, considering health and safety concerns related to the use of the Betsy Seisgun. HRG indicated that the sledgehammer, as an alternate energy source, would provide equivalent energy to the Seisgun. A "raw" seismogram has been attached to the Seismic Survey Report which is provided in Appendix 11. The seismogram is an example of the quality of the seismic refraction data obtained using the sledgehammer source.

Results. A preliminary table summarizing the estimated elevations of the water table, top of ablation till, and the tentatively identified top of competent bedrock was submitted to O'Brien & Gere on October 2, 1992. In providing this data, HRG cautioned that the bedrock surface was tentative based on calculated velocities of 9000 feet per second (fps) and required confirmation from boring data. Typically, bedrock velocities have been shown to range from 8000 to >12,000 fps (Redpath, Bruce B., May, 1993). Therefore, this velocity was included in the range typical of that for bedrock, but was on the lower end of the range. The depth of the tentatively identified "bedrock" surface was 48 to 92 feet below grade. During the conduct of the boring program, it became apparent that the top of "bedrock" predicted by HRG was accurate. The bedrock top identified, however, was the top of the completely weathered bedrock. The thickness of the weathered rock precluded detection of the true competent bedrock surface during the geophysical studies.

The final results of the seismic survey interpretation were formally submitted to O'Brien & Gere in July 1993 after information regarding the

true depth to competent bedrock was confirmed by deep test borings at the Site. The following provides HRG's final interpretation of the data submitted in July, 1993 after review of deep boring data:

- Depths of the water table at the time of survey were between about 3 and 17 feet below ground surface (elevations between 1,137 and 1,073 feet). The water table was located within unconsolidated sediments, probably the kame sands described in boring logs.

- Till of unknown thickness occurred at a depth between 14 and 36 feet below ground surface (elevations between 1,128 and 1,051 feet).

- The transition from till to deeply weathered bedrock, indicated from borings to occur at depths between about 45 and 90 feet at the Site, could not be identified because of the lack of contrast in seismic velocity between the two materials.

- Velocities typical of competent bedrock were not detected in this survey. Based on the configuration of the seismic lines and offset shotpoints, the seismic data indicate that the depth of competent bedrock is at least 170 feet at the Site which was consistent with boring data which indicated depths to competent bedrock of 230 to 412 feet.

A copy of the final report is attached as Appendix 11. In addition to discussion of the survey procedures and results, the report includes a table of seismic refraction results along with seismograms for seismic lines A, B1, B2, C, and D.

Phase 1B RI - Electromagnetic Geophysical Survey

Due to data gaps identified in the Phase 1A program, an electromagnetic (EM) survey was conducted in May 1994 by Hager-Richter Geoscience, Inc. (HRG). The survey was conducted to evaluate the possible presence of buried metal objects and/or pools of highly conductive leachate within the landfill, to detect and delineate a potential conductive leachate plume, if present, migrating from the landfill in the upper kame sand and ablation till units and to locate suspected buried drums. Objectives, methods and results are as follows. The HRG report is presented in Appendix 12.

Objectives and Methods. The survey was concentrated in three specific areas noted as Study Zones 1, 2, and 3. The objective at each zone was as follows:

- **Study Zone 1** (East and Northeast side of landfill):

evaluate possible concentrations of buried metal objects and/or pools of highly conductive leachate

- **Study Zone 2** (West of Landfill):
  detect and delineate potential conductive leachate plume

- **Study Zone 3** (West Side of Landfill):
  locate suspected buried drums

Prior to initiating field work, a land survey was conducted by FLS in the areas of the proposed EM (31 & 34-3) surveys. Survey lines are depicted on Figure 2 in each respective study zone.

Prior to gathering landfill data, background readings were collected in proximity to monitoring well W-01 and W-01 DI. Background data were necessary to evaluate instrument shifts and establish background values.

The EM survey for Study Zone 1 was conducted using the Geonics EM 31 terrain conductivity meter. The survey was conducted using the vertical dipole mode, recording data at 10-foot intervals along lines spaced 20 feet apart. Data for both the quadrature-phase and in-phase components were recorded. Contour plots of the EM31 data were generated on-site.

The EM survey for Study Zone 2 was conducted using the Geonics EM31 and the Geonics EM34-3 terrain conductivity meters. EM data were collected along two parallel traverses located approximately 150 feet apart. The data were recorded at 25-foot intervals in the vertical and horizontal dipole mode with the EM31 and EM34-3, and using intercoil separations of 10 to 20 meters with EM34-3., effectively exploring the apparent conductivity to nominal depths of about 9, 18, 25, 49, and 90 feet.

The EM survey for Study Zone 3 was conducted with the Geonics EM31. Both the quadrature-phase and in-phase components were recorded at 5-foot intervals along lines spaced 5 feet apart.

Results. The results of the EM survey as reported by HRG are as follows:

Study Zones 1 & 3. (Section 3.2.1, Geophysical Surveys, page 66) The combined results of the terrain conductivity survey for Study Zones 1 and 3 are presented on Figures 2 and 3 of the HRG Report (Appendix 12), which depict color contour plots of apparent terrain conductivity and the in-phase component, respectively. Apparent terrain conductivity data are useful for detecting;

- the presence of anomalously conductive ground, which might be caused by the presence of conductive fluids and/or soils such as contaminant plumes with electrical properties unlike those of the natural materials on-site; and

- metal objects.

The measured values of apparent terrain conductivity represented by green on Figure 2 of the HRG report are close to background for most of the area northeast of Grid Line 1. This area is interpreted to be natural, and the edge of landfill, as interpreted from the EM data, is shown as a heavy dashed line on Figure 2 of the HRG report. Four EM anomalies are located to the north of the fill/natural boundary, two of which are attributed to surface debris, and two to small buried metal objects.

On both Figures 2 and 3 of the HRG report, scattered zones of bright blue and red represent locally anomalous positive and negative values of apparent terrain conductivity and/or in-phase component that are typical patterns associated with metal objects. Some of the anomalies are attributed to areas of surface debris containing metal, and are marked such on Figure 4 of the HRG report. All other anomalies are attributed to buried metal objects. The small anomaly located at (T, 7.5) is attributed to buried objects, and is in the approximate location of the reported buried drums of Study Zone 3.

The large area of elevated conductivity located in the south central portion of Study Zones 1 and 3, represented by orange (greater than 10 and less than 20 mmho/m) on Figure 2 of the HRG report, is attributed to conductive soils or fluids. This area is outlined in Figure 4 of the HRG report.

Five objects, interpreted from the GPR data (1992) to be possible buried metal objects, are shown on Figure 4 of the HRG report with an X. Only two of the GPR anomalies lie within an area interpreted to contain buried metal from the EM data. The three remaining buried objects are attributed to non-metallic sources. The extent of landfill, as identified by the GPR survey (1992), outlines the area of elevated conductivity of soil and/or fluids inferred from the EM data.

Study Zone 2. Terrain conductivity profiling was conducted along two lines. Figures 5 and 6 of the HRG report are profile plots of the apparent terrain conductivity measured along lines 1000 and 2000, respectively.

The values of apparent conductivity measured in both the vertical and horizontal dipole modes range from about 9.5 mmho/m, west of the Soil

Staging Area, to about -1.0 mmho/m in the same general area. In particular, the apparent terrain conductivity values measured along Line 1000 are significantly elevated and variable from 300 to 600 feet. The in-phase component, as measured with the EM31 and shown in Figure 7 of the HRG report, is also elevated in this area indicating the presence of metal. It was inferred by HRG that the apparent terrain conductivity values measured along this section of Line 1000 were likely affected by either the 20,000-gallon storage tank located on the surface 30 feet west of the line, or by buried metal in the area. The values along the remainder of Line 1000 vary fairly smoothly from 0 mmho/m to 3 mmho/m, and do not indicate the presence of a conductive plume in this area.

The values of apparent conductivity measured in both the vertical and horizontal dipole modes along Line 2000 vary fairly smoothly from about 0 mmho/m to 2 mmho/m, and do not indicate the presence of a conductive plume in this area.

Geophysical surveys were used to evaluate the apparent boundaries of the landfill, provide information relative to shallow subsurface stratigraphy, and identify anomalies attributed to buried metal objects, conductive soils or fluids and surface debris. The depth to weathered bedrock was identified, however, the thickness of the weathered bedrock precluded detection of the competent bedrock surface.

3.1.3. Soil Vapor Survey

Soil vapor surveys were performed by O'Brien & Gere as part of the LFI and Phase 1A RI. A summary of these two surveys follows.

Limited Field Investigation - September 1992

Objectives & Methods. The objective of this survey was to evaluate the areal distribution of subsurface VOCs in the vicinity of the Former Lagoon Area. Due to the varying topography in and around the lagoon, several sample matrices were collected including surface water and sediment, shallow ground water (water table), deeper ground water (7 to 15 feet below grade), shallow soils, and soil vapor. Samples were secured as identified in the LFI, briefly consisting of:

- aluminum shield points and teflon tubing for soil vapor
- stainless steel bailer for deep ground water

- stainless steel core for surface soil

- Tygon® tubing and pipet for shallow ground water

The vapor screening survey included on-site analysis of soil vapor, soil headspace and water headspace. Soil and ground water samples were placed in a glass vial, heated and agitated to allow for volatilization of VOCs into the vapor phase. The resulting headspace vapor was then extracted for analysis by a portable gas chromatograph.

Results. Chlorinated VOCs, PCE, and TCE were the major constituents observed in and around the Former Lagoon Area, along with degradation products of these compounds. The VOC residues were observed at the highest concentrations in the landfill from the access road south to the lagoon and along the toe of the landfill within the Marshy Area.

Contaminant concentrations dropped off to near background to the east and south of the unnamed stream and tributary system and west of the landfill. Near background concentrations were observed north of the landfill.

Phase 1A RI - Soil Gas Survey

The soil gas survey was expanded under the Phase 1A RI to evaluate the distribution of VOCs in the Hillside and Soil Staging Areas and to aid in the selection of locations for shallow ground water monitoring wells and surface soil samples.

Objectives & Methods. A soil gas survey was performed by O'Brien and Gere in accordance with the RI Work Plan and the Work Plan revisions described in the September 25, 1992 O'Brien & Gere letter to USEPA.

The objectives of the survey were to:

- Evaluate the distribution of VOCs at three depths in the Hillside Area (south of Drainage Swale No. 1) to evaluate whether VOCs observed during the LFI are attributable to a surface source or a dilute ground water plume.

- Tentatively identify the chemical composition of subsurface VOCs detected during the survey.

- Generate spatial data to aid in the selection of locations for shallow ground water monitoring wells and surface soil samples.

- Assess the aerial extent of elevated soil gas concentrations detected north of the access road along the Woodford town line near the Soil Staging Area.

A total of 26 samples were collected from 20 locations in the Hillside and Soil Staging Areas. Included were 22 soil gas and 4 ground water headspace samples. The sample depths at each of the 20 locations are indicated on the soil vapor survey results summary table (Table 34). Sampling locations are designated by an "SG" symbol and are shown in Figure 32. Soil gas depth profiles were performed at nine sample locations positioned on a 200-foot grid in the Hillside Area designated SG-1 through SG-9. The soil gas samples installed near the Soil Staging Area, were designated SG-10 through SG-21, and were positioned on a 100-foot (south-north) by 50-foot (east-west) grid. Soil gas sampling locations SG-18 and SG-19 were moved 30 feet to the east because they were situated on top of a topsoil staging pile. Soil gas sampling location SG-16 was moved approximately 50 feet west of SG-11 (north of the access road) and relabelled SG-21. The former SG-16 location was moved because it was also situated on top of a topsoil staging pile. The SG-21 location was selected to confirm findings at SG-11 and SG-12.

The soil gas survey was performed in accordance with the method described in the RI Work Plan. Soil gas samples were collected using dedicated aluminum shield points attached to a length of teflon tubing. The teflon tubing/shield point assembly was driven to depth using hardened steel probes (7/8-inch OD) and an electric impact hammer. Prior to collection of a sample, the hardened steel probe was retracted 2 to 6 inches to expose the gas intake slots of the shield point. A sample was collected by connecting a 50 ml ground glass syringe, equipped with teflon stopcock, to the teflon tubing/shield point assembly and drawing back the plunger. Two 50 ml volumes of gas were purged from the syringe prior to collection of the sample for analysis to flush the sample collection apparatus of any residual ambient air. The apparatus was flushed so that the sample collected for analysis was representative of the soil gas.

The soil gas depth profile samples were scheduled to be collected at depths of 1, 4, and 7 feet in the Hillside Area. However, subsurface conditions including the presence of obstructions, boulders and/or the water table, resulted in sample collection at various depths, as indicated on Table 34 and Figure 32. The soil gas samples collected in the Soil Staging Area were collected at a depth of 3 feet to provide data consistent with the data that were collected during the LFI. At SG-1, SG-3, SG-4, and SG-15 the ground water table was encountered before the desired soil depth was reached.

Samples from these locations were collected as water samples, and headspace analysis was performed in accordance with the ground water headspace protocol presented in the RI Work Plan.

Soil gas samples were analyzed on-site using a Photovac 10S70 portable gas chromatograph equipped with a CPSIL-5 capillary column, isothermal column oven and 10.6 eV photoionization detector. Prior to analysis of soil gas samples, a four-point calibration was performed for the following compounds:

- trichloroethene (TCE)
- tetrachloroethene (PCE)
- vinyl chloride
- trans-1,2-dichloroethene (t-1,2-DCE)
- 1,1-dichloroethene (1,1-DCE)
- 1,2-dichloroethene (1,2-DCE)
- 1,2-dichloroethane (1,2-DCA)
- 1,1,1-trichloroethane (1,1,1-TCA)
- benzene
- toluene
- ethylbenzene
- xylene

Included was a zero level standard or method blank and three concentration levels of each standard. A four-point calibration was performed for benzene, toluene, and xylene (BTX) prior to the analysis of samples each day. A BTX standard was also run after every ten samples. Analysis of soil gas samples was initiated by direct injection of an aliquot of gas into the portable gas chromatograph. The output of each analysis is a chromatogram with a series of peaks on a strip chart which correspond to the constituents present in the sample.

Soil gas concentrations were calculated using a least squares regression on calibration data to develop an equation relating peak area to the sample concentration for each standard. Results of the sample analyses were quantified by comparison to calibration equations. The initial calibration was performed to establish retention time windows and response factors for each of the calibrant compounds. The daily BTX calibration (continuing calibration) was performed throughout the sampling effort. The retention times and peak areas for BTX for each continuing calibration were compared to initial calibration results to verify that instrument performance

was consistent throughout the soil vapor sampling program. An example of the calibration equation is provided in Appendix 13. Sample peaks which were consistent with a calibrant standard, on the basis of retention time, were quantified using the corresponding calibration equation. Sample peaks inconsistent with a calibrant standard were grouped, labeled "Other VOCs" and quantified using an average of the BTX calibration equations. The concentration of calibrant peaks plus "Other VOCs" equals "Total VOCs". Detection limits for each calibrant standard were calculated by placing the minimum detectable area (50 millivolt seconds) into the calibration equations.

Results. Results of the soil gas sampling are summarized in Table 34. Total VOC concentrations are shown on Figure 32. Also shown are results obtained during the LFI and previous investigations conducted by others. The data presented in the ISCR were designed to augment soil gas data collected in the LFI and prior studies. For the Hillside Area, depth to ground water ranged from 12 inches to 3 feet below grade. Depth to ground water in the Soil Staging Area was approximately 5 to 8 feet below grade. The following describes the results by area surveyed.

Hillside Area. Bouldery conditions were encountered at eight of the nine depth profile locations (SG-1 through SG-9) in the Hillside Area. Consequently, SG-7 was the only location at which samples were collected at the desired depths of 1, 4, and 7 feet. At locations SG-1, SG-3, SG-8, and SG-9, a maximum sampling depth of 4 feet was obtained, while refusal was encountered at a depth of 2 feet at locations SG-2, SG-4, and SG-6.

Relatively low detectable concentrations of VOCs were measured in 8 of the 15 samples collected from the Hillside Area. Calibrant compounds detected in these samples included TCE, PCE, and toluene. Compounds were detected at the shallow, intermediate, and deep intervals of the profiles. TCE was detected at a concentration of 0.009 parts per million by volume (ppmv) in sample SG-3 (1 foot). PCE concentrations ranged from 0.02 ppmv in sample SG-7 (7 feet) to 0.18 ppmv in sample SG-3 (1 foot). Toluene concentrations ranged from 0.01 ppmv in headspace sample SG-4 (2 feet) to 0.06 ppmv in sample SG-7 (4 feet). Sample SG-1 (1 foot) exhibited the highest total VOC concentration at 3.9 ppmv. This concentration was comprised entirely of non-calibrant compounds ("Other VOCs").

These results indicate a diffuse pattern of low VOC concentrations in this area and do not indicate a single-point source of concern although concentrations appear to be increasing toward the west in the direction of

the unnamed stream. The results of ground water testing in this area described in Section 3.2.5 indicate detectable VOC concentrations in only one of two sampling rounds occurring on 5/24/93 and 6/22/93, and included toluene at 12 ug/l and xylene at 5 ug/l at W-24 T (second round). Based on these results, this area does not appear to represent a source for significant release of VOCs to the environment.

Of the three depth intervals, the highest total VOC concentrations were observed in the shallow depth interval. However, limited data were obtained on the 7-foot depth interval due to boulders and/or shallow bedrock conditions in the area. With the exception of acetone (18 μg/kg) and 1,2-DCE (16 μg/kg) at SP-21, no volatiles were detected in two surface soil samples collected in this area. It should be noted that with exception of sample SG-1 (1 foot), VOC concentrations were observed at trace levels.

Soil Staging Area. Ten soil gas (SG-10 through SG-14 and SG-17 through SG-21) and one ground water headspace sample (SG-15) were collected from the Soil Staging Area. Each of the samples was obtained from a depth of 3 feet below grade.

Detectable concentrations of VOCs were observed in ten of the eleven samples. Total VOC concentrations detected in these samples ranged from 90 ppmv in headspace sample SG-15 to 838 ppmv in soil gas sample SG-11. Calibrant compounds detected in samples collected from the Soil Staging Area included TCE, PCE, trans-1,2-dichloroethene (t-1,2-DCE), 1,2-dichloroethane (1,2-DCA), 1,1,1-trichloroethane, (1,1,1-TCA), benzene, toluene, ethylbenzene, and xylene. The chromatographic pattern for samples collected in this area was consistent with that of a petroleum hydrocarbon residue. The highest total VOC concentrations were observed in samples SG-11, SG-12, and SG-13 situated along the western boundary of the sampling grid. Total VOC concentration dropped off as sampling proceeded in the northern direction from sample SG-11 to SG-13.

The detection of BTEX compounds and their distribution is consistent with information concerning the salvaging of fuel tanks reportedly done in this area. Volatiles measured in soil sample headspace from borings conducted in this area (W-07 S1, W-07 DI) were obtained over a depth interval of 0 to 55 feet and 218 to 230 feet. Detectable PID readings ranged from 1 to 38 ppmv in the interval of 0 to 55 feet and 0.6 to 4 ppmv from 218 to 230 feet. The highest reading found in this range was 38 ppmv at a depth of 2 feet.

The results of the soil gas testing indicated that the point with the greatest concentration of volatiles (SG-11 at 838 ppmv) consisted of mostly "other unidentifiable VOCs" with some toluene and xylenes. Some aromatic

volatile constituents were also detected at much lower concentrations in points SG-15, SG-17, SG-18, SG-19 and SG-20 located to the east in the Soil Staging Area.

The VOCs: TCE, PCE, 1,2-DCA and 1,1,1-TCA were detected with benzene in points SG-12 and 13 located to the north of SG-11. Total volatile concentrations in these points were 38.6 and 30.9 ppmv respectively. A lower total volatile concentration of 1.19 ppmv consisting of t-1,2-DCE and TCE was detected at SG-10 located southwest of SG-11.

The data are consistent with the reported salvaging of fuel tanks and the release of some solvents in the area of SG-10, SG-12 and SG-13.

Excavations for borings conducted in this area revealed some detectable diesel fuel-like odors in a stiff sandy silt layer. PID tests conducted from soil samples collected from well nest W-07 in the area indicated some slight potential impact to a depth of 55 feet. Soil gas surveys were completed to define the distribution of VOCs in surface soils. The results were used to select locations for surface soil sampling and shallow ground water monitoring wells.

3.1.4. Test Pit Installation

A test pitting program was performed as part of the Phase 1A RI and Phase 1B RI. Test pits were installed to identify and delineate potential landfilled materials or the presence of buried drums. Phase 1A test pits were completed in the Landfill Area, Bend in the Road Area, and Soil Staging Area. The Phase 1B program focused on delineating the limits of the landfill (along the northeast perimeter), the limits of the lagoon cell boundaries, and investigation of anomalies identified in the EM survey. A Sample Analysis Inventory (Table 35) presents test pit sample locations, area of Site, depth of samples and analyses requested. Results of the test pit program are presented in Appendix 14. A detailed description of these test pitting events follows.

Phase 1A RI: Test Pitting Program

Objectives & Methods. Following a review of soil gas data collected near the Soil Staging Area north of the access road, a test pitting program was conducted to evaluate the nature and extent of landfill materials in the Soil Staging Area and along the northern and western Landfill Area boundaries. Additional test pits were installed in the Bend in the Road to assess whether lead plater sludge had been deposited in that area, upon reviewing historical

aerial photographs which suggested potential areas of unknown fill material at grade. Test pit logs are provided in Appendix 14. Methods and findings are described in the following sections.

Landfill Test Pits. In the process of preparing to conduct soil borings SBW-16 and SBW-19 on the western edge of the Landfill Area, it was learned from Burgess Brothers personnel that this area had historically been the site of heavy filling operations. Burgess Brothers personnel indicated that the drilling equipment may encounter large buried objects and/or drums in this area. Based on this information, O'Brien & Gere proposed to install test pits at each of the two boring locations (SBW-16 and SBW-19) to visually inspect potential drums that may be at this location. Test pits were completed with a backhoe to an average depth of 12 feet. Soils encountered during excavation were photographed, logged according to the Wentworth Scale, field screened by a PID, and were visually observed for staining, discoloration, or the presence of separate phase liquids or solids. Soils were temporarily contained on 6-mil plastic sheeting in the event that drums were excavated. Following the completion of each pit, excavated materials were backfilled and the soil borings were installed. No drums were encountered. The fill material of TP SBW-16 and TP SBW-19 on the western Landfill Area boundary contained mixed municipal-type refuse consisting of newspaper, wood, steel, cardboard with a black charcoal and cinder layer at 6-7 feet in TP SBW-19. The layer contained a slight petroleum odor. A newspaper dated 1977 was found in the fill at this location.

Bend in the Road. Based on review of aerial photographs and historical information relative to Site disposal practices, USEPA requested that the area along the Site access road, referred to as the "Bend in the Road", be investigated on a screening level as a possible former Site for disposal of lead plater sludge. The purpose of the field verification testing was to evaluate the possibility that plater sludge was deposited in this area.

Soils encountered during excavation were logged according to the Wentworth Scale, field screened by a PID, and were visually observed for staining, discoloration, or the presence of separate phase liquids or solids. Sampling was performed in accordance with the RI Work Plan. One composite soil sample from each test pit consisting of an equal volume of soil at 1-foot intervals to a maximum depth of 5 feet was collected. Soil samples were submitted to OBG Laboratories, Inc. for chromium, lead, manganese, mercury, nickel and zinc analyses as indicated in Table 35. Following the completion of each pit, observations were made for the presence of ground water. Excavated materials were backfilled and each pit was staked, surveyed and labeled.

Visual observations of soils in the test pits indicated that for most of the pits, reworked natural soil fill was present to a depth of about 3 feet, which was then underlain by undisturbed kame sand. No discoloration attributable to plater sludge was observed. No separate phase liquids or ground water were encountered.

In pits BRP-5 and BRP-6, some minor pieces of glass, rubber, and metal were noted, typical of surface debris in the area. At BRP-10 located in the southern end of the area, where some turbines and other metal debris were located, a dark brown silty kame sand, cinders, burnt wood, and wood chunks were noted in fill to a depth of 3 feet. Visual observations and PID measurements were used to select soil sampling locations. PID values ranging from 5 to 96 ppmv were detected in test pits BRP-1 through BRP-4 and BRP-8 through BRP-10. However, for the most part, PID readings were below 50 ppmv. With the exception of soils at BRP-9 and BRP-10, the visual appearance of soils indicated little or no disturbance and potential for disposal of materials. In pits BRP-9 and BRP-10, some burnt wood and cinder fill was noted. The source of the PID readings is not known. It is possible that some residual methanol was left in the headspace jars as they were re-used and decontaminated between testing events.

It has been reported in the June 15, 1992 letter to USEPA that old cars were staged at this area prior to salvaging. Residual fuel amounts may have contributed to these readings, but no fuel staining was observed.

Ten soil samples were collected and analyzed for chromium, lead, manganese, mercury, nickel, and zinc as indicated in Table 35. A review of the analytical results indicates that chromium, lead, manganese, nickel and zinc were detected in each sample. Mercury was not detected in any of the samples. The analytical data are presented in Table 33 of Appendix 15. Results were compared to background concentrations. The metal concentrations considered to be background for the native kame sand like that in the Bend in the Road were collected from W-01 S1 (6 to 8 feet). Metal concentrations at the Bend in the Road were within an order of magnitude of background concentrations. A detailed discussion of background metals concentrations is presented in Section 3.1.6, Phase 1A RI - Soil Borings.

In summary, the available visual, field screening and laboratory data indicate that minor amounts of residual waste material such as petroleum products may have been disposed of in this area. No evidence of sludge or concentrated waste materials, however, were observed.

Soil Staging and Landfill Area. Six test pits were installed along the access road near the Soil Staging Area, denoted as TP-1 through TP-6, to evaluate the nature and extent of landfill materials. The tests pits were completed with a backhoe to an average depth of 7 feet. Soils encountered during excavation were photographed, and logged according to the Wentworth Scale. Landfilled materials or other soils were field screened by a PID and were visually observed for staining, discoloration, or the presence of separate phase liquids or solids. As with the Bend in the Road test pits, observations were made for ground water. Samples for laboratory analysis were not collected from test pits in this area. Excavated materials were backfilled following completion of the pit, and each pit was staked, surveyed, and labeled.

Results of the test pitting in the Soil Staging Area, along the northern Landfill Area boundary, and near the access road indicated that fill materials were encountered in TP-2 and TP-3. No fill materials were encountered at TP-1, TP-4, TP-5 or TP-6. Fill materials at TP-2 and TP-3 contained mixed municipal-type refuse with plastic, pans, shoes, tin, rubber, hair spray containers. PID values from these pits ranged from 1 to 22 ppmv.

Phase 1B RI - Test Pitting Program

Objectives & Methods. Test pitting activities were focused within the Landfill Area and suspected Former Lagoon Area. The objectives of the test pitting program were to:

- characterize nature and extent of contamination within the landfill
- further assess extent of landfill material along northeastern perimeter
- estimate the volume of landfill materials
- delineate lagoon cell boundaries
- evaluate EM anomalies within the landfill and the presence of reported buried drums along the western edge

To meet these objectives fourteen test pits were completed using an excavator operated by a Burgess Brothers employee, OSHA trained for health and safety at hazardous waste sites. Prior to commencing excavation activities and between each test pit the excavator was steam cleaned to prevent potential cross contamination between test pits.

Excavated soil was segregated into piles representing 2-foot depth intervals. Soil samples were then collected from each pile for headspace screening. Excavated material was then visually logged in accordance with the Wentworth Scale, fill materials noted, and photographs taken. Samples having a headspace reading greater than 10 ppmv were further screened for Non Aqueous Phase Liquids (NAPL) using an ultraviolet (UV) lamp. UV soil screening was performed at the end of each day. Bright sunlight does not allow for accurate identification of fluorescent material and as such UV screening was performed in the field trailer. Prior to UV soil screening, a soil sample containing petroleum residues was screened. The UV screening procedure is presented in Appendix 17. This sample indicated a positive fluorescent response, which was used to compare to environmental samples. Test pit logs and photographs are presented in Appendix 14.

Upon completing soil screening activities, samples were collected for laboratory analyses consisting of: volatiles, semi-volatiles, metals or PCB/pesticides based on the Sample Analysis Inventory presented in Table 35. Sample intervals were selected based on soil screening (PID and UV), visual observations of staining or discoloration and odor. Soil sample intervals and parameters at TP-15, TP-16 and TP-17 were selected for laboratory analysis based on the potential presence of leaking drums or significant staining adjacent to drums. If headspace readings were less than 50 ppmv, a soil sample was analyzed for TAL metals. If headspace readings exceeded 50 ppmv, TAL metals and VOC analyses was performed. If drums were not encountered, soil samples were not collected for laboratory analysis. The goal of the sample selection program was to develop the profile of constituent concentrations in the pit that could be later used in calculations for volumes of waste material present.

Samples were collected from the backhoe bucket or from segregated piles next to each pit using a decontaminated stainless steel spoon and bowl. Volatile samples consisted of a collection of soil from five points within a suspect area, but not composited. Samples were placed directly into a 4 oz. teflon-lined jar without headspace. Samples scheduled for metals, PCBs and semi-volatile analysis were comprised of soil from five locations within a suspect area. These five parts were then composited, transferred to a 16 oz. teflon-lined glass jar and put on ice. Sample locations, depths and results are outlined on Table 31 of Appendix 15.

Prior to backfilling at test pit locations TP-13, TP-15, TP-16, and TP-17 a cement/bentonite grout mixture was placed from the bottom of the trench to the top of native material followed by backfilling. Remaining test pits were not backfilled with bentonite/cement grout, due to USEPA's concern

that these buried cement pads could impede future remedial efforts. Pits were backfilled in 24-inch lifts in the order in which soils were removed. The findings of these investigations are described in the following section.

Results. The findings of the test pitting program have been divided into two sections: 1) Former Lagoon Area and 2) other landfill areas due to the distinct differences in fill materials and constituents observed in the field. In addition, fill types have been divided into three main groups, as described below.

1. **Industrial Type Waste** - Fill material exhibiting PID soil screening results above 50 ppmv, and waste materials including but not limited to batteries, drums, sludge material and fuel storage tanks in some instances.

2. **Municipal Type Waste** - Fill exhibiting soil screening results generally below 50 ppmv, and household waste materials, municipal refuse, and white goods (dryers, washers, furnaces, etc.).

3. **Fill Cover** - Kame sand and cover material taken from the nearby "sand quarry".

Former Lagoon Area. Based on information gathered during the Phase 1A RI and discussions with Burgess Brothers personnel, two distinct lagoon cells were reported along the southern edge of the landfill. Lagoon Cell 2 at the southern extent of the landfill is located within a hazard control fence and represents the latest lagoon to be used. A depression in the landfill surface still remains above this cell indicating it was only partially filled in. Lagoon Cell 2 was observed to have industrial fill material in its southern half with soil screening results in some instances up to several thousand ppmv. The northern half of Lagoon Cell 2 consisted primarily of fill cover and municipal waste with soil screening results in the range of 24 to 520 ppmv. The absence of sludge and lower soil screening results along the northern half may be due to spillage of industrial materials in this part of the Former Lagoon Area that was used to unload materials into Lagoon Cell 2. This part of Lagoon Cell 2 doesn't contain industrial sludges. Cross-sections depicting this feature and other subsurface conditions are presented on Figure 11. The divide within this Former Lagoon Area is depicted on Figure 15.

Lagoon Cell 1 is the older of the two cells and is currently filled in and thus not visible at grade. This cell is located beneath the fractionating (frac) tank or north of Lagoon Cell 2 along the stone wall. The horizontal boundaries of these cells as defined from available information have been depicted on

Figure 15. The northern boundary of Lagoon Cell 1 was estimated based on discussions with Burgess Brothers personnel and the absence of concentrated municipal/industrial waste materials at TP-10, located along the east side of the frac tank. A detailed cross section through the lagoon is shown on Figure 11 for illustrative purposes.

Four test pits (TP-9, TP-10, TP-11, TP-12) were performed to characterize lagoon boundaries and constituents. Test pits 10 and 12 were extended as the program was conducted to reach the northern perimeter of Lagoon Cells 1 and 2. A description of fill materials, PID readings and analytical results above method detection limits by test pit follows. Metal concentrations were compared to a background range of kame sand developed from samples taken at W-01 S1 (6 to 8 feet) and W-01 DI (formally SI) (4 to 6 feet). A detailed discussion of background metals concentrations is presented in Section 3.1.6, Phase 1A RI - Soil Borings.

Two soil samples from each pit were submitted for laboratory analysis of VOCs (EPA method 8240)/TAL metals and one soil sample for SVOCs (EPA method 8270) and PCBs (EPA method 8080). PCB samples for TP-9 and TP-10 exceeded holding times in the laboratory and thus were not analyzed. Laboratory analytical results are summarized on Tables 30, 31 and 32 of Appendix 15.

Materials in test pit TP-9, which was located immediately south of the decontamination (decon) pad, consisted of municipal refuse (lawn chairs, scrap metal, plastic sheeting) and fine to medium kame sand cover and some boulders. PID soil screening and visual observations did not indicate the presence of VOCs or discoloration and thus TP-9 is believed to be outside the Former Lagoon Area Cells 1 and 2. No PID readings were observed to a depth of 10 feet in this pit. Soil sample intervals collected and analyzed included intervals 6 to 8 feet (VOCs, semi-volatiles, PCBs, metals) and 10 to 12 feet (VOCs, metals).

- **Organic:** Semi-volatile compounds were not detected in the 6 to 8 foot interval. VOCs detected at the 6 to 8 foot interval included TCE and PCE at 31 and 200 ug/kg, respectively. VOCs detected in the 10 to 12 foot interval included TCE and PCE at 8 and 44 ug/kg, respectively.

- **Inorganic:** Metals concentrations elevated one order of magnitude above background concentrations were detected at 6 to 8 feet for iron and lead and 10 to 12 feet for lead. Mercury (not detected in background samples) was detected one order of magnitude above the detection limit.

Materials in test pit TP-10, located along the east side of the frac tank, consisted of municipal refuse (household trash, rags, rubber tires, etc.) and sandy silt cover material. Inspection of the pit showed that the depth of fill materials increased along its western edge indicating Lagoon Cell 1 could be further to the west. Further excavation and visual observation of fill material to the west was not possible due to the frac tank and its associated containment berm. Test pit TP-10 was extended north until municipal fill material changed to sandy fill. Discussions with Burgess Brothers personnel indicated that household trash was put in Lagoon Cell 1 to level off the area prior to starting Lagoon Cell 2. Although no direct observation of industrial waste was observed in this pit, industrial waste believed to be associated with Lagoon Cell 1 was observed in adjacent pit TP-11. The PID data from this pit ranged from 72 to 230 ppmv throughout the fill material to a depth of 10 feet. Results of UV soil screening were negative. Soil sample intervals collected and analyzed included 2 to 4 feet (VOCs, semi-volatiles, PCBs, metals) and 8 to 10 feet (VOCs, metals).

- **Organics:** Semi-volatile compounds were not detected in the 2 to 4-foot interval. The sample collected from the 2 to 4-foot interval for PCB/pesticides exceeded its holding time in the laboratory and was not analyzed. VOCs detected at the 2 to 4-foot interval included cis-1,3-dichloropropene and tetrachloroethene at 44 and 690 ug/kg, respectively. VOCs detected at the 8 to 10-foot interval included tetrachloroethene at 13 ug/kg.

- **Inorganics:** Metals concentrations elevated one order of magnitude above background concentrations were detected at 2 to 4 feet for iron, manganese, mercury, nickel and 8 to 10 feet for mercury, nickel, and potassium. Metals concentrations two orders of magnitude above background concentrations were detected at 2 to 4 feet and 8 to 10 feet for lead.

Materials in test pit TP-11, located between the hazard fence and frac tank, consisted of layers of industrial and municipal type waste and cover kame sand to a depth of approximately 19 feet. The municipal refuse identified was mixed with kame sand cover to a depth of 10 feet. Industrial waste mixed with kame sand cover was noted from 10 to 19 feet. The industrial waste consisted of a white pasty sludge, miscellaneous electrical parts, and deodorant spray cans manufactured by Union Carbide. Municipal refuse consisted of household trash and some horse hair clippings. Underlying native soils were not encountered, due to unstable trench walls. The boundaries of Lagoon Cell 1 were inferred from this information. The PID data in this pit ranged from 8 to 62 ppmv from 0 to 10 feet where municipal

refuse was noted. PID values increased to 162 to 300 ppmv from 10 to 19 feet where industrial waste was noted.

Results of UV soil screening indicated a positive response when evaluating the observed white pasty sludge. Other materials did not show a positive response. Soil sample intervals collected and analyzed included 10 to 12 feet (VOCs, metals) and 17 to 19 feet (VOCs, PCBs, semi-volatiles, metals).

- **Organics**: VOCs detected at the 10 to 12-foot interval included 1,2-dichloroethene (total 1,2-DCE), TCE and PCE at 10,000, 36,000, and 72,000 ug/kg, respectively. Semi-volatile compounds and PCBs were not detected in the 17 to 19-foot interval. Volatile compounds detected at the 17 to 19-foot interval included TCE and PCE at 10 and 40 ug/kg, respectively.

- **Inorganics:** Metals concentrations elevated one order of magnitude above background concentrations were detected at 10 to 12 feet for potassium, zinc and 17 to 19 feet for copper, potassium, and zinc.

  Concentrations elevated two to three orders of magnitude above background concentrations were detected at 10 to 12-foot interval for chromium, copper, nickel and at 17 to 19-foot interval for nickel, and lead. Lead was detected in sample interval 10 to 12 feet at five orders of magnitude above background concentrations (498,000 mg/kg). Antimony and silver (not detected in background samples) were detected at one order of magnitude above the detection limit. Mercury (not detected in background samples) was detected two and three orders of magnitude above the detection limit at 10 to 12-foot and 17 to 19-foot intervals, respectively.

Materials in test pit TP-12, located on the northern side of Lagoon Cell 2, consisted of household trash, pallets, lumber and sandy silt to a depth of 12 feet. This pit was later extended further to the north to evaluate the northern berm. The thickness of fill materials was observed to decrease in a northerly direction, indicating that the base of the cell sloped to the south toward SBW-15. Industrial sludge-type waste was previously noted in SBW-15. The PID data ranged from 24-74 ppmv from 0 to 6 feet where primarily municipal refuse was noted. PID values increased from 6 to 16 feet to 166-520 ppmv. Results of UV soils screening were negative. Soil sample intervals collected and analyzed included 10 to 12 feet (VOCs, metals) and 14 to 16 feet (VOCs, semi-volatiles, PCBs/pesticide metals).

- **Organics:** VOCs detected at the 10 to 12-foot interval included PCE at 11 ug/kg. VOCs detected at 14 to 16-foot interval included PCE at 11 ug/kg. Semi-volatile and PCB/pesticide compounds were not detected.

- **Inorganics:** Metals concentrations elevated one order of magnitude above background concentrations were detected at the 10 to 12-foot interval for potassium and the 14 to 16-foot interval for nickel and potassium. Concentrations elevated two to three orders of magnitude above background concentrations were detected at 10 to 12-foot and 14 to 16-foot intervals for lead. Mercury (not detected in background samples) was detected one order of magnitude above the detection limit at the 10 to 12-foot and 14 to 16-foot intervals.

Landfill Area: Western Edge. Test pits TP-15, TP-16, and TP-17 were positioned along the western edge of the landfill in an area suspected to contain buried 55-gallon drums as reported by Burgess Brothers personnel. Fill material at these locations was generally 5 to 7 feet deep and consisted of varying amounts of municipal-type waste (kame sand, household trash, lumber, oil filters, plywood, steel cables, etc.). No 55-gallon drums were encountered. Headspace soil screening results ranged from 1.5 to 34 ppmv. No signs of soil staining or discoloration were evident and UV soil screening was negative. As a result, no soil samples were submitted for laboratory analysis per the Work Plan.

After consultation with USEPA, additional test pits TP-19 and TP-20 were positioned east and north, respectively, of TP-15, TP-16 and TP-17 in an effort to locate the reportedly buried drums. Test pit TP-19 was excavated to a depth of 22 feet below grade. Fill material consisted of industrial and municipal-type waste and layers of silty kame sand, specifically, roofing shingles, roofing tar buckets, plastic sheeting, household trash, building material and eight to ten crushed 55-gallon drums. Labeling on these drums was not decipherable with the exception of one drum, indicating "Eastern Chemical, Rensselaer, New York, Methyl Ethyl Ketone". As observed on the photographs following test pit log TP-19, drums were severely crushed and altered. The poor condition of these drums was due to activities prior to test pit activities. No NAPLs were observed and petroleum odors were significantly less than observations at Lagoon Cell 2. The PID results ranged from 4 to 32 ppmv at a depth of 0 to 14 feet in this pit. PID readings increased to 144 to 190 ppmv from 14 to 22 feet. Results of the UV soil screening were negative. Soil samples collected and analyzed at TP-19 included soil sample intervals 14 to 16 feet (VOCs, semi-volatiles, metals) and 20 to 22 feet (VOCs, semi-volatiles, metals). In addition one water sample was collected from a drum observed in the pit. The drum was distorted and badly compromised. The water is believed to be from

precipitation migrating through the soil column in this area and then pooling inside the drum. The sample was analyzed for VOCs (EPA Method 8240).

- **Organics:** VOCs detected at 14 to 16-foot and 20 to 22-foot intervals included TCE at 2,100 and 9,100 ug/kg, respectively. Semi-volatile compounds detected at the 14 to 16-foot interval included benzoic acid, 4-chloroaniline, and 2-methylnaphthalene at 630, 540, and 420 ug/kg, respectively. Semi-volatile compounds detected at the 20 to 22-foot interval included naphthalene and 2-methylnaphthalene at 3,800 and 5,400 ug/kg, respectively.

  VOCs detected within the drum water sample included vinyl chloride (350 ug/l); 1,2 dichloroethene (total)(1,125 ug/l); 4-methyl-2-pentanone (2,350 ug/l); toluene (175 ug/l); and xylene (total)(150 ug/l).

- **Inorganics:** Metals concentrations detected one order of magnitude above background concentrations were lead and nickel at the 20 to 23-foot interval. Mercury (not detected in background samples) was detected two orders of magnitude above the detection limit at 14 to 16-foot and 20 to 22-foot intervals.

Remaining analytes were below or within the same order of magnitude of background concentrations or were below detection limits. Test pit TP-20 was performed north of TP-17. Fill material consisted primarily of typical newspaper and silty kame sand cover. No drums were encountered. Soil screening PID values ranged from 5 to 32 ppmv in this pit from 0 to 16 feet. Results of the UV soil screening were negative. No soil samples were submitted for laboratory analysis as a result of low PID screening results and visual absence of suspect materials.

Central Portion and Northeastern Perimeter of Landfill. Test pits TP-7, TP-8, TP-13, TP-14, and TP-18 were positioned along the central and northeastern edge of the landfill in areas where EM anomalies suggested the presence of buried metallic objects. Test pits TP-13 and TP-18, positioned along the north east perimeter of the landfill were used to evaluate fill contents and boundaries only in this area. A description of fill material, PID soil screening and analytical results above method detection limits is provided below:

Test pit TP-13 was located in an area exhibiting an EM anomaly and where Burgess Brothers personnel indicated small batteries were disposed. Materials in test pit TP-13, located along the northeastern perimeter,

contained 5-gallon DOT cans with plastic liners containing white-gray ash-like material, a single crushed 55-gallon DOT drum containing size "C" batteries (at a depth of 2.5 to 4 feet), pallets, wooden boxes, and silty-fine kame sand cover material. The pit was extended to the north until fill materials thinned out. The edge of the fill boundary was staked and surveyed and was consistent with the landfill boundary as defined by the EM survey. The PID values in this pit ranged from 6 to 32 ppmv. Results of the UV soil screening were negative. Soil sample intervals collected and analyzed included 0 to 2-foot and 2 to 4-foot for VOCs and metals.

- **Organics:** VOCs detected at the 0 to 2-foot interval included 1,2-DCE, TCE, and PCE at 9, 30 and 10 ug/kg, respectively. VOCs detected at the 2 to 4-foot interval included TCE and PCE at 25 and 11 ug/kg, respectively.

- **Inorganics:** Metals concentrations elevated one order of magnitude above background concentrations were detected at 0 to 2 feet for copper, iron, nickel, potassium, sodium and 2 to 4 feet for iron, nickel, potassium, and zinc. Concentrations elevated two to three orders of magnitude above background concentrations were detected at 0 to 2 feet and 2 to 4 feet for lead and zinc. Mercury (not detected in background samples) was detected five and three orders of magnitude above the detection limit at 0 to 2 feet and 2 to 4 feet, respectively. Mercury concentrations of TP-13 were the highest observed on the Site. Silver (not detected in background samples) was detected one order of magnitude above the detection limit.

Test pit TP-18 was conducted to confirm the boundary of the landfill based on the EM anomaly in this area. The boundary of buried landfill defined by EM was located just southeast of this pit. The presence of automobile mufflers and scrap steel near the surface (0 to 6 inches) covered with surface debris was the source material for other localized EM anomalies northeast of this area (see photographs of TP-18 in Appendix 14). No fill materials were encountered below ground surface in TP-18. Some miscellaneous debris was found on the southeast end of the pit near the edge of the landfill. The true fill boundary is, therefore, south of this location as defined by EM. Headspace soil screening results of native kame sand were 150/190 ppmv from 2 to 4 feet in the southeast corner of the pit. The source of this VOC contamination could not be identified from visual observations and may represent a small surface release. The results of UV soil screening were negative. Soil samples were not collected for laboratory analysis in accordance with the Work Plan for this area.

Materials in test pits TP-7, TP-8, and TP-14, located along the central and east side of the landfill, consisted of household trash, construction or demolition debris, sheet metal, white goods (washer, dryers, electric range, etc.) furnace parts, electric motors and wiring. Fill materials extended to a depth of 12 to 14 feet. A steel tank, which appeared to be a household fuel tank, was observed in test pit TP-14. Careful efforts were made to not disrupt or puncture the tank. A tape measure lowered and guided into the tank revealed that no fluids were present.

Headspace soil screening results at TP-7 were less than 10 ppmv. Results at TP-14 were less than 10 ppmv to a depth of 8 feet, below this depth readings increased to 180 ppmv. Results at test pit TP-8 were less than 10 ppmv to a depth of 4 feet, below this depth readings increased to 70 to 160 ppmv. Results of UV soil screening were negative at these three locations. Soil samples for VOC and metals analysis were collected at each test pit with the exception that a VOC sample was not collected from TP-7.

- **Organics:** VOCs detected at TP-8 from 10 to 12 feet included TCE and PCE at 14 and 15 ug/kg, respectively. VOCs were not detected at TP-14 from 12 to 14-foot interval.

- **Inorganics:** Metals concentrations at TP-7 detected one order of magnitude above background concentrations included: iron, potassium, and zinc at 6 to 8 feet and copper, iron, nickel, potassium, vanadium, and zinc at 10 to 12 feet. Lead was detected at two orders of magnitude above background concentrations at 6 to 8 feet and 10 to 12 feet. Mercury (not detected in background samples) was detected one order of magnitude above the detection limit.

  Metals concentrations at TP-8 detected one order of magnitude above background concentrations included: chromium, copper, iron, lead, nickel, potassium, vanadium, and zinc at 4 to 6 feet and lead at 10 to 12 feet. Mercury (not detected in background samples) was detected two orders of magnitude above the detection limit at 4 to 6 feet and 10 to 12 feet.

  Metals concentrations at TP-14 detected one order of magnitude above background concentrations included arsenic, chromium, iron, vanadium, and zinc at 10 to 12 feet. Concentrations detected at two orders of magnitude above background concentrations included barium, lead, and nickel at 10 to 12 feet and nickel at 12 to 14 feet. Mercury (not detected in background samples) was detected one order of magnitude above the detection limit at 10 to 12 feet and 12 to 14 feet.

The results of excavations at test pits TP-7, TP-8 and TP-14 confirmed the source material for EM anomalies. This source material consisted of miscellaneous construction/demolition type debris containing a significant amount of metallic debris. Locally elevated PID readings were noted in the lower 4 to 8 feet of unsaturated fill in TP-8 and TP-14. The source of this volatile contamination could have resulted from residues associated with the fuel tank observed at 2 to 4 feet or a crushed drum at 2 feet.

Upon completion of the Test Pitting program, the limits and nature of the landfill materials had been identified. The Bend in the Road Area was investigated, however, evidence of concentrated waste materials were not observed. The Former Lagoon Area boundaries and constituents have been characterized. Several test pits were excavated to attempt to located reportedly buried drums in the Landfill Area. Eight to ten crushed 55-gallon drums were found in TP-19. Areas of anomalies identified in the EM survey were investigated.

3.1.5. Surface Soil Sampling

Surface soil samples were collected across the Site and at several boring/well locations to supplement the well data. Phase 1A surface soil samples were collected in the Landfill Area, Soil Staging Area, Marshy Area, Hillside Area and the West of the Landfill Area, as well as from an area east of the Site to be used as background samples. The Phase 1B program focused on the Marshy Area to address data gaps identified following the Phase 1A RI. A Sample Analysis Inventory (Table 35) presents surface soil sample locations, areas of the Site and analyses requested. Results of surface soil samples by Site Area are presented in Tables 24 to 29. Surface soil sample results for VOCs, SVOCs and PCBs, which exceeded detection limits are presented in Table 17. Complete results of the surface soil sampling are presented in Appendix 15.

Surface soil sampling programs were performed as part of the Phase 1A and Phase 1B RI investigations. A description of both programs follows.

Phase 1A RI - Surface Soil Sampling Program

Objectives and Methods. Surface soil samples were collected from various locations on the Site at discrete points designated in the RI Work Plan. Surface soil samples were also collected at selected test boring locations for well installations to supplement these data. Surface soil sampling points designated by an "SP" symbol are shown on Figure 2. Surface soil sampling points designated with a "S2" were collected at "S1" well

locations with the exception of W-04 S2 which was collected at W-04 B (abandoned) located in the Marshy Area.

A total of 22 discrete surface soil samples were collected across the Site and were designated as samples SP-01 through SP-22. Samples SP-14 and SP-22 were relocated within the Former Lagoon Area at the toe of the slope, at USEPA's request, following a Site walkover. Samples SP-20 and SP-21 were located in the Hillside Area based on soil gas results. Similar surface soil samples were collected from a total of eight soil boring locations designated SBW-10, SBW-13, SBW-18, SBW-21, W-12 S2, W-07 S2, W-08 S2, and W-25 S2.

Surface soil samples were collected in advance of soil boring activities at well clusters W-04 (Marshy Area), W-07, W-08, W-25 and well nest W-12. As discussed later "S2" wells were not necessary and thus additional reference to "S2" soil boring activities is not included in this document. Specifically, surface soil samples were collected in the following areas:

- Background Area (east of the Site): SP-17, SP-18, SP-19
- Landfill Area: SP-02, SP-03, SP-04, SP-05, SP-14, SP-15, SP-22, SBW-13, SBW-18, SBW-21
- Soil Staging Area: SP-01, SBW-10
- Marshy Area: SP-06, SP-07, SP-08, SP-09, SP-10, SP-11, SP-12, SP-13, SP-16, W-04 S2 (initial location), W-12 S2 (Note: SP-06 and SP-13 are located at the toe of the Landfill.)
- Hillside Area: SP-20, SP-21
- West of Landfill Area: W-07 S2, W-08 S2, W-25 S2

The objective of the surface soil sampling program was to further evaluate the results obtained during the LFI and to gather data relating to the chemical quality of shallow soils for the purpose of evaluating the potential for ingestion and possible contact exposure for human or ecological receptors.

Samples were collected using a clean stainless steel hand auger, spoon and bowl consistent with those described in the RI Work Plan. The sampling

locations were staked, surveyed, and labelled. The top portion consisting of vegetation or leafy matter was removed. The sample for volatile analyses was then collected from the mid-depth of the sample interval (6 inches). The remaining sample was then screened using a PID, homogenized using a stainless steel bowl and spoon, and transferred to appropriate sample containers. A sufficient volume of sample was collected to allow for potential splitting by the USEPA oversight contractor. Collection equipment was decontaminated between locations following the procedures set forth in the RI Work Plan. Surface soil samples were shipped to OBG Laboratories, Inc. utilizing chain-of-custody procedures. Samples were analyzed for parameters as described in the RI Work Plan.

Results of surface soil analyses are presented in Tables 1 through 4 of Appendix 15. The analytical results are discussed below.

Results. The VOC concentrations detected in the surface soil samples are illustrated on Figure 27 for ease of comparison. VOCs, semi-volatiles and PCB/pesticides which were detected are summarized by sample location on Table 17. The following describes the results by area of concern.

Background Samples. Surface soil samples SP-17, SP-18, and SP-19 were collected to assess background conditions at the Site. These samples were collected from higher ground east of the Site where disposal activities reportedly did not occur. Analytical results at these locations indicate the following:

- The VOC analysis indicated that acetone was detected in background sample SP-19 (15 ug/kg). Acetone was also detected in a blank sample associated with sample SP-17 (170 ug/kg).

- In accordance with the RI Work Plan, background samples were not analyzed for semi-volatiles or PCB/pesticides.

- The background concentrations provide a range against which to compare inorganic concentrations detected in surface soils at other locations at the Site. In accordance with the RI Work Plan, cyanide was not analyzed in the background samples.

Background surface soil results can be found in Table 29.

Landfill Area (south of the access road). Surface soil samples SP-02, SP-03, SP-04, SP-05, SP-14, SP-15, SP-22 and SBW-13, SBW-18, SBW-21 were collected from the Landfill Area south of the access road. These samples were collected principally from native kame sand cover material

and loam used to provide a temporary cap for the landfill. Results from these samples indicate the following:

- VOCs were detected at SP-03 at levels of 13 ug/kg for PCE and at SP-22 and its duplicate at levels of 13 and 15 ug/kg for TCE, respectively, and 22 and 26 ug/kg for PCE, respectively. Acetone was also detected at SP-22 at 9 ug/kg.

- Semi-volatile concentrations were below the method detection limits.

- PCB/pesticide compounds were detected only at SP-03 (62 ug/kg of 4,4'-DDE).

- Inorganic constituent concentrations elevated above background were detected in the surface soil samples. The following inorganics were detected at concentrations up to two orders of magnitude above background concentrations: calcium, lead, and nickel. The surface soil background concentrations can be found in Table 29.

The following inorganic analytes were detected at concentrations one order of magnitude above background levels: barium, magnesium, chromium, zinc, and copper. Cadmium and mercury (not detected in background samples) were detected at concentrations one order of magnitude above the detection limits.

The remainder of the inorganics were detected at concentrations within one order of magnitude of background, with the exception of selenium which was analyzed and not detected. In addition, cyanide was detected at 0.66 mg/kg at SP-02.

The range of concentrations for each parameter analyzed in surface soils in the Landfill Area is presented in Table 24.

Soil Staging Area. Surface soil samples SP-01 and SBW-10 were collected from the disturbed area north of the access road. This area is close to the Soil Staging Area. Results from these samples indicate the following:

- VOC concentrations were only detected at SP-01 at 8 ug/kg for acetone and 14 ug/kg for xylene.

- Semi-volatile organics and PCB/pesticides were only analyzed and not detected at SP-01.

- Inorganics concentrations elevated above background were detected in the surface soil samples from the Soil Staging Area. The background surface soil concentrations can be found in Table 29. The following metals were detected at concentrations one order of magnitude above the background levels: barium, cobalt, and manganese. Cadmium (not detected in background samples) was detected at concentrations one order of magnitude above the detection limits.

The remainder of the inorganic analytes were detected at concentrations within one order of magnitude of background, with the exception of selenium which was analyzed and not detected.

The range of concentrations for each parameter analyzed in surface soils in the Soil Staging Area is presented in Table 25.

Marshy Area. Surface soil samples SP-06 through SP-13, SP-16, W-04 S2, and W-12 S2 were collected from the Marshy Area. The Marshy Area soil samples were collected from soils saturated with ground water (average 62% solids). This was due to the water table existing at grade in this area which is typically the case. Therefore, the results may be influenced by migration of residues from source areas in the Landfill Area. Results from these samples indicate the following:

- VOCs were detected in surface soil samples from the Marshy Area, with the exception of SP-06 and W-12 S2. Analytical results indicate trace levels (less than 1000 ug/kg) of TCE, PCE, 1,2-DCE, vinyl chloride, carbon disulfide, acetone, toluene, ethylbenzene, xylene, 2-butanone, 1,1-DCE, 1,1-DCA, 1,1,1-TCA and benzene. VOCs were detected at SP-10 (toluene at 1700 ug/kg), SP-11 (1,2-DCE at 1700 ug/kg, TCE at 1500 ug/kg, and PCE at 5300 ug/kg) and at SP-07, vinyl chloride at 4900 ug/kg, acetone at 1100 ug/kg, 1,2-DCE at 66000 ug/kg and toluene at 15000 ug/kg. Several additional VOCs were detected at SP-07 at concentrations below 1000 ug/kg. Refer to Table 17 for a summary of compounds which were detected.

- The following semi-volatile compounds were detected at SP-07: acenaphthylene (910 ug/kg), phenanthrene (14000 ug/kg), anthracene (1500 ug/kg), fluoranthene (12000 ug/kg), pyrene (12000 ug/kg), benzo(a)anthracene (4900 ug/kg), chrysene (6100 ug/kg), benzo(b)fluoranthene (6700 ug/kg), Benzo(k) fluoranthene (4900 ug/kg), benzo(a)pyrene (4600 ug/kg), indeno (1,2,3-cd)pyrene (3300 ug/kg). Concentrations of the semi-volatile compounds detected at SP-07 were below 6700 ug/kg with the exception of phenanthrene (14000 ug/kg), fluoranthene (12000 ug/kg), and pyrene (12000 ug/kg). Semi-

volatile concentrations were below the method detection limits at other sampling locations.

- PCB/pesticide compounds were not detected.

- Inorganics at concentrations above background were detected in the surface soil samples from the Marshy Area. The background surface soil results can be found in Table 29. Lead and nickel were detected at concentrations up to two orders of magnitude above background levels. The following inorganic analytes were detected at concentrations one order of magnitude above background levels: barium, calcium, chromium, copper, manganese, potassium, zinc, and sodium. Cadmium (not detected in background samples) was detected at concentrations one order of magnitude above the detection limits.

The remainder of the inorganics were detected at concentrations within one order of magnitude of background levels with the exception of selenium which was not detected. Cyanide was detected at 1900 ug/kg at SP-07.

The range of concentrations for each parameter analyzed in surface soils is in the Marshy Area is presented in Table 26.

Hillside Area. Surface soil samples SP-20 and SP-21 were collected from the Hillside Area, and results from these samples indicate the following:

- VOC residues were only detected at SP-21 at 18 ug/kg for acetone and 16 ug/kg for 1,2-DCE .

- In accordance with the RI Work Plan, Hillside Area samples were not analyzed for semi-volatiles or PCB/pesticides.

- Inorganics at concentrations above background were detected in the surface soil samples from the Hillside Area. Background surface soil results can be found in Table 29. With the exception of calcium and chromium which were detected at concentrations one order of magnitude above background levels, metals were detected in the Hillside Area samples at concentrations within one order of magnitude of background. Selenium was analyzed and not detected.

The range of concentrations for each parameter analyzed in surface soils in the Hillside Area is presented in Table 27.

West of Landfill Area. Surface soil samples were collected from the well nests at W-07 S2, W-08 S2, and W-25 S2. Samples W-08 S2 and W-25 S2 were located in a wooded area where no disposal activities are suspected to have occurred. Sample W-07 S2 was located northwest of the Landfill Area at an area formally used for underground storage tank salvaging. Results from analysis of these samples indicate the following:

- The only VOC detected was acetone at W-07 S2 (8 ug/kg) and W-08 S2 (11 ug/kg).
- In accordance with the RI Work Plan, the well nest surface soil samples were not analyzed for semi-volatiles or PCB/ pesticides.
- Inorganic compounds were detected in the surface soil samples from the West of the Landfill Area at concentrations within one order of magnitude of background levels, with the exception of selenium which was analyzed and not detected. Background surface soil results can be found in Table 29.

The detectable acetone found in surface soils is not representative of unaffected background soils. With regard to inorganics, all parameters were at or below average concentrations in northeast U.S. soils (see Table 44), collected from depths of 24 centimeters, with the exception of manganese which ranged from 77 to 708 mg/kg. The average concentration in northeast U.S. soils for manganese is 272 mg/kg.

The range of concentrations for each parameter analyzed in surface soils in the West of the Landfill Area is presented in Table 28.

The results of the Phase 1A program indicated that the detection of trace VOCs in several surface soil samples was just above the instrument detection limit in the Hillside Area and the forested area West of the Landfill Area. Some apparent metal residues were observed in the Landfill Area and Soil Staging Area, as would be expected due to the scattered debris observed on the landfill. VOCs and semi-volatiles were detected on Landfill Area surface soils and surface soils in the Soil Staging Area. The highest VOC and inorganic concentrations were detected in the Marshy Area, most likely due to its proximity to the Former Lagoon Area and the migration potential of impacted surface and ground water into the Marshy Area from the lagoon cells.

Phase 1B RI - Surface Soil Sampling Program

Objectives & Methods. Eight surface soil samples were collected north and south of the temporary well access road in the Marshy Area. These samples

were submitted for the analysis of VOCs and metals only. The objective of this sampling effort was to supplement existing data and address data gaps identified in the preliminary risk assessment conducted by USEPA.

Surface soil samples were collected from surveyed locations and designated SP-23 through SP-30 as shown on Figure 2. Samples were secured as described above in accordance with the RI Work Plan.

In addition, several shallow surface soil samples (SS-1 through SS-7) were collected for PID screening in the vicinity of well cluster W-07. The purpose of this preliminary sampling was to evaluate the extent of surface VOC contamination.

Results. Results of the soil analyses are presented on Tables 1 through 4 of Appendix 15. A discussion of analytical results above method detection limits follows.

Surface soil samples SP-23, SP-24, SP-25, and SP-26 were collected north of the temporary well access road within the Marshy Area.

- **Organics:** VOCs were not detected at surface soil samples SP-25 and SP-26. VOCs were detected at SP-23 consisting of TCE at 21 ug/kg, and PCE at 99 ug/kg. VOCs detected at SP-24 included 1,2 DCE (total) at 20 ug/kg, TCE at 19 ug/kg, and PCE at 22 ug/kg.

- **Inorganics:** Inorganic concentrations were compared to background concentration ranges developed during the Phase IA. Inorganic concentrations elevated above background were detected north of the well access road. The following inorganics were detected at concentrations one order of magnitude above the background: barium, calcium, chromium, copper, lead, and nickel. Mercury (not detected in background samples) was detected at concentrations one order of magnitude above the detection limit.

Surface soil samples SP-27, SP-28, SP-29, and SP-30 were collected south of the temporary well access road within the Marshy Area.

- **Organics:** VOCs were not detected at surface soil samples SP-27, SP-28, and SP-30. VOCs detected at SP-29 included TCE at 16 ug/kg.

- **Inorganics:** Inorganic concentrations elevated above background were detected south of the well access road. The following metals were detected at concentrations one order of magnitude above the background

levels: zinc, beryllium, calcium, and chromium. Mercury (not detected in background samples) was detected at concentrations one order of magnitude above the detection limit.

The range of concentrations for each parameter analyzed in surface soils in the Marshy Area is presented in Table 26.

Results of the PID screening for the seven shallow surface samples collected north and west of SB-23 (Vicinity of W-07 well cluster) were as follows:

- SS-1, SS-2 and SS-3 were collected in an area of fuel tanks, stained soil and car parts and were found to have PID soils screening results in the range of 38-110 ppmv.

- SS-4, SS-5, SS-6, and SS-7 collected along the perimeter were found to have PID soil screening results in the range of 9.4 to 11.4 ppmv.

The PID soil screening results are presented on Table 36.

In summary, surface soil samples were collected from across the Site during the RI for use in evaluating the potential for ingestion and possible contact exposure for human and ecological receptors. Surface soil samples were compared against background soils from an area of the Site where disposal activities did not occur. Surface soils in the Landfill Area detected TCE, PCE, acetone and one pesticide compound (4-4'-DDE). Inorganics were detected at concentrations of up to two orders of magnitude above background levels. In the Soil Staging Area, acetone and xylene were detected, as well as several inorganics at up to one order of magnitude above background.

Marshy Area surface soils detected several VOCs. The nature and distribution of VOCs likely indicates migration of VOCs from the source areas in the Former Lagoon Area from primarily the ground water and leachate seep pathways. The surface water runoff pathways may also contribute VOCs to the Marshy Area, since some VOCs were detected in Landfill Area surface soils. Semi-volatile organics were detected (at SP-07 only) in the Marshy Area, along with several inorganics at concentrations up to two orders of magnitude above background.

In the Hillside Area, acetone and 1,2-DCE were detected. Acetone was also detected in the West of the Landfill Area. In both of these areas, inorganics were within an order of magnitude of background concentrations.

3.1.6. Soil Borings

Soil borings were performed as part of the Phase 1A and Phase 1B RI programs. A detailed description of these events follows:

Phase 1A RI: Soil Borings

Soil borings were installed to various depths in the Landfill and Soil Staging Areas, and to facilitate monitoring well installations inside and outside the Landfill Area. A total of 53 soil boring samples were submitted for laboratory analysis of VOCs, semi-volatiles, PCBs/pesticides and inorganics. Samples exhibiting the highest PID values and/or the most visually contaminated layer (i.e., separate phase solids or liquids and/or discoloration) were selected for laboratory analysis, as described in the RI Work Plan. Since very few samples exhibited staining or discoloration, most samples were selected based on PID readings. Typically, a sample was selected from the fill materials if they were encountered and the underlying kame sand or ablation till depending on the area investigated. In addition, six soil samples collected from the kame sand were submitted for analysis of TOC only to evaluate the organic carbon content of soils for later screening of remedial alternatives.

Specifically, the 53 soil boring samples were collected from the following areas:

- Landfill and Soil Staging Areas (27 samples): SBW-10, SBW-14 through SBW-25

- Monitoring Wells Outside Landfill Area (26 samples):
  Background Wells: W-01 S1 (SBW-13), W-01 B
  Hillside Area: W-23 T, W-24 T
  Marshy Area: W-03 T, W-04, W-11 S1, W-22 S1, W-06 S2

Soil boring samples were shipped to OBG Laboratories, Inc., utilizing chain-of-custody procedures. Samples were analyzed for the parameters indicated in Table 35. Complete analytical results are presented in Tables 5 through 8A of Appendix 15. VOCs, semi-volatiles and PCB/pesticides which were detected are summarized by sample location on Table 18. The VOC, SVOC and PCB concentrations detected in the soil boring samples are illustrated on Figure 33.

Results. The results are discussed below for each area. Soil boring logs are provided in Appendix 7 of this report.

Background Borings. The soil samples of kame sand from borings for W-01 S1 and W-01 B which were analyzed for inorganic constituents were similar to results from the Bend in the Road samples and were similar to landfill borings with respect to aluminum, arsenic, cadmium and iron. With respect to lead, nickel, zinc, and to a lesser degree chromium, the landfill boring results (SBW-15, SBW-20 and SBW-21) were much higher than that from W-01 S1 and W-01 B. Analytical results for these locations are in Tables 5 through 8 of Appendix 15, and indicate the following:

- The soils at W-01 S1, 6 to 8 feet and 10 to 12 feet, indicate no detectable VOCs, thereby suggesting no impact by VOCs to the shallow ground water zone at this location.

- Semi-volatiles were only analyzed in samples W-01 S1 (6 to 8 feet and 10 to 12 feet) and W-01 B (32 to 34 feet) and no compounds were detected.

- In accordance with the RI Work Plan, PCBs and pesticides were not analyzed in these monitoring well boring samples.

- The inorganic results from (W-01 S1)(0 to 12 inches), W-01 S1 (10 to 12 feet), W-01 S1 (6 to 8 feet), and W-01 B (32 to 34 feet) can be considered background because the following metals were detected at relatively low concentrations and over relatively narrow ranges compared to fill samples as follows: chromium 4.4-5.1 mg/kg, iron 8,430-9,860 mg/kg, lead 4.2-7.7 mg/kg, nickel 5-7.2 mg/kg and zinc 16-25 mg/kg. Samples from the Landfill Area such as SBW-15 (4 to 6 feet), SBW-20 (12 to 14 feet) and SBW-21 (12 to 14 feet) showed the following: chromium 5.7-14.9 mg/kg, iron 8,860-13,200 mg/kg, lead 48-14,000 mg/kg, nickel 5-1,700 mg/kg and zinc 91-1,860 mg/kg. The variability in the background samples was relatively low and the concentrations were lower than landfill samples. The variability of background results was 10 to 30 percent around the mean value with landfill samples 44 to 230 percent around the mean.

Landfill and Soil Staging Area Borings

Objectives and Methods. Soil borings for potential monitoring well installations were conducted in the Landfill Area near the Former Lagoon Area and in areas of elevated VOC soil gas concentrations detected in the LFI. The objective of the soil test boring program in this area was to characterize, through visual observations and analytical testing, the nature and extent of soils contamination and potential waste materials in the Landfill Area, if they exist, their phase distribution (e.g., NAPLs) and their

potential migration into the upper part of underlying natural kame sand soils.

Soil test borings were performed at nine locations designated as SBW-10 and SBW-14 through SBW-21 in the landfill as shown on Figure 2. Wells were installed at SBW-13, SBW-15, SBW-20 and SBW-21 as discussed later in Section 3.2.1, Ground Water Monitoring Well Installation.

Soil boring samples were continuously collected to depths of three feet below the bottom of landfilled materials in accordance with the RI Work Plan. Borings were completed with mobile B-61 truck mounted rigs utilizing 4¼-inch ID hollow stem augers as described by drilling procedures in the RI Work Plan. Soil sampling equipment was decontaminated between sample intervals according to procedures in the RI Work Plan. Drilling equipment was steam cleaned between borings at the designated decontamination area except as noted below.

Split spoon soil samples were visually observed for waste materials classified according to the Wentworth Scale and field screened with a PID for VOCs. The bottom sample of naturally deposited soils in each boring was submitted for laboratory analysis, along with a minimum of two discrete samples (soil sample collected from one splitspoon sampling interval) or composite samples (soil samples collected from two splitspoon sampling intervals and mixed together in a stainless steel bowl) of similar landfill materials as defined from visual observations and field testing were submitted for laboratory testing. Samples selected for VOC analysis were not composited. Soil sample intervals of interest not containing the required quantity of soil as a result of poor splitspoon recovery were composited with similar landfill materials from above or below the splitspoon sampling interval. Typically, discrete landfill samples exhibiting discoloration or the highest headspace VOC concentration in the boring were submitted for laboratory analysis. Laboratory analysis included VOCs, semi-volatiles, PCBs/pesticides and metals.

The RI Work Plan specified that test borings may be converted to monitoring wells depending on the saturation of landfill materials and that wells be installed at SBW-14 and SBW-20 regardless of saturation. A well was installed at SBW-15 in the Former Lagoon Area rather than SBW-14 since potential lagoon constituents were visually observed in SBW-15 soils (alternating layers of sludge-like material and kame sand cover) and PID readings were significantly higher. No apparent indication of sludge materials were observed at SBW-14. Wells were also installed at SBW-10 in the Soil Staging Area and at SBW-20 and SBW-21. Other SBW borings

were not converted to wells since no saturated zone was visually observed in the landfill materials sampled. Soil borings at locations where wells were not installed were grouted in accordance with the RI Work Plan.

Results

Former Lagoon Area. Visual descriptions from the boring conducted in the known area of the Former Lagoon Area (SBW-15) indicated alternating layers of loose black to red discolored kame sand and silty clay. The layers were a few inches to a few feet thick. Some layers were described as possible sludge material and decayed organic material. Strong solvent odors were noted, and elevated PID readings were measured throughout the boring. The fill material was 8 feet thick and represented what appeared to be episodes of liquid waste disposal and settling with subsequent covering by kame sand. This is consistent with the reported history of waste disposal in the Former Lagoon Area. No separate phase solvent liquids could be visually observed, but may have been incorporated in the sludge material based on PID and laboratory results.

Other borings in the Former Lagoon Area included SBW-14 and SBW-18 (two attempts). SBW-14 was drilled in an accessible area by truck and encountered primarily kame sand to a depth of 11 feet followed by ablation till. SBW-14 is interpreted to be the side of the bermed area based on the presence of kame sand fill in soil samples. This interpretation was also based on surface observations, absence of fill materials, and elevated PID readings increasing with depth ranging from 0.1 to 146 ppmv. SBW-18 encountered alternating kame sand and silt layers that were discolored or stained to some degree. Solvent odors and elevated PID readings were detected into the natural underlying kame sand which was noted at a depth of 10 feet.

Landfill Area. The results of the remaining borings conducted in the Landfill Area were consistent with the test pit findings at TP SBW-16 and TP SBW-19, and indicated that the material consisted primarily of mixed municipal type refuse (burnt newspapers, wood, household items, cinders, and metal debris) mixed with kame sand fill. Some petroleum stained layers were noted in test pit and boring SBW-19. The PID screening results indicated detectable VOCs in the underlying kame sand chiefly at SBW-14, SBW-15, and SBW-18 near the lagoon and, to a lesser extent, SBW-20. These data suggests migration of VOCs into the natural kame sand at these locations.

Soil borings SBW-10 and SBW-14 through SBW-21 were collected from the Landfill Area and Soil Staging Area. Analytical results indicate the following:

- The highest VOC concentrations of TCE and PCE were detected in fill at a depth of 2 to 6 feet in SBW-15 in the Former Lagoon Area. TCE at SBW-15 ranged from 2,400,000 to 6,900,000 ug/kg and PCE ranged from 5,700,000 to 8,100,000 ug/kg. The PCE decreased in underlying sand at SBW-15 at 8 to 10 feet to 540,000 ug/kg. In nearby borings SBW-14 and SBW-18 located near the lagoon, TCE and PCE were detected at concentrations as high as 3,200 ug/kg and 13,000 ug/kg, respectively, at depths of 4 to 14 feet. The PCE and TCE decreased in the lower sample intervals from 12 to 14 feet. Acetone was also detected at SBW-18 at 150 ug/kg. Several other VOCs were detected in SBW-10, SBW-19, SBW-20, SBW-21, SBW-16, and SBW-17 in the remainder of the Landfill Area and Soil Staging Area. Toluene was detected in sample SBW-20 (20 to 22-foot interval) at 10 ug/kg. 4-methyl-2-butanone was detected at 19 ug/kg in sample SBW-17 at a depth of 12 to 14 feet. 1,2-DCE was detected in SBW-21 (20 to 22 feet) at 17 ug/kg and SBW-16 (4 to 6 feet) at 9 ug/kg. TCE at 14 ug/kg was detected in SBW-21 at the 20 to 22-foot interval. Acetone was identified in SBW-20 (74 ug/kg) in the 20 to 22-foot interval, SBW-21 (97 ug/kg) in the 20 to 22-foot interval and SBW-16 (48 ug/kg) in the 8 to 10-foot interval. In addition, toluene was detected at 140 ug/kg and 2-butanone at 120 ug/kg at SBW-19 (6 to 8-foot interval).

- Semi-volatiles were not detected in SBW-10, located in the Soil Staging Area, or in SBW-14, located in a bermed area near the Former Lagoon Area. For the most part, semi-volatiles were not detected in SBW-20 and SBW-21 located along the eastern side of the Landfill Area except 970 ug/kg bis(2-ethylhexyl)phthalate at SBW-20 at depths of 12 to 14 feet and 460 ug/kg pyrene at SBW-21 at depths of 12 to 14 feet. 4-Methylphenol was detected at concentrations of 1,000 to 2,900 ug/kg in borings SBW-16 (4 to 6 feet), SBW-17 (6 to 8 feet, 12 to 14 feet), and SBW-19 (4 to 6 feet, 6 to 8 feet), located in the central and western part of the Landfill Area. Phenanthrene was detected at SBW-19 (4 to 6 feet) at 570 ug/kg.

  In the Former Lagoon Area (SBW-15 and SBW-18), the compounds 1,2, 1,3, 1,4-dichlorobenzene, naphthalene, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, 1,2,4-trichlorobenzene, 2-methylnaphthalene, phenanthrene and fluoranthene were detected at concentrations ranging from less than 1 to 19 mg/kg each. Concentrations of semi-volatiles decreased with depth in the interval of 2 to 10 feet.

- No pesticides were detected in the landfill samples, PCBs were detected in the soil borings in and near the Former Lagoon Area. Aroclor 1260

was detected at 25,000 ug/kg (4 to 6 feet) and less than 1,000 ug/kg (4 to 6 feet) in SBW-15 and SBW-18, respectively. PCB Aroclor 1254 was detected in SBW-18 (8 to 10 feet) at 590 ug/kg (8 to 10 feet) and in SBW-16, SBW-17, SBW-19, and SBW-20 (2 to 10 feet) at 170 to 660 ug/kg (2 to 10 feet). Aroclor 1016/1242 was detected in SBW-19 at 1,200 ug/kg (4 to 6 feet). The highest detected concentration was 25,000 ug/kg (Aroclor 1260) at the 4 to 6-foot interval at SBW-15, near the Former Lagoon Area. Most other concentrations were below 1,000 ug/kg.

- Lead was detected at concentrations up to and including four orders of magnitude above background with higher concentrations in borings SBW-15 (2-4 feet), SBW-18 (8-10 feet), and SBW-21 (12-14 feet). Nickel was detected at concentrations up to and including three orders of magnitude above background with higher concentrations in borings SBW-15 (2-4 feet) and SBW-18 (8-10 feet). These results are consistent with the reported disposal of battery wastes in the Former Lagoon Area and potential disposal at SBW-21. Calcium was detected at every soil boring and at every elevation sampled in the Landfill area. Concentrations were up to and including two orders of magnitude above background levels. The following inorganic analytes were also detected in the Landfill Area borings at concentrations up to and including two orders of magnitude above background levels:

  - silver (SBW-18 [8-10'] and SBW-15 [4-6'])
  - sodium (SBW-16 [8-10'], SBW-17 [8-10'], and SBW-18 [8-10'])
  - zinc (SBW-15 [2-4'], SBW-18 [8-10']), and SBW-21 [2-4', 12-14'])
  - copper (SBW-15 [2-4'])

  Mercury (not detected in background samples) was detected at concentrations two orders of magnitude above the detection limits.

  The remaining inorganic analytes were detected at concentrations ranging up to and including one order of magnitude above background levels with the exception of aluminum, arsenic, iron magnesium, thallium and vanadium, which were detected within one order of magnitude of background concentrations. Selenium was analyzed and not detected.

Soil Borings for Monitoring Wells Outside Landfill

Objectives and Methods. The RI Work Plan specified that soil borings for monitoring well placements be installed outside the Landfill Area to evaluate the potential for migration of constituents in soil and ground water and to define the hydrogeologic system surrounding the landfill.

Primary objectives of the drilling program outside the landfill were:

- to evaluate the geologic units and to establish the number and connectiveness of distinct water-bearing zones at the Site
- to evaluate the potential for free-phase or residual NAPL contamination
- to identify key stratigraphic units, zones of high hydraulic conductivity, and confining layers or aquitards
- to further evaluate unusual geologic features such as faults or fractures delineated in the seismic refraction survey and their influence on the Site hydrogeology

Results.
West of the Landfill Area. Soil samples were not analyzed from borings W-07, W-08, W-09 or W-25 West of the Landfill in accordance with the RI Work Plan. PID readings in these borings generally ranged from less than 1 to 25 ppmv in the upper 50 feet in borings W-07, W-08 and W-25. Lower detections of less than 1 to 10 ppmv were recorded at depths of 50 to 110 feet in borings W-08 and W-09. Finally, low readings of less than 1 to 12 ppmv were detected in the intervals of 218 to 234 feet in W-07, 192 to 333 feet in W-08 and 243 to 247 feet in W-09.

Soil boring samples were collected from monitoring wells in two other areas outside the Landfill Area:

- Hillside Area (W-23 T and W-24 T)
- Marshy Area (W-03 T, W-04 B (abandoned), W-11 S1, W-22 S1, W-06 S2)

NOTE: Boring W-06 S2 was not converted to a monitoring well.

A description of the specific drilling objectives, procedures, and modifications to the program from that stated in the RI Work Plan is presented in Appendix 16. The drilling program conducted outside the Landfill Area was designed to characterize the subsurface geology in detail and to provide for an evaluation of contaminant migration pathways from source areas in the Landfill Area. The soil sampling program was modified when lodgement till and weathered bedrock layers were encountered beneath the Site. The goal of the program continued to be visual characterization of geologic layers and field screening of those layers for

indicators of contaminant migration. Well screen intervals were then modified, as agreed to with USEPA based on the data. Laboratory analysis included VOCs, SVOCs, PCBs/pesticides, and inorganics.

Marshy Area Well Borings

- VOCs were prevalent in the Marshy Area soil borings. The results of sampling at W-04 B, W-03 T, W-11 S1, and W-22 S1 in the Marshy Area indicate the presence of methylene chloride in concentrations ranging from 6 to 110 ug/kg, with 110 ug/kg at W-11 S1 (2 to 4 feet); 1,2-DCE in concentrations from 13 to 620 ug/kg, with 620 ug/kg at W-11 S1 (8 to 10 feet); TCE in concentrations from 6 to 320 ug/kg, with 320 ug/kg at W-11 S1 (8 to 10 feet); and PCE ranging from 11 to 340 ug/kg with 340 ug/kg at W-03 T (10 to 12 feet). These depths typically represent the base of the kame sand and uppermost ablation till. The following VOCs were also detected in the Marshy Area: acetone from 25 ug/kg to 320 ug/kg; carbon disulfide at 6 ug/kg; 2-butanone at 63 ug/kg; toluene at 12 ug/kg; 4-methyl-2-pentanone 29 ug/kg, and vinyl chloride ranging from 5 to 110 ug/kg.

- In accordance with the RI Work Plan, semi-volatiles, PCBs and pesticides were not analyzed in these soil boring samples.

- Inorganic analyses were not performed because no staining or discoloration was noted in the Marshy Area, which, according to the RI Work Plan, would prompt analysis for inorganics.

Results of Hillside Area Borings.

- The only VOCs detected in soil was acetone at 72 ug/kg at W-24 T.

- Samples were not submitted for inorganics, SVOCs, PCBs or pesticides.

Phase 1B RI - Soil Borings

Soil test borings were performed within the Marshy Area, West of the Landfill Area and within the Former Lagoon Area for the purpose of collecting additional soil samples and to facilitate monitoring well installations. In addition, a background weathered bedrock well (W-01 DI) was installed, which was originally to be screened in the shallow weathered bedrock core (SI). When no obvious water bearing zone was encountered during the drilling, the boring was continued to a depth of 215 to 217 feet and screened within the lower portion of the weathered bedrock zone (DI).

Monitoring wells were installed in the ablation till in the Marshy Area and below the lagoon in kame sand. Additional data was gathered concerning

the VOC distribution in the kame sand and ablation till. A description of the soil sampling methods and soil analytical results follows:

Marshy Area.

Objectives and Methods. The objective of Marshy Area wells was to provide more data regarding the extent of migration of residues into the ablation till. Wells W-04 T and W-22 T screened within the ablation till were installed using an all-terrain, vehicle-mounted drill rig and 4 1/4-inch I.D. hollow stem augers. Soil samples were collected every 5 feet from the base of the neighboring shallow well using split spoon sampling method ASTM 1586-84. Upon sample retrieval a portion was immediately placed in a 4 oz. teflon-lined glass jar for later VOC analysis and placed on ice. The remaining soil sample was screened with a PID and classified. Samples exhibiting PID readings greater than 10 ppmv were screened with a UV lamp for non-aqueous phase liquids.

One soil sample from each boring was submitted for VOC and TOC analysis based on visual observations, PID, and UV screening results. Samples were shipped to OBG Laboratories, Inc. for analysis. In addition one sample per boring was submitted for geotechnical analysis (bulk density, porosity, soil, moisture, vertical permeability). Samples were collected using 6-inch brass sleeves in a 3-inch I.D. split spoon. One representative sleeve which was undisturbed was sealed with wax on either end, labelled and shipped to GEI Consultants, Inc., Winchester, MA for testing.

Results.

Marshy Area. Soil borings were completed to depths of 30 to 32 feet. Kame sand was observed in the two borings to a depth of 8 to 12 feet followed by a bouldery ablation till. VOC and TOC samples were collected at W-04 T (19 to 21 feet) and W-22 T (17 to 19 feet). Geotechnical samples were collected at W-04 T (14 to 16 feet) and W-22 T (22 to 24 feet).

PID tests in the two borings were performed below the deepest interval sampled in the neighboring S-1 well. PID screening results at W-04 T were 40 and 17 ppmv at 14 to 16 feet and 19 to 21 feet in till, respectively. No screening results were achievable below this depth due to the bouldery till conditions that prohibited sampling and/or sufficient recoveries. The PID data in kame sand above this zone were 22 to 37 ppmv in well W-04 B (abandoned).

PID screening results at W-22 T were 9, 10, and 7 ppmv at sample intervals 17 to 19 feet, 22 to 24 feet, and 28 to 30 feet in till, respectively. Only one

headspace test per sample interval was performed due to poor recoveries. The PID results in kame sand above the ablation till at this location was 10 to 57 ppmv.

- **Organics:** VOCs detected at W-4 T included TCE at 22 ug/kg and PCE at 9 ug/kg. A duplicate sample at this location detected TCE at 150 ug/kg and PCE was detected at 52 ug/kg. VOCs detected at W-22 T included acetone at 12 ug/kg, 1,2-DCE at 16 ug/kg, 1,2 dichloropropane at 6 ug/kg, and trichloroethene at 170 ug/kg. TOC was measured at W-04 T (19 to 21 feet) and W-22 T (17 to 19 feet) at 526 and 663 mg/kg, respectively

  These results confirmed the presence of VOCs in the ablation till in the Marshy Area but concentrations decreased by about 1 order of magnitude from the overlying kame sand.

Borings for Wells West of Landfill

Objectives and Methods. Two wells were installed West of the Landfill Area to assess whether site related residues would migrate west of the Site in kame sand or ablation till. Soil borings were performed using 4 1/4-inch I.D. hollow stem augers similar to Marshy Area wells. Continuous soil sampling using ASTM Method 1586-84 (300 lb. hammer/3-inch I.D. split spoon) was performed during the completion of W-26 T and W-27 T. Soil samples were classified and screened using a PID.

Results. No soil samples were submitted for laboratory analysis.

Shallow Monitoring Well Between Former Lagoon Area

Objectives and Methods. The objective of placing a well below the lagoon was to evaluate the degree of migration of constituents into kame sand and ablation till and whether lagoon fill was below the water table. Sampling at W-TP-12 was performed continuously from 18.5 to 28.5 feet using a 3-inch I.D. split spoon and 300 lb. hammer. Upon sample retrieval a portion was immediately placed in a 4 oz. teflon-lined glass jar and placed on ice. The remaining soil sample was screened with a PID and classified. Samples exhibiting PID readings greater than 10 ppmv were screened with a UV lamp for NAPLs. Based on these results and visual observations, four volatile, one semi-volatile, and two metal soil samples were submitted for laboratory analysis. Samples were submitted to OBG Laboratories, Inc. Results of the soil boring, screening and analytical data follow.

Results. The PID results in fill ranged from 24 to 460 ppmv with values increasing with depth to 28.5 feet. PID values in underlying kame sand ranged from 55 to 520 ppmv at a depth of 10 to 26.5 feet. PID values in

ablation till were lower at 5 and 6.5 ppmv. Although industrial wastes were not noted directly in this pit, elevated PID readings were noted similar to SBW-15 located in the middle of Lagoon Cell 2. Discussions with Burgess Brothers personnel indicated the unloading of industrial wastes was done from this immediate area and solvents probably spilled onto the ground surface at this location. For this reason, this area is included within the delineation of Lagoon Cell 2. Results of UV soil screening were negative. Results of the four VOC, two metals, one semi-volatile, and two PCB samples collected from this boring are as follows.

- **Organics:** Virtually no VOCs were detected from 0 to 16 feet because relatively clean fill was placed in the lagoon at this location. VOCs detected at 20.5 to 22.5 feet included TCE at 54,000 ug/kg and PCE at 1,000,000 ug/kg. PCE was detected at a concentration of 1,200,000 ug/kg in the duplicate sample, whereas TCE was not detected. This is the depth where sludge was noted. Since TCE was not detected in the duplicate, the detected results for this compound was approximated. VOC concentrations decreased by 4 to 5 orders of magnitude below this sample. VOCs detected at 22.5 to 24.5 feet included vinyl chloride at 120 ug/kg, acetone at 20 ug/kg, and 1,2-DCE at 110 ug/kg. VOCs detected at 24.5 to 26.5 feet included vinyl chloride at 68 ug/kg, acetone at 16 ug/kg, 1,2-DCE at 75 ug/kg, TCE at 45 ug/kg and PCE at 15 ug/kg. VOCs detected at 26.5 to 28.5 feet included 1,2-DCE at 100 ug/kg and TCE at 420 ug/kg. The TCE concentration increased somewhat in the ablation till at 26.5 to 28.5 feet as compared to kame sand above it. This may have been due to the somewhat lower porosity at this depth. Semi-volatile and PCB/pesticide compounds were not detected at 22.5 to 24.5-foot interval. PCB/pesticide compounds were not detected at the 24.5 to 26.5-foot interval.

- **Inorganics:** Metals concentrations elevated one order of magnitude above background included nickel at sample interval 22.5 to 24.5 feet, lead, and zinc at 24.5 to 26.5 feet. Lead was detected 2 orders of magnitude above background at 22.5 to 24.5 feet. Mercury (not detected in background samples) was detected one order of magnitude above the detection limit at sample interval 22.5 to 24.5 feet and 24.5 to 26.5 feet.

Soil Staging Area

Objectives & Methods. Objectives of this soil boring program were to further evaluate the vertical (to the water table) and horizontal extent of potential soil contamination in this area from the reported fuel tank salvaging operations. A total of four soil borings were installed and designated SB-22, SB-23, SB-24, SB-25 as presented in Figure 2.

Based on results of the Phase 1A RI soil vapor survey, test pitting, and soil boring data, which indicated the presence of petroleum hydrocarbon residues in shallow soil and ground water, four shallow soil borings were completed in the Soil Staging Area. The locations of the two initial soil borings were selected based on soil vapor survey. Two additional locations were chosen based on findings in the field and the planned relocation of the loam pile to this area by Burgess Brothers. Seven shallow soil samples were also collected by shovel and screened with a PID to supplement boring data. The remaining Phase 1B RI soil borings were performed to facilitate well installations and are discussed in Section 3.2 Hydrogeologic Investigation.

Soil borings were installed using 4 1/4-inch inside diameter hollow stem augers to the water table. Soil samples were secured continuously using 3-inch inside diameter split spoons and a 140 or 300 pound hammer. Upon retrieval of the split spoon sample, a portion of the collected sample was placed in a 4 oz. teflon-lined glass jar for later selection of VOC analysis pending PID data. The remaining portion was visually logged according to the Wentworth Scale and divided among two 32-oz. glass jars for headspace soil screening. Samples exhibiting a PID reading greater than 10 ppmv were screened using a UV lamp for NAPLs. A total of two samples per boring were then selected for analysis of VOCs by EPA Method 8240, based on PID headspace readings, discoloration or presence of NAPLs. Selected samples were shipped on ice to OBG Laboratories, Inc. for analysis.

Upon reaching the desired depth the boring was grouted within the augers using a bentonite/cement mixture. The augers were then retrieved, more grout was added, and the boring staked, labeled, and surveyed. Soil boring logs are presented in Appendix 7 and laboratory data is presented in Appendix 15. A discussion of the soil boring data and analytical results follows.

Results. The four soil borings installed within the Soil Staging Area were completed to a depth of 4 to 7 feet. Kame sand was observed in each boring with the exception of SB-23, which consisted of a bouldery flow till as identified in the Phase 1A RI.

PID soil screening results indicated elevated readings in the uppermost 2 feet of boring SB-23 at 90 to 280 ppmv. Concentrations below two feet in this boring were slightly elevated ranging from 0.8 to 24 ppmv. Concentrations in the other three borings ranged from 8 to 12 ppmv throughout the soil profile. A detailed summary of PID soil screening data is presented on Table 36. Results of UV soil screening were negative. Two

soil sample intervals per boring were selected for VOC analysis (EPA method 8240).

- VOCs were not detected at soil borings SB-22, SB-23, SB-24 and SB-25

Background Weathered Bedrock Boring

Objectives and Methods. Samples were collected from upgradient well W-01 DI to evaluate background inorganic concentrations in sand and weathered bedrock (ocher). Soil samples were taken at 5-foot intervals within the weathered bedrock utilizing a 300 lb. hammer and 3-inch ID split spoon. In addition, soil cuttings were monitored for sandier materials that might indicate a water bearing zone. Upon field classification soil samples were screened using a photo-ionization detector. Soil samples submitted for inorganics analysis were
collected at 4 to 6 feet (kame deposit) and 210 to 212 feet (weathered bedrock). Results of the background inorganics samples are as follows.

Results. A comparison of background inorganics data collected from sand at W-01 DI (formerly SI) (4 to 6 feet and 10 to 12 feet) indicates metals concentrations to be generally within the same order of magnitude to other background sand samples with the exception of calcium found to be one order of magnitude higher at W-01 DI. These results were also similar to Bend in the Road sand samples previously mentioned.

These data were compared to average concentrations for northeast soils based on a compilation of data from 54 references (see Appendix 18) and soils from Vermont as excerpted from a publication by Shacklette and Boerngen, 1981 (see also Appendix 18). The Site data are at or below values from background soils referenced in the literature. As a result, both samples can be considered representative of background concentrations within the kame sand. A range of concentrations developed from these data in Table 44.

A description of background inorganic data developed during the Phase 1A RI is presented earlier in this section. This comparison indicates that kame sand soils in the study area fall within the range of Vermont and Northeast U.S. soils. The Vermont data was collected from silty loam surface soils similar to those at the site.

A comparison of detected inorganics concentrations in the weathered bedrock sample (210 to 212 feet) from boring W-01 DI with kame sand inorganics concentrations indicated the following inorganics one order of magnitude above the kame sand range: barium, beryllium, cobalt, copper,

iron, lead, manganese, nickel, vanadium, and zinc. The higher metal concentrations were likely attributable to naturally occurring metals in the silt and clay found in this sample as opposed to the higher silica content in the sand, as this boring is located 200 feet upgradient from the defined landfill boundary.

The highest concentrations of SVOCs, PCB, and inorganic results were detected in the immediate vicinity of the Former Lagoon Area at SBW-15 and SBW-18 and inorganics at SBW-21. Lower concentrations were detected in the remainder of the Landfill Area in a distribution not indicative of another major source area for these constituents. VOCs were detected beneath the Former Lagoon Area and in an area around SBW-21 and W-22 S1 located on the east side of the landfill. Constituents in this area included 1,2-DCE and TCE while these constituents plus vinyl chloride and PCE were detected in the Former Lagoon and Marshy Areas. The soil gas map shown on Figure 32 also suggested another volatile source area near SBW-21 (SV-9).

TCE and PCE were present in Marshy Area borings chiefly in the upper 10 to 14 feet (maximum depth where VOCs were analyzed). Most of the VOCs were detected in the kame sand, and levels decreased by an order of magnitude in the ablation till. Methylene chloride and 1,2-dichloroethylene were also detected primarily in borings W-3 T and W-11 S1 indicating the same vertical distribution.

3.2. Hydrogeologic Investigation

3.2.1. Ground Water Monitoring Well Installations

Ground water monitoring wells were installed during the Phase 1A and 1B RI programs to provide information regarding the occurrence and movement of ground water in the various hydrologic units beneath the Site. At some locations well nests were installed to characterize the nature and horizontal and vertical extent of ground water impacts at the Site and to facilitate an evaluation of the interaction of ground water movement between the various hydraulic units. A description of each program is provided below.

Phase 1A RI - Ground Water Monitoring Wells

A total of 15 overburden monitoring wells and 12 weathered and competent bedrock monitoring wells were installed as part of the Phase 1A RI investigation to supplement the seven existing shallow ground water

monitoring wells installed by Geraghty and Miller. A summary of newly installed and existing monitoring well specifications and ground water elevations summary is included in Table 4. The locations of the monitoring wells installed in the Study Area to date are shown in Figure 2. The soil boring and ground water monitoring well construction logs are included in Appendix 7. Ground water monitoring well development logs and sampling logs are located in Appendices 19 and 20 respectively.

Objectives and Methods. The following monitoring wells were installed at the Site during the Phase 1A RI investigation:

- Kame Sand and Landfill Wells, (S1) — W-01, W-07, W-08, W-09, W-11, W-12, W-22, W-25; SBW-10, SBW-15, SBW-20, SBW-21
- Ablation Till Wells (T) — W-03, W-23, W-24 T (NOTE: W-03 S2 scheduled as a lower kame sand well was installed in till and is henceforth denoted W-3 T)
- Shallow Intermediate Weathered Bedrock Wells (SI) — W-04, W-07, W-08, W-09, W-25,
- Deep Intermediate Weathered Bedrock Wells (DI) — W-04, W-07, W-25
- Competent Bedrock Wells (B) — W-01, W-04, W-08, W-09

Drilling methods are described in Appendix 16, Drilling Objectives, Procedures and Modifications (For Wells Installed Outside the Landfill). Bentonite seals consisting of hydrated bentonite pellets were installed above the water table prior to grouting.

Kame Sand, Landfill and Ablation Till Wells

Overburden wells were constructed with 2-inch inside diameter (I.D.) flush joint threaded PVC or stainless steel riser casing attached to 2-inch I.D. machine slotted PVC or stainless steel well screen (0.020 inch slot size), as specified in the RI Work Plan. Stainless steel screens were used in the Landfill Area and PVC screens outside the Landfill Area. A washed silica sand was placed around and two feet above the well screen. A bentonite pellet seal was then installed above the sand pack with a minimum thickness

of 2 feet and hydrated. The thickness of the seal and sand pack above the well screen was modified to account for shallow ground water conditions at some locations. Following installation of the bentonite seal, a Portland cement/bentonite grout was placed in the annular space between the outside of the well casing and the borehole wall above the bentonite seal. Each well was fitted with a locking protective cover to complete the well installations.

Although the RI Work Plan specified that W-23 T and W-24 T be installed with 10 feet of screen to a depth of 7 feet below the water table, the water table was found to be shallower than 8 feet at W-23 T. Consequently, W-23 T was installed with 5 feet of screen to a depth of 3 to 4 feet below the water table.

The RI Work Plan specified that water table wells be equipped with 10 feet of screen, be screened 3 feet above the water table, and include 2 feet of sand along with a 2-foot bentonite seal above the top of the screen. However, the water table was encountered at ground surface with the top of till at a depth of 8 feet at W-11 S1, and similar conditions were encountered at W-12 and W-22 S1. Consequently, these three overburden wells were installed with 5 feet of screen along with 1 foot of sand, 1 foot of bentonite, and 1 foot of grout.

As specified in the RI Work Plan, a lower kame sand well (S2) was to be installed at the W-03 cluster regardless of the depth of saturated sand. A shallow ablation till well (W-03 T) was installed at that location rather than a lower kame sand well due to elevated PID readings encountered in till during drilling.

Intermediate Weathered Bedrock Wells

Intermediate weathered bedrock wells, which were added to the drilling program during the Phase 1A RI investigation to develop a monitoring network at two levels in the weathered bedrock, were constructed differently than indicated in the RI Work Plan for other monitoring wells. Each SI well was screened with 10 feet of PVC screen in a loose, weathered sand zone that was observed at reasonably similar intervals, and DI wells were also screened with 10 feet of screen in a lower sand layer using the same strategy.

SI wells were installed using air rotary rigs utilizing 6-inch Odex® casing to depths of 5 to 20 feet into the weathered bedrock with the exception of W-07 SI which was set at a depth of 15 feet above weathered rock in lodgement till. The borings were advanced further with B-61 drill rigs utilizing 4-inch casing advancement systems. Upon reaching the desired depth, the borehole was flushed with potable water, and 2-inch diameter

schedule 40 PVC well screen (10 slot) and riser was set inside the 4-inch casing. A washed silica sand was placed around and two feet above the well screen followed by a bentonite seal extending to the weathered bedrock/lodgement till interface or 6-inch casing. Grout was then tremied into the 4-inch casing and the 4-inch casing removed. The remaining annulus between the 6-inch steel and 2-inch PVC casing was then grouted to grade.

DI wells were installed in the same manner as SI wells except that the 6-inch casing used for W-07 DI and W-25 DI was left at deeper depths because these wells were originally scheduled to be competent bedrock wells. The 6-inch casing at W-04 DI, which was later requested by USEPA, was set at a depth of approximately 50 feet to penetrate bouldery till in that area.

Competent Bedrock Wells

Due to the thickness of till and weathered bedrock encountered while drilling the bedrock wells in the well nests W-01 B, W-04 B, W-08 B and W-09 B were drilled initially with an Odex® air rotary rig and 6-inch steel casing to the maximum depth achievable with that system and at W-04 SI to a depth fully penetrating the ablation till. Borings were advanced further with B-61 rigs fitted with a Longyear® casing advancement system utilizing 4-inch spun casing. Upon reaching the maximum depth achievable with the 4-inch casing, the borehole was further telescoped using the 3-inch casing advancement system. Four-inch and 3-inch casings were used together with the 6-inch casing, rather than use of exclusively 6-inch casing as specified in the RI Work Plan, as the maximum depth achievable with 6-inch casing had been reached.

The boreholes for W-04 B, W-08 B and W-09 B were telescoped using the 3-inch casing advancement system 10-feet into competent bedrock. The annulus between the 3-inch, 4-inch and 6-inch casing was then grouted and allowed to cure for 24 hours. Residual grout with the 3-inch casing was then excavated, and the borehole was flushed with potable water. Bedrock was then cored with an AV size core rather than drilled with a roller bit as specified in the RI Work Plan. The bedrock was cored to the maximum depth of 50 feet as specified in the RI Work Plan, rather than conducting yield tests in the interval of 20 to 50 feet into bedrock.

The size of boulders encountered in drilling the deeper wells necessitated the use of larger rigs than originally anticipated, and the existing mud access road at the Site was not suitable for supporting an air rotary drill rig and utility/water truck. Therefore, the existing mud road was modified to support the vehicles and provide access to well nests W-08, W-09 and W-

25. Construction activities were performed by Burgess Brothers and included laying down soil stabilization fabric, sand and gravel. The road was placed as far from the stream and wetland as practical in order to preserve a vegetated buffer, in accordance with USEPA and VTDEC direction. Wetland boundaries were marked in the field, and a silt fence was installed for erosion control prior to placement of fill. No fill materials were placed in or at the edge of the wetland area. Standard construction methods were employed to minimize impacts to the environment.

Phase 1B RI - Ground Water Monitoring Well Installations

Additional ground water monitoring wells were completed in the Phase 1B RI program with the objective of delineating the vertical extent of VOC impacts in the Marshy Area, the extent of potential westward migration of the VOC plume in the shallow ground water zone, and to assess background inorganic concentrations in the weathered bedrock. To meet these objectives wells were installed as follows:

- **W-01 DI (formerly SI)**: A background weathered bedrock well installed hydraulically upgradient and northeast of the landfill near existing well W-01.

- **W-22 T and 04 T**: Ablation till wells installed east and southeast of the landfill in the Marshy Area. These wells were installed as part of the W-04 T and W-22 T clusters.

- **W-27 S1, W-27 T, W-26 T**: A shallow kame sand well and ablation till wells installed in the West of Landfill Area based on EM survey results and interpolation of shallow ground water flow direction.

- **W-TP-12 S1**: A shallow kame sand well installed in the Former Lagoon Area to evaluate constituent concentrations below Lagoon Cell 2.

Well locations are presented on Figure 2 and soil boring/monitoring well logs are presented in Appendix 7. A summary of well installation procedures and findings follows.

Objectives and Methods.

Background Weathered Bedrock Well

The background weathered bedrock well was installed using a truck-mounted air percussion rig with the Sandvik/Odex® system and B-61 truck mounted rig outfitted for water rotary with 4-inch casing per the methods in the Work Plan. The Odex system was used to permanently install 6-inch casing through the ablation and lodgement till to a depth of 118 feet below grade or approximately 6 feet into the weathered bedrock. The bore hole

was then flushed and a B-61 mobile drill rig was then used to advance temporary 4-inch steel casing to a depth of 230.5 feet where competent bedrock was encountered. The bore hole was then roller bitted 3 feet into bedrock to confirm the presence of competent bedrock. An HX size core barrel was then used to retrieve and observe 2-foot core of the competent bedrock.

The well was originally scheduled to be a shallow intermediate (SI) weathered bedrock well, but due to the absence of a sand lens or other water bearing zone expected within 25 feet of the top of weathered bedrock the boring was continued deeper per agreement with USEPA. No obvious water bearing zone was observed throughout the boring in the stiff silty clay or decomposed bedrock.

Soil samples appeared to be dry or slightly damp. Moist conditions were observed at a depth of 215 to 217 feet and thus this interval was chosen to be screened along with the lower portion of the boring as agreed to by USEPA and oversight personnel.

Upon boring completion a well constructed of 25 feet of 2-inch ID machine slotted schedule 40 PVC screen (0.01 slot size) and flush jointed threaded PVC riser was then set at a depth of 234.5 feet. This interval screened (209.5 to 234.5 feet) was the only zone observed to exhibit conditions which might have provided measurable water yield to the well. A washed silica sand was then placed around and 2.5 feet above the screen followed by 3-foot bentonite seal. Grout was then tremied into the 4-inch casing and the casing removed. The remaining annulus between the 6-inch steel and 2-inch PVC casing was then grouted to grade. The well was then completed with a locking cover and a cement pad.

Due to the large volume of water and depth of the well a submersible Grundfos Redi-Flo 2 pump was permanently installed to facilitate well development, hydraulic conductivity testing and ground water sampling.

Marshy Area Ablation Till Wells

Upon completion of the soil borings at W-4 T and W-22 T to the base of the ablation till (as interpreted from blow counts - 28.5 to 30 feet), a well was installed consisting of 10 feet of Schedule 40 PVC screen (0.01 slot size) and riser extending 2 feet above grade. A washed silica sand was then placed around and 2 feet above the well screen followed by a 2-foot bentonite seal. The remaining annulus was backfilled with a bentonite/cement grout and augers removed. Six-inch casing was then placed in the borehole to a depth of 14 feet to seal off the kame sand

extending 2 feet above grade. The well was then completed with a locking cover and cement pad. Monitoring wells were developed and hydraulic conductivity tested in accordance with the RI Work Plan.

Wells West of the Landfill

Two well nests, consisting of a shallow well screened within the kame sand and a deeper well screened within the ablation till, were scheduled at locations W-26 and W-27 to evaluate the potential migration of the VOC plume and inorganic constituents West of the Landfill Area. As discussed in Section 3.1 (Field Investigations), these wells were installed at locations depicted on Figure 2.

Ground water at W-26 location was observed to be below the kame sand/ablation till interface and thus W-26 S1 was not installed. Well nest W-27 consisted of a shallow well installed to a depth of 19 feet within the kame sand and deeper well installed to a depth of 25 feet (top of lodgement till) within the ablation till. W-26 T was installed to a depth of 20 feet.

Upon completion of each boring, a well was constructed consisting of 10 feet of Schedule 40 PVC screen (0.01-inch slot size) and riser. Wells were constructed similar to Marshy Area wells.

Soil boring W-26 T was completed to a depth of 36 feet, approximately 16 feet into the lodgement till. The boring was extended into the lodgement till because the blow count criteria for determining top of lodgement till (greater than 100 blows per 6 inches) had not been achieved until that depth. Field classification of soil samples indicated the interface between ablation and lodgement till to be at a depth of 20 feet. The stratigraphic change was based on consistently higher blow counts, a decrease in the number of boulders encountered, and a more compact matrix of silt-sand-clay surrounding larger grains indicative of lodgement till in other borings. PID screening results were consistently below 5 ppmv with the exception of the surface sample exhibiting 26/12.5 ppmv.

Soil boring data for well nest W-27 indicated kame sand to a depth of 17 feet followed by ablation till to 31 feet. Lodgement till was encountered from 31 to 35 feet. PID screening results were consistently below 4 ppmv with the exception of the surface sample exhibiting 12/18 ppmv.

Shallow Monitoring Well in Former Lagoon Area

A 6-inch steel casing was installed in the Lagoon Area during the test pitting program, along the southern end of TP-12. The objective of this casing placement was to enable drilling to proceed below the lagoon while minimizing the potential for carrying constituents vertically downward into

natural soil. The purpose of the well was to evaluate the potential presence of NAPLs and aqueous phase organic and metal residues in the shallow ground water.

The actual well location was modified somewhat in the field upon consideration of health and safety aspects and field observations (i.e., trees, loose surface debris, etc.) in the area. The boring and casing placement was moved further east in a location more hydraulically downgradient of the Former Lagoon Area that would more likely intercept potential migration of NAPLs.

Following the excavation of fill material from TP-12 with the backhoe, a 3 to 6-inch layer of bentonite slurry was placed to seal off the bottom of the pit. The 6-inch steel casing was then lowered in the pit to a depth of 16 feet. A cement/bentonite grout was then gradually placed around the outside of the casing with the backfill material. During installation the casing settled 2 feet, making the total depth below grade 18 feet.

The casing and grout was allowed to set for 24 hours. A B-61 truck mounted drilling rig utilizing 4-inch I.D. spun casing was then used to excavate the borehole and collect split spoon samples to a depth of 28.5 feet or 2 feet below the top of ablation till. A well was constructed consisting of 10 feet of stainless steel screen (0.020-inch slot size) and riser. Washed silica was then placed around and three feet above the well screen followed by a two-foot bentonite seal and grout to grade.

3.2.2. Monitoring Well Development

Objectives and Methods. Monitoring wells installed during the Phase 1A and 1B field programs were developed following installation to remove fine-grained sediments that may have settled around the well screen during drilling activities and well placements and to enhance the hydraulic connection between the sand pack and natural earth material.

Wells screened within the kame sand ablation till and weathered bedrock wells W-07 DI, W-04 SI, and W-25 SI were developed using a stainless steel bailer. Due to depths and large volumes of water in deeper well casings, the remaining intermediate and competent bedrock wells were developed using a Grundfos Redi-Flo 2 submersible pump.

Results. During development, field measurements of pH, temperature (Celsius/C), specific conductance (microsiemens/uS), and turbidity

(nephelometric turbidity units/NTU) were recorded after each well volume had been purged. Development was considered complete after three successive measurements of pH, temperature, specific conductance, and turbidity did not vary by more than 10 percent.

Where successive readings varied to a greater extent, development was considered completed when a total of ten well volumes had been purged. At wells where turbidity measurements consistently exceeded 100 NTUs and pH, temperature, and specific conductance reached development criteria, development ceased prior to the 10 volumes. The well development logs are included as Appendix 19.

Development water from W-01 DI was released at grade in a direction away from the nearby stream. Development water from remaining wells was collected and transferred to the on-site frac tank or 55-gallon DOT drums.

3.2.3. Hydraulic Conductivity Testing

The following summarizes hydraulic conductivity testing performed during the Phase 1A and Phase 1B RI programs.

Objectives and Methods. In-situ hydraulic conductivity tests were performed on the wells installed during the Phase 1A and 1B field programs to estimate the horizontal hydraulic conductivity in the kame sand, ablation till, weathered bedrock and competent bedrock units in accordance with procedures presented in the RI Work Plan. Each test was conducted by drawing the well down by removing water with either a stainless steel bailer or Grundfos Redi-Flo 2 submersible pump and then measuring the ground water recovery over time. Ground water measurements taken at shallow kame wells and till wells were collected using a 100-foot Solonst water level probe. The minimum head displacement goal for unconfined conditions was 10-25% of the water column and 10 feet for confined conditions. At well locations where ground water recovery was too rapid (50-100% recovery within 5 seconds) for accurate manual measurements, an Aquistar single channel data logger connected to a pressure transducer was used to record the water level data.

The recorded data from kame sand and ablation till wells was interpreted using the Bouwer and Rice Method for unconfined aquifers (Bouwer, H., and Rice, R.C., 1976). The data collected from the shallow and deep intermediate weathered bedrock wells were interpreted using the Cooper Method (Cooper and others, 1967) for confined aquifers. Data obtained was evaluated using methods contained in the AQTESOLV® Aquifer

Analysis Program (Geraghty & Miller, Inc., Oct. 1991). Results of the hydraulic conductivity testing are as follows:

Results. Hydraulic conductivity logs for each well are presented in Appendix 8. In evaluating the data for some unconfined wells, the very early time data exhibited a different slope than later time data. The early time data may have been affected by hydraulic changes in the sand pack around the well and so was not considered representative. The data in the late portions of tests for W-08 S1, W-12 S1, and W-25 S1 showed some deflection possibly attributable to local recharge or semi-confining conditions. The reason for this is not known. Of the units tested, most data were considered to be generally similar to the published values.

Phase 1A RI Wells

Kame Sand and Ablation Till. Shallow ground water monitoring wells screened within saturated kame sand and ablation till deposits were found to have hydraulic conductivity values ranging 0.01 to 0.56 ft/day with an arithmetic average value of 0.15 feet/day. The arithmetic mean for the three till wells was 0.26 feet/day. The arithmetic mean was used due to the narrow distribution of data. This value is within the range of values presented in *Ground Water and Wells*, Fletcher G. Driscoll, 1986, p.75, indicating a range of 0.013 to 1340 feet/day for fine to coarse sands. Values obtained in the Phase 1A RI investigation are at the low end of this range indicating finer-grained, and possibly less sorted materials. The description of soils on the boring logs as silty-fine sand and ablation till supports this data.

Weathered Bedrock. The description of the hydraulic characteristics of the shallow weathered bedrock is presented in Chapter 2.

Wells installed within the weathered bedrock were found to have hydraulic conductivity values ranging from less than 0.001 to 0.13 feet/day. Since the weathered bedrock layers in which the SI and DI wells are installed are of comparable grain size, the hydraulic conductivities of the DI wells were expected to be similar to the SI wells.

Competent Bedrock Wells. Wells installed within the competent bedrock were found to have hydraulic conductivity values ranging from 0.46 to 2.88 feet/day with an average of 1.67 feet/day. These values are slightly greater than the values for the sand and weathered bedrock values. This may be attributable to effective interconnection of water bearing fractures in the unweathered bedrock. The hydraulic conductivity for metamorphic rock was estimated to range from 0.0014 to 8,501 ft/day (Freeze and Cherry,

1979). The median value in this publication was 28 ft/day which is slightly greater than the average value calculated from on-site competent bedrock wells.

Phase 1B RI Wells

Kame Sand and Ablation Till. Kame sand and ablation till wells (W-04 T, W-22 T, W-26 T, W-27 T and W-TP-12) exhibited hydraulic conductivity values ranging from 0.03 to 0.55 feet/day similar to the range of 0.01 to 0.56 feet/day associated with data from existing ablation till and kame sand wells. The new arithmetic mean value for new and existing wells was 0.05 feet/day and 0.15 feet/day for kame sand and ablation till wells, respectively.

Weathered Bedrock. Weathered bedrock well W-01 DI was found to have a hydraulic conductivity value of less than 0.001 feet/day similar to existing well W-07 DI. The new arithmetic mean value for new and existing wells is 0.047 feet/day.

The hydraulic conductivity data were consistent with previous results and indicated reasonable uniformity of the transmissive capacities of the respective hydrologic units.

3.2.4. Geotechnical Properties of Soils

Soil samples were collected for geotechnical analysis during the Phase 1A and Phase 1B RI investigations. A description of both programs follows.

Phase 1A Geotechnical Sampling

Geotechnical analysis of surface soils located above the Landfill Area was completed by Haley & Aldrich, Inc. (H&A). O'Brien & Gere collected and submitted ten surface soil samples of the Landfill Area to H&A for grain size gradation and analysis of permeability and porosity.

Objectives and Methods. The objective of the analyses was to classify the geotechnical characteristics of the surface soils covering the Landfill Area. Ten surface soil samples (SBW-10, SBW-13, SBW-14, SBW-15, SBW-16, SBW-17, SBW-18, SBW-19, SBW-20 and SBW-21) were submitted to H&A for geotechnical testing. The locations of these samples are shown on Figure 2. Grain size classifications, porosity tests, and constant head permeability tests were performed for each sample. The methods used in the geotechnical testing are described in the H&A Report on Geotechnical Analyses (Appendix 22).

Results. The soil is generally a non-plastic silty coarse to fine sand or coarse-fine sandy silt with little to trace gravel and trace of clay as described in the grain size analysis shown in Appendix 22. The range in water content in surface soils used for cover material on the landfill was 5.4 to 18.7 percent. The average water content was 10.7 percent. The samples were collected in October 1992 during a period considered normal for autumn when the ground surface is not completely saturated with surface water from excess precipitation/runoff as evaluated from on-site measurements of precipitation and stream flow. The water content likely represents the residual water saturation after drainable water from prior precipitation had been removed.

The range in porosity was 19 to 59 percent with an average value of 49 percent. The porosity value may be indicative of the loosely compacted nature of the surface soils. The saturated vertical permeability of the surface soils as measured in a laboratory Shelby Tube ranged from 2.4×10^{-5} cm/sec to 1.7×10^{-3} cm/sec. The average permeability was calculated to be 4.8×10^{-4} cm/sec. or 1.4 ft/day. This permeability was calculated from laboratory tests assuming constant saturation. Typically landfill cover materials are unsaturated. Therefore, the use of these data for landfill cover applications should be reviewed appropriately. The range of permeability values (k) was within the range of 1×10^{-1} to 1×10^{-5} cm/sec. identified for silty sand in "Ground Water" (Freeze and Cherry, 1979). In loosely compacted sand deposits, the k_v may be similar to k_{ho}.

Phase 1B RI Geotechnical Sampling. Ablation till samples were collected at wells W-04 T and W-22 T for the purpose of evaluating vertical permeability. Samples were analyzed by GEI Consultants, Inc. (GEI), Winchester, MA.

Two soil samples, collected at W-04 T (14 to 16 feet) and W-22 T (22 to 24 feet) were secured using four 6" brass sleeves inside a 2-foot, 3-inch outside diameter splitspoon. Upon retrieving splitspoons, the most undisturbed soil sample contained in the four sleeves was selected for analysis. Upon selection, the sample was encapsulated by capping and waxing the ends. Due to the bouldery conditions at W-04 T an undisturbed sample could not be collected and thus a jar sample was submitted. Permeability, unit weight, water content, specific gravity and porosity testing were performed. The methods used in the geotechnical testing was described in the GEI report presented in Appendix 23.

Results. The results of the testing are presented below:

Sample number	MW-22T	MW-4T
Initial total unit weight (pcf):	147.6	133.7
Inititial water content %:	9.0	16.9
Specific gravity of solids:	2.68	2.7
Inititial porosity	0.188	0.321

3.2.5. Ground Water Sampling and Analysis

Five rounds of ground water sampling were completed during the RI. These included two rounds during the Phase 1A investigation, two interim sampling programs and one round collected during the Phase 1B investigation. Ground water results are compared to regulatory standards (federal MCLs or Vermont PGWS). Often, the turbidity exceeded 100 NTUs in groundwater; therefore, the sediment load may have affected the representativeness of actual metals concentrations in ground water. The preventative action limit (PAC) of the VT PGWS has been used throughout this report to compare to Site ground water characteristics. The PAC is a numerical value expressing the detectable concentration of a substance in ground water that requires a response under Vermont regulations. For constituents that exceed the PAC, other factors, such as background water quality, reliability of sampling data risk assessment, etc. are considered by the regulatory agency to establish the need for remedial action. To define the impacts from site related operations, as opposed to naturally occurring background conditions, inorganics are also compared against concentrations observed in upgradient (background) wells. These background wells are typically placed in areas thought to be unimpacted by historical Site operations.

During completion of the RI, it became apparent that the well initially selected as a background well in the shallow (kame sand) zone may have been impacted by landfill operations. In addition, the need for a background well screened in the weathered bedrock was identified for comparison to other weathered bedrock wells.

Although these additional wells were installed and sampled in the Phase 1B program, the results of the sampling will be discussed at the beginning of this section to allow results of Phase 1A and interim sampling to be compared to the established background conditions.

Background Wells.

Objectives and Methods. Wells were utilized on the hydraulically upgradient part of the Site to assess background ground water conditions.

Upgradient Shallow Well. Ground water samples were collected from the shallow upgradient (background) well at W-01 S1. Analytical results indicate the following:

- VOCs were not detected during Round 1 sampling and only carbon disulfide (5 ug/l) was detected during Round 2. VOCs were also detected in soils and soil headspace in this area.

- Semi-volatiles were not detected.

- In accordance with the RI Work Plan, PCB/pesticides were not analyzed.

- Inorganic results were generally higher for Round 1 (May, 1993) than Round 2 (June, 1993), with the exception of antimony and mercury. Results for the two rounds of sampling were of the same order of magnitude with the exception of aluminum, nickel and zinc. Aluminum, antimony, barium, chromium, iron, lead, and manganese concentrations exceeded federal Maximum Contaminant Levels (MCLs) or Vermont Primary Ground Water Standards (PGWS). For filtered samples, only barium exceeded the Vermont PGWS. Filtered sodium results were on occasion higher than unfiltered results due to elevated detection limits for unfiltered samples. When evaluating inorganic results in ground water, unfiltered samples are typically more concentrated.

These results suggested that W-01 S1 located north of the landfill may be affected by inorganic constituents from the landfill. Inorganic constituents: chromium, iron, lead, nickel and zinc in unfiltered ground water from W-01 S1 were similar to wells SBW-21, W-04 S and W-05 in the landfill and affected parts of the Marshy Area.

The above analytical results and the proximity of this well to the landfill indicated that this well not be considered as a shallow background well. An existing well (W-01) located further upgradient was identified for future sampling to provide more representative background data for the shallow zone.

Inorganic results from sampling of W-01 identified aluminum, barium, chromium, iron, lead and manganese at levels exceeding regulatory standards. Filtered inorganic results were below the regulatory standards.

A comparison of background metals data for W-01 filtered and unfiltered (Rounds 4 and 5) located further upgradient was made to private wells: Ryder Spring, Olin and Dickinson located near the Site. These wells were considered to represent background for the kame sand and ablation till in the area. The unfiltered results from W-01 indicated higher concentrations (typically by one to three orders of magnitude) as compared to the drinking water supplies. This would be expected due to higher amounts of suspended sediment in the monitoring well, as opposed to the drinking water standards.

The filtered results, however, were similar to private wells. Table 37 depicts a comparison of the filtered and unfiltered results for ground water sampling Rounds 4 and 5 for shallow upgradient well (W-01) to residential well results.

The currently available information indicates that through a comparison of W-01 filtered inorganic results to residential drinking water results, W-01 is a representative upgradient shallow well (kame sand). However, since unfiltered inorganic results are used for risk assessment purposes, the current results may inaccurately portray the background conditions and, therefore, may misrepresent the impact of inorganic contaminants at the Site. Low flow sampling should be conducted on future ground water sampling events to evaluate the representativeness of data collected by the low flow method.

Upgradient Competent Bedrock Well. Monitoring well W-01 B was installed as a background well in competent bedrock.

Analytical results are as follows:

- 1,2-DCE (3.3 ug/l) during Round 3 was the only VOC detected. This detection occurred in only one round to date and was below regulatory standards. Otherwise no detectable VOCs were noted.

- The semi-volatile sample bis(2-ethylhexyl)phthalate (4.7 ug/l) was detected on one round only. This result may be due to a sampling contaminant.

- Unfiltered inorganic results identified aluminum, iron, lead and manganese at levels exceeding regulatory standards. Filtered inorganic results were below regulatory standards.

Based on these results, W-01 B may not be considered to be representative of background conditions in the competent bedrock zone and low flow sampling is being conducted.

Weathered Bedrock Well. The Phase 1A investigation identified the need for a background well in the weathered bedrock zone to allow comparison to other SI and DI wells at the Site. The Phase 1B Work Plan described a well to be installed in the shallow intermediate weathered bedrock (W-01 SI). however, the absence of a sand lens or other water bearing zone, expected to be encountered in this area within the weathered bedrock, required the well to be screened in the lower part of the weathered bedrock. This well, completed to the deep intermediate weathered bedrock zone is now identified as W-01 DI.

Results of sampling of W-01 DI are as follows:

- no VOCs were detected in the sampling conducted during the RI
- semi-volatile organics and PCBs were not analyzed for in the Phase B program
- unfiltered inorganic results identified aluminum, barium, beryllium, chromium, iron, lead, manganese, nickel and thallium at levels exceeding regulatory standards; filtered results for manganese also exceeded the regulatory standards

The results for W-01 DI were compared to a range of background inorganics from W-01 B for filtered and unfiltered samples. This comparison is presented below:

Comparison of inorganics in competent bedrock ground water to weathered bedrock ground water.

Analyte	Concentration Range Competent Bedrock (ug/l) W-01B):		Concentration Range Weathered Bedrock W-01DI: (July 1994)(ug/l):	
	Filtered	Unfiltered	Filtered	Unfiltered
Aluminumm	ND	ND-440	ND	13,100 to
Antimony	ND	ND	ND	ND
Arsenic	ND to 1.1	ND to 4.2	ND	ND
Barium	86 to 128	112 to 160	45.2 to 50.6	4,890 to 6,210
Beryllium	ND	ND	ND	14.5 to 18.4
Cadmium	ND	ND	ND	ND
Calcium	15,600 to	13,900 to	14,300 to	17,200 to
Chromium	ND	ND to 17	ND	139 to 165
Cobalt	ND	ND to 18	ND	527 to 626
Copper	ND	ND to 41	ND	137 to 167
Iron	ND to 260	172 to	ND to 61.1	142,000 to
Lead	ND	ND to 11	ND	103 to 114
Magnesium	5,500 to	5,300 to	5,420 to	7,980 to 8,880
Manganese	ND to 46	ND to 200	286 to 369	10,600 to
Mercury	ND	ND	ND	ND
Nickel	ND	ND to 8.2	4.5 to 5.7	671 to 743
Potassium	ND to 2,000	ND to 2,100	956 to 1,140	3,350 to 3,780
Selenium	ND	ND	1 to 1.2	R
Silver	ND	ND	ND	ND
Sodium	960 to	ND to 3,800	2,580 to	1,910 to 2,170
Thallium	ND to 1.6	ND	ND	6 to 6.5
Vanadium	ND to 8.2	ND	ND	33.4 to 43

Comparison of inorganics in competent bedrock ground water to weathered bedrock ground water.

Analyte	Concentration Range Competent Bedrock (ug/l) W-01B):		Concentration Range Weathered Bedrock W-01DI: (July 1994)(ug/l):	
	Filtered	Unfiltered	Filtered	Unfiltered
Aluminumm	ND	ND-440	ND	13,100 to
Zinc	ND to 15	ND to 750	21.8 to 105	1,160 to 1,420

Notes: ND = Not Detected R = Not Available

The unfiltered inorganic results for W-01 B were relatively low compared to well W-01 DI, the unfiltered results for W-01 DI indicated higher concentrations for some metals than downgradient DI wells (W-04, W-09, W-25 DI) and the competent bedrock well W-01 B. The reason for higher inorganic concentrations in W-01 DI which is located 200 feet northeast of the landfill may be due to the fact that this well screens silty clay in this unit whereas other DI wells screen sandy lenses which may contribute less mineralized water.

A soil sample from W-01 DI at the 210 to 212 feet also exhibited relatively high beryllium, lead, manganese, nickel and zinc concentrations with respect to background sandy soils which correlate with the unfiltered ground water data.

A comparison of W-01 DI filtered results to residential well sampling results indicates similar concentrations to private wells sampled in the area with the exception of manganese. Therefore, suspended sediments are most likely attributable to the elevated metal concentrations in W-01 DI and possibly to metals in other SI and DI wells.

Based on the results to date and comparison to other background well data, W-01 DI may not be representative of background conditions in the weathered bedrock zone and should be further assessed by low flow sampling.

The number of unfiltered inorganic results which exceeded regulatory standards, especially in upgradient areas of the site thought to be unimpacted by historical site operations suggests that suspended particulates in these samples are contributing to the increased concentrations. A modified sampling technique, recently approved for use in USEPA Region I (finalized August 1994) has the potential to collect

unfiltered samples which are more representative of ambient ground water quality. Since unfiltered inorganic results are used for risk assessment purposes, the current results may inaccurately portray the background conditions, and therefore may misrepresent the impact of inorganic contaminants at the Site. The new low flow purging and sampling method could be used on future ground water sampling rounds to evaluate the representativeness of prior data versus that collected by the new method.

A minimum of two rounds of low flow sampling should be performed and recorded in the RI addendum to adequately assess background conditions.

The range of inorganic concentrations developed above may be considered to be representative of background water concentrations at this time for shallow (kame sand) wells, as well as competent and weathered bedrock wells, but should be further assessed by low flow sampling.

Phase 1A RI - Ground Water Sampling Program

Objectives and Methods. Two rounds of ground water samples were collected from scheduled wells starting on May 24 and June 22, 1993, respectively. The purpose of these two sampling events was to characterize and confirm the concentrations of constituents within the various water bearing zones. Ground water samples were collected in accordance with the procedures specified in the RI Work Plan. Ground water sampling equipment was decontaminated in accordance with procedures specified in the RI Work Plan. Purge water generated was transferred to the on-site frac tank and 55-gallon DOT drums. Ground water field sampling logs are contained in Appendix 20.

Geraghty and Miller had reported in March, 1989 that the well casing of existing well W-04 S had been damaged by ice. O'Brien & Gere attempted to collect a sample from the well during the LFI, but could not lower a bailer into the well due to obstruction from a disconnected coupling. This well may have been affected by ice during this event. Upon inspection during the Phase 1A RI investigation, W-04 S appeared to be accessible for sampling. Successful sampling of monitoring well W-04 S was completed, which may have been attributable to sampling during unfrozen conditions.

Seven new Grundfos Redi-Flo 2® submersible ground water pumps were used during the Phase 1A RI investigation to develop, purge, and sample the wells at the Site. The sample was collected from the pump discharge, as described in the Purging Procedure presented in Appendix 24. This was done to minimize disturbance which may have occurred during the removal of the pumps. An equipment/field blank was collected from one of the seven pumps prior to sampling. A pump, 300 feet of tubing, and laboratory

equipment was placed on a 20 x 20-foot section of polyethylene sheeting. A field decontaminated stainless steel reservoir was used to circulate 12 gallons of laboratory deionized water through the pump and ancillary tubing for two minutes. After completion of the two-minute cycle, samples of the deionized water were collected in accordance with procedures outlined in the RI Work Plan. The deionized equipment/field blank collected from the pump recirculation test was analyzed for VOCs, semi-volatiles, filtered and unfiltered metals, PCB/pesticides, cyanide, TOC, BOD, and hardness.

Each ground water sample was shipped to OBG Laboratories, Inc. using approved chain-of-custody procedures. The samples were analyzed for the parameters and by the methods as described in the RI Work Plan. The TCE concentrations detected in the shallow ground water samples for Rounds 1 and 2 are illustrated on Figures 34A and 34B. Contaminant concentration contours shown on Figures 34A and 34B are representative of all sampling dates. TCE was contoured on these maps for three reasons: 1) it was the most ubiquitous VOC observed in ground water on-site, 2) it exhibited a relatively regulatory standard (0.5 ug/l) and, 3) it was present in the downgradient edges of the plume.

Results. The two rounds of ground water sampling which were conducted in May and June 1993 were intended to provide for an evaluation of the extent of constituent migration from the suspected primary source area (Former Lagoon Area) and the variability of the ground water data. Samples were analyzed for parameters indicated in Table 35. Ground water analytical data is presented on Tables 10 through 14 of Appendix 15. A summary of detected analytes listed by location and area is presented on Table 22.

Samples collected during the Phase 1A investigation were analyzed for the parameters as shown on Table 35. Inorganic analytical parameters included cyanide, BOD_5, hardness, and hexavalent chromium. Since detectable results for these parameters were limited, a discussion of results is provided herein. Cyanide was detected in W-06 D in the second round of sampling at 21.9 ug/l. Cyanide was also detected in W-011 S1 during the first four rounds of sampling at concentrations of 7.5 ug/l, 19.8 ug/l, 24 ug/l, and 27 ug/l respectively. Cyanide was not detected in any other Site wells. BOD_5 results were detectable at W-02 (3.1-3.3 mg/l), W-03 (4.8 mg/l) and W-04 (3 mg/l). No BOD_5 results were detectable in deep wells. Hardness results in shallow wells ranged from 20 to 2,530 mg/l with an average of 429 ug/l. Hexavalent Chromium results were not detectable in shallow or deep wells. The only detectable level of hexavalent chromium was found in the second round of sampling at Ryder Spring (20 ug/l).

Soil Staging Area Wells. Ground water samples were collected from the shallow overburden well at SBW-10 and W-07 S1 located north of the access road. Analytical results indicate the following:

- VOCs and semi-volatiles were not detected at SBW-10. Benzene was detected at W-07 S1 (Round 2) at 7 ug/l which exceeded regulatory standards. Naphthalene was also detected in this well (11 ug/l) during Round 1.

- In accordance with the RI Work Plan, PCB/pesticides were not analyzed.

- Manganese was detected at more than three orders of magnitude above background at W-07 S1. Although several inorganics in both rounds exceeded federal MCLs or Vermont PGWS in unfiltered samples, only manganese exceeded the standards in the filtered samples. Round 1 samples were generally higher than samples collected during Round 2.

Landfill Area Wells. Ground water samples were collected from the shallow overburden well designated SBW-21 located in the Landfill Area. Ground water samples were not collected from landfill wells SBW-15 and SBW-20, as these wells were found to be dry. Analytical results for samples from SBW-21 indicate the following:

- VOCs were detected above federal MCLs and Vermont PGWS in Round 1 and Round 2 samples, including 1,2-DCE (8700 and 7500 ug/l, respectively) and TCE (9000 ug/l and 14000 ug/l).

- Semi-volatiles were analyzed and not detected in Round 1. 2-methylnaphthalene was detected (12 ug/l) in Round 2.

- In accordance with the RI Work Plan, PCB/pesticides were not analyzed.

- Aluminum, antimony, barium, beryllium, chromium, iron, manganese and nickel concentrations exceeded federal MCLs or Vermont PGWS in Round 1 unfiltered samples. In Round 2 sampling, aluminum, barium, chromium, iron, lead and manganese exceeded federal MCLs or Vermont PGWS in unfiltered samples. For the filtered samples, only antimony, iron and manganese (Round 1), iron and manganese (Round 2) exceeded federal MCLs or Vermont PGWS. No unfiltered inorganics exceeded an order of magnitude above background. Barium, iron, and potassium in filtered samples were more than one order of magnitude

above background. Manganese in filtered samples was more than two orders of magnitude above background.

Hillside Area Wells. Ground water samples were collected from the shallow till wells designated W-23 T and 24 T located in the Hillside Area. Analytical results indicate the following:

- VOCs were not detected during Round 1 sampling, and only toluene (12 ug/l) and xylene (5 ug/l) were detected at W-24 T during Round 2.

- Semi-volatiles were not detected. Approximately two-thirds of the semi-volatile results for the Round 1 W-24 T sample were rejected. The basis for data rejection is explained in the Data Validation Reports (Appendix 1).

- In accordance with the RI Work Plan, PCB/pesticides were not analyzed.

- Barium, beryllium, chromium, lead and nickel were detected in Round 1 unfiltered samples from both W-23 T and W-24 T at levels exceeding Vermont PGWS or federal MCLs. Antimony at W-23 T also exceeded the federal MCL in Round 1 (unfiltered). Antimony, chromium, and lead exceeded Vermont PGWS or federal MCLs in Round 2 unfiltered samples from W-23 T.

  Lead also exceeded the Vermont PGWS in the Round 2 filtered sample from this location. Barium, chromium and lead at W-23 T (unfiltered) exceeded Vermont PGWS or federal MCLs in Round 3 samples. Antimony was detected in W-24 T (Round 2 unfiltered and Round 3 filtered) at levels exceeding the Vermont PGWS or federal MCLs.

  Filtered manganese concentrations were one to two orders of magnitude above background.

Wells West of the Landfill. Ground water samples were collected from the shallow overburden wells located West of the Landfill designated W-08 S1, W-09 S1 and W-25 S1. Analytical results indicate the following:

- VOCs were detected above federal MCLs and Vermont PGWS in Round 1 and Round 2 samples, including TCE (5 to 260 ug/l) at all four wells, PCE (49 ug/l) at W-08 S1 (Round 1) and 73 ug/l at W-08 S1 (Round 2). In addition, trace levels of acetone and 1,2 DCE were also detected at W-09 S1.

These results suggest that the boundaries of the VOC plum migrating from the Former Lagoon Area source was detecte W-08, W-09, and W-25 S1.

- No semi-volatile compounds were detected.

- In accordance with the RI Work Plan, PCB/pesticides analyzed.

- Aluminum, antimony, iron, lead and manganese exceeded t MCLs and Vermont PGWS in unfiltered samples. In chromium, barium, beryllium and nickel also exceeded the In filtered samples, antimony, iron and manganese exceed the

  Nickel (one order of magnitude), iron (two orders of magni manganese (three orders of magnitude) were detected in conc above background levels in filtered samples. No unfiltered were more than an order of magnitude above background.

Marshy Area Wells. Ground water samples were collected from t overburden wells located in the Marshy Area designated as W- W-04 S, W-04 D, W-05, W-06 S, W-06 D, W-11 S1, W-12 S1 S1. In addition, samples were collected from the shallow till wel in the Marshy Area. Detection limits in the shallow ground v samples W-02, W-03, W-04, W-11 and W-22 were elevated c presence of target compounds 1,2-dichloroethene, trichloroet tetrachlorethene at concentrations which were above that of calibration standard. Analysis of these samples required dilutio the sample concentrations within the linear range of the i Extremely high concentrations of compounds can cause instrume saturation. Ideally, the laboratory would attempt to analyze sam as these using the smallest required dilution. However, t compound with the highest concentration would restrict this eff assessment using these compromised detection limits may be li resampling would likely produce similar results. Analytical resul the following:

- Several VOCs were detected in the Marshy Area above fede and Vermont PGWS, including:

  vinyl chloride (620 to 2300 ug/l)
  1,2-DCE (56 to 22,000 ug/l)
  TCE (5 to 40,000 ug/l)

- Shallow intermediate wells detected aluminum, barium, antimony, chromium, iron, lead, manganese and nickel above the referenced federal MCLs or Vermont PGWS for unfiltered samples in both rounds. Filtered samples from these locations identified aluminum and barium above the referenced standards in both rounds of sampling. Round 1 detected iron and lead above regulatory levels. Round 2 samples also identified antimony at concentrations exceeding the standards. In the deep intermediate wells, iron, aluminum, chromium, manganese and lead exceed the standards for the unfiltered samples. Filtered samples identified aluminum, barium and antimony in excess of the standards. A spatial comparison of deep well results did not indicate elevated inorganic results in any area in comparison with other Site areas.

  In the bedrock wells, only iron in unfiltered samples and antimony in filtered samples exceeded regulatory standards. Concentrations of lead, calcium, potassium, sodium, iron, lead and barium were detected at one order of magnitude above background.

Residential Well Sampling. Water samples were collected from the Dickinson and Olin residences as well as Ryder Spring in June and July of 1993.

- Inorganics were detected during sampling. Barium, calcium, magnesium and sodium were detected in both rounds at the Dickinson well. Lead was detected in both rounds of testing at the Dickinson well except the filtered sample from Round 2. Thallium was detected during Round 1. Vanadium was detected in filtered samples from Rounds 1 and 2. Manganese was detected in Round 2. Levels of lead in Round 1 unfiltered samples exceeded regulatory standards.

At the Olin residence, barium, calcium and magnesium were detected in filtered and unfiltered samples in both rounds. Copper was detected in Round 2 (unfiltered). Iron was detected during Round 2 (unfiltered). Potassium was detected during Round 2. In addition, sodium was detected during Round 1 (filtered) and Round 2 (unfiltered). Manganese was detected during Round 2 (unfiltered) and zinc was detected during Round 1 (unfiltered). No concentrations exceeded regulatory standards.

At the Ryder Spring well, barium, calcium and magnesium were detected during both rounds of sampling. In addition, mercury was detected during Round 2 (filtered) and vanadium was detected during Round 1 (filtered).

Copper was detected during Round 1 (unfiltered). No concentrations exceeded regulatory standards.

Resampling of the residential and Ryder Spring locations was performed during the November interim sampling event due to rejection of the Round 1 and 2 organic data. A table comparing residential sampling data to background results has been included as Table 37.

Interim Sampling Program

Objectives and Methods. Two rounds of ground water samples were collected in November 1993 (Round 3) and February 1994 (Round 4) as part of the interim sampling plan. The objective of these sampling events was to evaluate long-term changes and the nature, extent, and seasonal variability of constituents at the Site.

Appropriate shallow sand, ablation till, and deep wells were sampled as agreed to with USEPA.

Ground water field sampling logs and laboratory analytical results are presented in Appendix 20 and 15, respectively. Analytical results are summarized in Tables 10A through 14E of Appendix 15. A summary of detected analytes listed by location and areas is presented as Table 22. The following describes the results of the ground water sampling program by hydrostratigraphic units and by area.

Results

Soil Staging Area Wells. Ground water samples were collected from the shallow overburden wells at SBW-10 (Round 3 only) and W-07 S1 (Round 3 and 4). These wells are located north of the access road within the Soil Staging Area. Analytical results indicate the following:

- VOCs were not detected at SBW-10 and W-07 S1.

- Semi-volatiles were detected at SBW-10. Bis(2-ethylhexyl)phthalate was detected at 7.3 ug/l.

- Inorganic concentrations elevated in filtered and unfiltered samples at SBW-10 (Round 3) were detected within the same order of magnitude as background with the exception of aluminum, barium and copper which were detected one order of magnitude higher in the filtered sample. The comparison is made to data from a background well screened in the same hydrogeologic unit as sample SBW-10. Aluminum (filtered and unfiltered), iron (filtered and unfiltered), lead (unfiltered) and manganese (unfiltered) exceeded regulatory standards.

- Inorganic concentrations in unfiltered samples at W-07 S1 included aluminum, iron, lead and chromium at levels exceeding regulatory standards. For filtered samples, antimony and manganese exceeded regulatory standards. Manganese was detected in the filtered samples at two orders of magnitude higher than background.

- Inorganic concentrations detected in filtered and unfiltered samples at W-07 S1 during Round 4 included manganese and sodium at three and one order of magnitude above background concentrations (from W-01, screened in the same hydrostratigraphic unit), respectively. Remaining inorganic parameters were below or within the same order of magnitude of background concentrations or were below detection limits.

Landfill Area Wells. Ground water samples were collected and analyzed for VOCs and metals from the shallow overburden well SBW-21 located in the Landfill Area during sampling Rounds 3 and 4. Analytical results were as follows:

- VOCs detected during Round 3 included chloromethane (140 ug/l), vinyl chloride (300 ug/l), 1,1 dichloroethene (61 ug/l), 1,2-DCE (4,000 ug/l), 1,2-dichloroethane (25 ug/l) and TCE (8400 ug/l).

- VOCs detected during Round 4 included vinyl chloride (280 ug/l), 1,2-DCE (3600 ug/l) and TCE (5700 ug/l).

- Semi-volatiles detected during Round 3 included 2-methylnapthalene (14 ug/l) and acenapthylene (1.7 ug/l) at location SBW-21.

- Inorganic concentrations detected for filtered samples at SBW-21 during Rounds 3 and 4 above background concentrations by one order of magnitude included barium, iron, and potassium. Manganese was detected three orders of magnitude above background concentrations during Rounds 3 and 4.

- Detected inorganic concentrations for unfiltered samples at SBW-21 (Rounds 3 and 4) were within one order of magnitude of background concentrations.

- Aluminum, chromium, iron, lead, manganese, barium, beryllium and nickel in unfiltered samples exceeded regulatory standards. In filtered samples, iron and manganese exceeded the regulatory standards.

All other analytes were below or within the same order of magnitude of background concentrations or were below detection limits.

Hillside Wells. Ground water samples were collected from the shallow till wells designated W-23 T and W-24 T located in the Hillside Area. Samples included VOC, semi-volatile and inorganic analysis for W-23 T and VOCs and inorganics for W-24 T. Analytical results indicate the following:

- Toluene (12 ug/l) and xylene (5 ug/l) were detected at W-24 T during Round 2. Toluene (5.2 ug/l) and xylene (5 ug/l) were also detected at W-24 T in Round 3. The toluene and xylene detections at W-24 T were below the state and/or federal MCLs. VOCs were not detected in W-23 T.

- Semi-volatiles were not detected in sample W-23 T.

- Aluminum, barium, chromium, iron, lead and manganese exceeded regulatory standards in unfiltered samples. Manganese in filtered samples from W-24 T also exceeded the standards. Filtered manganese was greater than one order of magnitude above background levels.

Wells West of the Landfill. Ground water samples were collected from the shallow overburden wells located West of the Landfill designated W-08 S1, W-09 S1 and W-25 S1. Analytical results indicate the following:

- VOCs detected during Round 3 included: 1,2-DCE (14 ug/l), TCE (360 ug/l), PCE (160 ug/l) at W-08 S1; vinyl chloride (1.3 ug/l), 1,2-DCE (22 ug/l), TCE (7.1 ug/l) at W-09 S1; and acetone (88 ug/l), 2-butanone (6.9 ug/l), TCE (1.2 ug/l) at W-25 S1. TCE and PCE were detected above State and/or federal MCLs at W-08 S1. TCE was also detected above standards at W-09 S1.

- VOCs detected during Round 4 included: TCE (390 ug/l), PCE (200 ug/l) at W-08 S1; vinyl chloride (2.9 ug/l), acetone (9.1 ug/l), 1,2-DCE (30 ug/l), TCE (2 ug/l) at W-09 S1; and acetone (87 ug/l), 2-butanone (29 ug/l) at W-25 S1. TCE and PCE were detected above state and/or federal MCLs at W-08 S1.

- Semi-volatiles detected during Round 3 at W-08 S1 included benzoic acid (9.9 ug/l). Semi-volatiles were not analyzed at other well locations or sampling rounds.

- Inorganic concentrations in filtered samples detected one order of magnitude above background concentrations at W-25 S1 included:

nickel during Round 3, and no analytes during Round 4. Concentrations in filtered samples detected two to four orders of magnitude above background concentrations included iron and manganese during Round 3 and 4. Remaining analytes were below or within the same order of magnitude of background, or were below detection limits. Concentrations of aluminum, chromium, iron, lead and manganese in unfiltered samples exceeded regulatory standards. In filtered samples, only iron and manganese exceeded the regulatory standards.

- Inorganic analyses from wells W-08 S1 and W-09 S1 detected aluminum, barium, chromium, iron, lead and manganese above regulatory standards in unfiltered samples. Filtered samples detected aluminum, barium, iron and manganese above the standards. Aluminum, iron and manganese were detected at one, two and three orders of magnitude above background levels, respectively.

Marshy Area Wells. Ground water samples were collected from the shallow overburden wells located in the Marshy Area designated as W-02, W-03, W-04 S, W-04 D, W-05, W-06 S, W-06 D, W-11 S1, W-12 S1, and W-22 S1. In addition, samples were collected from the ablation till well W-03 T (formerly W-03 S2). Analytical results from samples analyzed during Rounds 3 and 4 are as follows:

Round 3. Wells were sampled for VOCs (except W-06 S/W-06 D wells), semi-volatiles (except W-04 D, W-06 D, W-12 and W-22), and filtered/unfiltered metals. In addition, PCB/pesticides were analyzed at W-02 and W-11 S1.

- VOCs detected included: vinyl chloride (630 ug/l), 1,1-dichloroethene (620 ug/l), 1,2-DCE (14,000 ug/l), TCE (1500 ug/l), benzene (550 ug/l), PCE (400 ug/l), toluene (610 ug/l), chlorobenzene (580 ug/l) at W-02; 1,2-DCE (11,000 ug/l), TCE (1300 ug/l), PCE (350 ug/l) at W-03; TCE (1.4 ug/l) at W-03 T; vinyl chloride (1500 ug/l), 1,1-dichloroethene (120 ug/l), 1,2-DCE (3800 ug/l), TCE (2000 ug/l), benzene (110 ug/l), PCE (640 ug/l), toluene (110 ug/l), chlorobenzene (120 ug/l) at W-04 S; 1,2 DCE (150 ug/l) at W-04 D; 1,2 DCE (310 ug/l), TCE (870 ug/l), PCE (130 ug/l) at W-05; 1,1-dichloroethene (90 ug/l), 1,2 DCE (7600 ug/l) at W-11 S1; none detected at W-12 S1; and 1,2 DCE (1500 ug/l), TCE (9000 ug/l) at W-22 S1. The following VOCs were detected above state and/or federal MCLs: at W-02: vinyl chloride, 1,1-DCE, 1,2-DCE, TCE, benzene, PCE and chlorobenzene; at W-03: 1,2-DCE, TCE and PCE; at W-04 S: vinyl chloride, 1,1-DCE,

1,2-DCE, TCE, benzene, PCE, chlorobenzene; at W-04 D: 1,2-DCE; at W-05: 1,2-DCE, TCE, PCE; at W-11 S1: 1,1-DCE, 1,2-DCE; and at W-22 S1: 1,2-DCE and TCE. TCE concentrations in the shallow ground water zone from the November 1993 sampling are shown on Figure 35.

- Semi-volatile compounds detected included: 1,4-dichlorobenzene (1.6 ug/l) at W-02; 1,4-dichlorobenzene (1.4 ug/l) at W-03; 1,3-dichlorobenzene (1.3 ug/l), 1,4-dichlorobenzene (2.4 ug/l) at W-04 S; and bis(2-ethylhexyl)phthalate (3.2 ug/l) at W-11 S1.

- PCB/pesticide compounds were not detected in samples W-02 and W-11 S1. Remaining wells were not scheduled for analysis in accordance with agreements with USEPA.

- Inorganic concentrations detected in filtered samples one order of magnitude above background concentrations included: barium at W-02; nickel at W-03; nickel at W-03 T; iron, potassium, nickel, sodium at W-04 S; manganese, nickel at W-04 D; nickel at W-05 and W-06 D; barium and potassium at W-11 S1; and manganese and nickel at W-12 S1 and W-22 S1. Inorganic concentrations detected in filtered samples two orders of magnitude above background concentrations included: manganese at W-02 and W-03; and manganese at W-04 S. Iron and manganese at W-11 S1 were detected at three orders of magnitude above background concentrations.

- Inorganic concentrations detected in unfiltered samples one order of magnitude above background concentrations include: nickel W-04 S.

- Concentrations of aluminum, iron, lead, manganese, chromium, nickel, cadmium and barium (unfiltered samples), and aluminum, iron, barium, antimony and manganese (filtered samples) exceeded regulatory standards.

All remaining analytes were below or within the same order of magnitude of background concentrations, or were below detection limits.

Round 4. Wells were sampled for VOCs and metals concentrations at W-11 S1, W-12 S1, and W-22 S1.

- VOCs detected included: vinyl chloride (580 ug/l), 1,2 DCE (2000 ug/l), TCE (320 ug/l), 2-hexanone (48 ug/l) at W-11 S1; 1,2 DCE (3.3 ug/l), TCE (11 ug/l) at W-12 S1; and 1,2 DCE (1600 ug/l), TCE (13000 ug/l) at W-22 S1.

- Inorganic concentrations detected in filtered samples one order of magnitude above background concentrations included: potassium at W-11 S1 and manganese at W-12 S1. Concentrations detected in filtered samples two to three orders of magnitude above background concentrations included: iron and manganese at W-11 S1 and manganese; at W-22 S1. Unfiltered samples detected concentrations within an order of magnitude of background or lower.

- Concentrations of aluminum, iron, lead, manganese and chromium exceeded regulatory standards in unfiltered samples. Iron and manganese in filtered samples also exceeded the standards.

All remaining analytes were below or within the same order of magnitude of background concentrations, or were below detection limits.

Deep Wells

Ground water samples were collected from four shallow intermediate weathered bedrock wells, two deep intermediate weathered bedrock wells, and four competent bedrock wells.

Competent Bedrock Wells. Competent bedrock wells W-04 B, W-08 B, and W-09 B, were sampled during Rounds 3 and 4. Analytical results are as follows:

- VOC samples were collected during Round 3 (W-04 B, W-08 B, W-09 B) and Round 4 (W-04 B, W-09 B). Carbon disulfide (1.2 ug/l) was detected at W-09 B during Round 3.

- Semi-volatile samples were collected at W-04 B and W-08 B during Round 3. Bis(2-ethylhexyl)phthalate was detected at concentrations of 2.4 ug/l at W-04 B and 6.2 ug/l at W-08 B.

- Inorganic (filtered and unfiltered) samples were collected during Round 3 (W-04 B, W-08 B, W-09 B) and Round 4 (W-04 B, W-09 B). Inorganic concentrations were detected below or at the same order of magnitude of background concentrations, or were below detection limits.

- Concentrations of iron in all three wells exceeded the regulatory standards.

Shallow Intermediate Weathered Bedrock Wells. Shallow intermediate weathered bedrock wells W-04 SI, W-07 SI, W-08 SI, W-09 SI, and W-25 SI during Rounds 3 and 4.

- VOCs samples were collected during Round 3 (W-04 SI, W-08 SI, W-09 SI, W-25 SI) and Round 4 (W-04 SI, W-07 SI, W-08 SI, W-09 SI, W-25 SI). VOCs detected during Round 3 included: acetone (17 ug/l), carbon disulfide (5.4 ug/l) at W-08 SI; acetone (2.3 ug/l) at W-09 SI; chloroform (2.7 ug/l) at W-25 SI. VOCs detected during Round 4 included: carbon disulfide (2.5 ug/l) at W-08 SI; carbon disulfide (1.1 ug/l) at W-09 SI; and chloroform (2.9 ug/l) at W-25 SI.

- Semi-volatiles samples were collected at W-04 SI, W-07 SI, and W-08 SI during Round 3. Semi-volatile compounds detected included: benzoic acid (21 ug/l), bis(2-ethylhexyl)phthalate (5 ug/l), di-N-octylphthalate (1.6 ug/l) at W-04 SI; bis(2-ethylhexyl)phthalate (2.6 ug/l) at W-07 SI; and bis(2-ethylhexyl)phthalate (6.9 ug/l) at W-08 SI.

- Inorganic (filtered and unfiltered) samples were collected during Rounds 3 and 4.

  Inorganics detected one order of magnitude above background concentrations during Round 3 included: calcium and sodium (unfiltered) and barium, calcium and potassium (filtered) at W-08 SI.

  Inorganics detected one order of magnitude above background concentrations during Round 4 included: potassium (filtered) at W-07 SI; calcium (unfiltered) and calcium and barium (filtered) at W-08 SI. Remaining analytes were below or within the same order of magnitude of background concentrations or were below detection limits.

- Concentrations of inorganics above regulatory standards included; aluminum, chromium, iron, lead, manganese (unfiltered) and antimony (filtered) at W-04 SI; iron and lead (unfiltered) at W-07 SI; aluminum, antimony, barium, chromium and iron (unfiltered) and aluminum and barium (filtered) at W-08 SI; chromium, iron and manganese (unfiltered) at W-09 SI; and aluminum, iron, lead and manganese (unfiltered) and aluminum (filtered) at W-25 SI.

Deep Weathered Bedrock Wells. Deep weathered bedrock wells were sampled during Round 3 (W-04 DI, W-07 DI, W-25 DI) and Round 4 (W-04 DI, W-25 DI). Analytical results were as follows:

- VOCs detected during Round 3 included: acetone (5.1 ug/l) at W-04 DI; chloroform (1 ug/l), TCE (1.1 ug/l), PCE (1 ug/l), toluene (3.8 ug/l), and xylene (total) (4.8 ug/l) at W-07 DI.

  VOCs were not detected during Round 4.

- Semi-volatile samples were collected at W-04 DI during Round 3 only. No semi-volatile compounds were detected.

- In organics detected one to two orders of magnitude above background in Round 3 included barium (filtered) and calcium, potassium and sodium (filtered and unfiltered) at W-07 DI.

- Inorganics detected three orders of magnitude above background concentrations during Round 3 included: copper (filtered) at W-04 DI.

- Concentrations of inorganics sampled during Round 4 were within one order of magnitude of background or lower.

- Concentrations of inorganics above regulatory standards included: chromium, iron, lead, manganese, nickel and aluminum (unfiltered) and copper (filtered) at W-04 DI; aluminum, chromium, iron, lead, manganese and nickel (unfiltered) and aluminum and barium (filtered) at W-25 DI; and aluminum, barium, chromium, iron, lead and manganese (unfiltered) and antimony and barium (filtered) at W-07 DI.

As previously mentioned, some metals (beryllium, lead, manganese, nickel and zinc) were found at higher concentrations in unfiltered water in the background well. The reason for this is explained in the upgradient well section.

Residential Well Sampling

Ground water samples were collected from two residential wells (Dickinson and Olin) and Ryder Spring during ground water sampling Rounds 3 and 4. Samples were analyzed for organics VOCs and inorganics.

- VOCs detected included chloroform (1.1 ug/l) at Dickinson in Round 4.

- Inorganics were detected during interim sampling. Barium, calcium, magnesium and sodium were detected in both rounds at the Dickinson well. Lead was detected in Round 3 at Dickinson. Zinc was detected in Rounds 3 and 4. Chromium, cadmium and iron were detected in Round 3. Iron was detected in Round 3. Potassium was detected in filtered

samples from Rounds 3 and 4. The lead concentration detected in Round 3 exceeded regulatory standards.

At the Olin well, barium, copper, calcium and magnesium were detected in both filtered and unfiltered samples. During Round 3 cadmium, chromium, cobalt, iron, lead and zinc were detected in the unfiltered samples. Lead was detected during Round 4. Potassium was detected during Rounds 3 and 4 (unfiltered only). In addition, sodium was detected during Round 3 (filtered and unfiltered). Thallium was detected during Round 4 (unfiltered). Zinc was detected during Round 3 (filtered) and unfiltered).

At the Ryder Spring well, barium, calcium and magnesium were detected during both rounds of sampling. Antimony was detected in Rounds 3 and 4 at concentrations exceeding regulatory standards. Cadmium was detected during Round 3 in the unfiltered sample and its blind duplicate. Potassium was detected during Round 3 (unfiltered, filtered and blind duplicate). Lead, chromium and copper were detected during Round 3 and Round 3 blind duplicate (unfiltered) and in the blind duplicate of the filtered sample from Round 3.

The detection limit reported for antimony (unfiltered) during Rounds 3 and 4 was 60 ug/l. This detection limit is different from previous rounds due to the use of Enseco Analytical Services which reported results to the USEPA CRDL of 60 ug/l.

Phase 1B RI - Ground Water Sampling and Analyses

Objectives and Methods. One round of ground water samples was collected from the monitoring wells installed during the Phase 1B RI field investigation. Samples were collected two to four weeks following well development. These wells included:

- Former Lagoon Area well: W-TP-12
- shallow kame sand well: W-27 S1
- Marshy Area ablation till wells: W-04 T, W-22 T
- West of the Landfill Area Ablation Till Wells: W-26 T, W-27 T

The purpose of this sampling event was to further characterize the water quality within the ablation till below the Marshy Area, the kame sand and ablation till West of the Landfill Area, the water quality and in kame sand below the Former Lagoon Area.

Finally, samples were collected from the Dickinson residence well to compare selected inorganic constituents (lead and sodium) to previous data.

Previous samples were collected from the tap at the residence and it was thought that distribution piping may have affected results.

Ground water samples were collected in accordance with the procedures specified in the RI Work Plan. Analytical results were as follows:

Results.
Former Lagoon Area Well W-TP-12. Ground water samples were collected at W-TP-12 for VOCs semi-volatiles, PCB/pesticides, and metals (filtered and unfiltered). Analytical results indicated the following:

- VOCs detected at W-TP-12 included: vinyl chloride (45 ug/l), methylene chloride (22 ug/l), 1,1-dichloroethene (10 ug/l), 1,2-DCE (3,000 ug/l), TCE (27,000 ug/l), PCE (21,000 ug/l), and toluene (140 ug/l). All VOCs detected exceeded federal MCLs and Vermont PGWS.

- The only semi-volatile compounds detected at W-TP-12 were 1,3-dichlorobenzene (10 ug/l) and 1,4-dichlorobenzene (32 ug/l).

- The only PCB/pesticide compound detected at well W-TP-12 was endrin (0.085 ug/l).

- Inorganic concentrations detected at W-TP-12 one order of magnitude above background concentrations included: barium, lead, iron and zinc for filtered and lead for unfiltered. Concentrations detected two to three orders of magnitude above background concentrations included: aluminum, manganese, nickel and potassium for filtered and nickel for unfiltered samples.

Shallow Kame Sand Well W-27 S1. Ground water samples were collected and analyzed for VOCs and inorganics (filtered and unfiltered).

- VOCs were not detected in W-27 S1.

- Inorganic concentrations detected at W-27 S1 one order of magnitude above background concentrations included only manganese (filtered sample). The remaining analytes were detected below or within the same order of magnitude of background concentrations or below. Concentrations that exceeded regulatory standards included aluminum, chromium, iron, lead and manganese (filtered).

- Concentrations of inorganics that exceeded regulatory standards included; aluminum, chromium, iron, lead, manganese and potassium

(filtered) at W-TP-12; and aluminum, chromium, iron, lead and manganese (unfiltered) at W-27 S1.

Marshy Area Ablation Till Wells. Ablation till wells, W-04 T and W-22 T located within the Marshy Area at the toe of the landfill, were sampled for VOCs and metals. Analytical results indicate the following:

- VOCs detected included: vinyl chloride (200 ug/l), methylene chloride (35 ug/l), 1,2-DCE (total) (320 ug/l), 1,2-dichloroethene (9 ug/l), TCE (1200 ug/l), PCE (41 ug/l) at W-04 T and methylene chloride (150 ug/l), 1,2-DCE (total) (310 ug/l), 1,2-dichloroethane (21 ug/l), TCE (6400 ug/l) at W-22 T. All VOCs detected exceeded federal MCLs and Vermont PGWS.

- Inorganic concentrations detected in the background kame sand well (W-01) were used to evaluate inorganic concentrations in the ablation till ground water system.

  Inorganic concentrations detected at W-22 T one order of magnitude above background concentrations included aluminum and iron (filtered). Manganese (filtered) was detected at two orders of magnitude above background.

  Manganese was detected at W-04 T two orders of magnitude above background in filtered samples.

  Remaining analytes were below or within the same order of magnitude of background concentrations or were below detection limits.

- Concentrations of inorganics exceeding regulatory standards included aluminum, iron, lead, manganese, nickel and thallium (unfiltered) and aluminum, iron and manganese (filtered) at W-22 T; and aluminum, barium, chromium, iron, lead manganese and nickel (unfiltered) and manganese (filtered) at W-04 T.

West of Landfill Area Ablation Till Wells. Ablation till wells W-26 T and W-27 T located west of the landfill were sampled for metals and VOCs. Analytical results are as follows:

- VOCs were not detected in samples collected at W-26 T and W-27 T.

- Inorganic concentrations detected at W-26 T one order of magnitude higher than background concentrations included: manganese (filtered).

- Inorganic concentrations detected at W-27 T one order of magnitude higher than background concentrations included: potassium (filtered). Manganese was detected two orders or magnitude above background concentrations in the filtered samples.

  Remaining analytes were below or at the same order of magnitude to background concentrations, not detected or detected below detection limits.

- Concentrations of inorganics exceeding regulatory standards included: aluminum, chromium, iron, lead and manganese (unfiltered) and manganese (filtered) at W-27 T; and aluminum, barium, chromium, iron, lead, manganese and nickel (unfiltered) at W-26 T.

Residential Well Sampling. Ground water samples were collected from one residential well (Dickinson) for lead and sodium (filtered and unfiltered). Analytical results are provided in Appendix 15.

Analytical results indicated that concentrations did not exceed federal MCLs and Vermont PGWS.

3.2.6. Ground Water Users Survey

A ground water users survey was conducted to identify and locate residential, commercial, municipal, and industrial ground water users within a one mile radius of the Site. Information obtained during the LFI indicated that two municipal water supply systems are located within a one mile radius of the Site. These systems (Ryder Spring, and Morgan Spring) are sampled by the Bennington Water Department on a daily basis for bacteria and turbidity. Ryder Spring is located approximately 3,000 feet from the Site. Morgan Spring is approximately 2,500 feet from the Site. Another system known as Bolles Brook is located two miles upgradient of the Site. Ryder Spring was sampled during the Phase 1A RI investigation, as described previously. Sampling of the Bolles Brook and Morgan Spring was not performed during the Phase 1A RI investigation as the Morgan Spring supply is sampled quarterly for VOCs and Bolles Brook is located two miles upgradient of the Site.

Based on information provided by the Bennington Town Listers office, private water supply well owners within a one mile distance and apparently downgradient of the Site were initially identified as:

Mr. Noel Olin P.O. Box 102 Burgess Road Bennington, VT 05201 (#150 of the LFI Report, formerly John Williams property, *1400 feet)	Mr. Joseph Guetty Burgess Road Bennington, VT 05201 (#75 of the LFI Report, formerly Reno Guetty property. Reportedly obtains drinking water from Ryder Spring, *1400 feet)
Mr. Ralph Dickinson Burgess Road Bennington, VT 05201 (*1,000 feet)	Mr. Patrick Kinney, Sr. Burgess Road Bennington, VT 05201 (* 1,000 feet)

* References approximated distance from the Site.

Although other residential wells are listed on Table 3, only the wells previously listed are located within one mile of the Site and were evaluated in this study.

Prior to sampling, discussion with Patrick Kinney revealed that the Kinney well went dry in 1987, has been inactive ever since, and is now buried. Although Joseph Guetty provided written permission to sample his well, upon investigating his property prior to sampling and discussion with Mr. Guetty, it was learned that there was never any well. Both residences are connected to Ryder Spring, and therefore no wells were sampled.

It was confirmed that both the Dickinson and Olin residences obtain drinking water from their wells. Sampling of two locations (Dickinson and Olin residences) for USEPA 524.2 volatiles and

filtered and unfiltered metals was performed during the Phase 1A RI, interim sampling events and the 1B RI investigation as described previously.

Several abandoned well locations were also identified during the ground water users survey. These include the Ms. Mary Albrycht property (listed as #281 of the LFI Report) and well points at the abandoned reservoir located on Burgess Road approximately one-quarter mile southwest of the Site. Upon further investigation, it was identified that there was no well at the Ms. Mary Albrycht property.

The installation of a well was reportedly attempted at this location, but insufficient water was encountered. Therefore, the well was removed or abandoned. Further investigation revealed that the abandoned reservoir located on Burgess Road was essentially a holding pond which received water from Ryder Spring. Mr. Terry Morse at the Town of Bennington Water Department, confirmed that Ryder Spring feeds a spring house located just west of Burgess Road in the Town of Bennington, near the Town of Woodford line. Several residences are connected to this distribution system downstream of the spring house. Based on this information, sampling of the furthest upstream point of the Ryder Stream distribution system (the spring house overflow) was completed in the Phase 1A RI.

3.3. Surface Water and Sediment Investigations

3.3.1. Surface Water Flow Measurement Program

In accordance with the RI Work Plan, surface water flow and precipitation measurements were collected during two monthly periods, one period representative of "dry" season conditions, the other representative of "wet" season conditions.

Dry season monitoring was conducted from September 24 through November 19, 1992. Wet season monitoring was conducted from April 5 through April 29, 1993. In New England, the dry season typically occurs during the summer and fall months when potential evapotranspiration rates are greater than that which is required for infiltration of precipitation to the water table. The result is a lowering of the water table because net recharge through available percolation of precipitation approaches zero. The precipitation totals for October and November 1992 as collected by the Bennington Public Works Department were 2.73 and 4.65 inches respectively.

One quarter of the November precipitation (1.2 inches) fell during November 23-25, 1992. The average value for November was 3.92 inches. The precipitation for April 1993 collected by the public works department was 5.72 inches which is higher than average value (4.02 inches) and therefore could be considered a "wet" month.

The precipitation totals from the nearby Pownal Vermont Station as shown in Appendix 3 indicate that precipitation totals prior to the October-November 1992 "dry month period" were normal. Therefore, this period could be considered a typical "dry month". The snow melt and precipitation recorded for April 1993 suggests this was a typical "wet month". In addition, a comparison of historical ground water elevation data at the Site indicate higher ground water elevations in the spring and lower ground water elevations in the fall consistent with presentation patterns. This condition further illustrates these "wet" and "dry" month designations.

The wet season represents a period when potential evapotranspiration or uptake of soil moisture by plants is negligible and infiltration of precipitation results in recharge to the ground water table through direct percolation. This period typically occurs in late winter and early spring when the ground has thawed and plants are dormant. This process is described in a publication entitled *The Water Balance*, (Thornthwaite and Mather, 1955).

According to *Climates of the States, Vermont*, (U.S. Department of Commerce Weather Bureau, 1959), Vermont's precipitation is well distributed throughout the year. According to Mr. Mark Siderman, (meteorologist with the National Climatic Data Center in Asheville, NC), precipitation data for Bennington from 1959 to 1993 are not available. However, data were obtained for the Pownal, VT. station which is located 7 miles south of the Site and is the nearest station to the Site. In the western part of the state, winter precipitation is noticeably less than summer rainfall. This is due to less of a moderating effect from the Atlantic Ocean than occurs in the eastern part of the state. Low pressure storm systems are the principal moisture producers year round. When this activity ebbs somewhat in the summer, patches of thunderstorms increase in activity, more than making up the difference. These storms sometimes produce washouts indicating high amounts of runoff.

Prolonged droughts are infrequent, as are widespread floods. Based on National Oceanic and Atmospheric Administration (NOAA), National Climate Data Center , Climate Services Division, Annual Climatological Summaries for the 13 year period from 1979 - 1992, average annual rainfall and snowfall totals are 42 and 52 inches, respectively. These data were measured at the Pownal, VT NOAA weather station. According to the climatic publication, the mean annual runoff in streams ranges from 10 to 40 inches. According to data available for Rutland, which is in the same climatic region as Bennington, monthly precipitation averages from 1931 to 1955 ranged from 2.11 to 4.78 inches. Higher monthly averages occurred in the summer, and lower averages occurred in the winter.

Continuous readings of precipitation were collected from the Landfill Area during the time periods studied. The precipitation gage malfunctioned from October 14 to October 30, and from April 17 to April 20. Sufficient data were gathered, however, to permit an evaluation of the response of surface water flows to precipitation. Graphs depicting the precipitation data are shown in Appendix 3.

Continuous readings of surface water flows were collected at station number S-01 located in the unnamed stream, about 175 feet south of the southern toe of the Landfill Area. The continuous recorder at S-01 malfunctioned from April 12 to 14. Graphs depicting continuously recorded flows from this station are shown in Appendix 4.

Surface water flow rates at other stations were also collected during the program. These stations, designated as S-02 through S-05, are shown on Figure 2 and were located in the following areas:

- S-02: unnamed stream prior to its confluence with Barney Brook
- S-03: Barney Brook prior to its confluence with the unnamed stream
- S-04: Barney Brook prior to its confluence with the Walloomsac River, South Stream
- S-05: Walloomsac River, South Stream prior to its confluence with Barney Brook

Flow rates measured in these stations are presented in Appendix 4.

For the purpose of estimating the components of recharge to the primary unnamed stream in the Marshy Area, a comparison was made of continuously recorded flows at station S-01 to precipitation events. The objective of this effort, as stated in the RI Work Plan, was to provide estimates of the amount of surface runoff to the unnamed stream during a typical precipitation event, and to estimate the amount of ground water discharge to the stream from the Landfill Area. A secondary objective of this program was to estimate the amount of dilution of water from the unnamed stream to receiving waters in Barney Brook and Walloomsac River, South Stream.

3.3.2. Estimate of Runoff in the Landfill Area

In order to estimate the component of runoff to the unnamed stream in the Landfill Area, the drainage area upstream of station S-01 was estimated using a USGS topographic map as illustrated on the Drainage Basin Map, Figure 3 and hydrographs in Appendix 4. As described in Chapter 6 of *Ground Water*, (Freeze and Cherry, 1979), the great heterogeneity of soil types at the ground surface over a watershed and the very irregular patterns of precipitation create a very complex hydrologic response in streams. It has also been postulated that most overland flow may result from as little as 1 to 10% of the basin area, (p 219, *Ground Water*). These factors indicate that runoff coefficients developed from the data are approximate for the area in the unnamed stream drainage basin and do not necessarily represent the landfill cover.

The results of a stream study by Freeze and Cherry indicated that flows in a stream can be separated into components attributable to: a) overland surface flow, b) subsurface interflow, and c) subsurface ground water flow. Subsurface interflow is that which recharges a stream through the uppermost soil horizon. In the case of a moderate to highly permeable upper soil horizon, much of the stream flow response during a precipitation event can be attributed to interflow.

The coefficient of runoff (Cro) was estimated for precipitation events during the wet and dry monthly periods. In order to estimate this number, the recharge area for the unnamed stream upgradient of station S-01 was approximated from topographic contours on the Bennington, Vermont 7.5 minute USGS Quadrangle map. The drainage basin area interpreted from topography as shown on Figure 3 is approximately 92 acres. The measured precipitation events over time were multiplied by the drainage area to obtain the total precipitation in gallons per minute, per event that fell in the drainage basin. The change in surface flow from base flow conditions noted for that particular event was divided by the total water addition in the basin to estimate the percent of surface runoff.

For the dry period, surface water flows correlated reasonably well with precipitation for the dates of October 9 through 12, and November 12 through 19. The antecedent soil moisture conditions as well as the intensity of the precipitation event affected the stream flow response, as can be seen by comparing the hydrographs from the October 9 through 12 event to the event on November 23 through 24 in Appendix 4.

In order to estimate runoff coefficients in the area of the unnamed stream, the two precipitation events were evaluated. The first event on October 9 through the 12th produced 0.3 inches of rain over 2 hrs. The total water

added to the basin (92 acres) was approximately 751,410 gallons. The average flow above base conditions resulting from the precipitation using the data in Appendix 4 was 31.79 gpm for 90 hours. Dividing the total flow of 171,666 gallons by the precipitation amount yielded a fraction of 0.22 for runoff. This value resulted from a moderate size precipitation event over relatively short duration.

For the November 12-14 event, 0.64 inches fell over 22 hours. The total precipitation amount in the basin was approximately 1.6 million gallons. The average flow above base conditions at S-01 was 5 gpm for 33 hours at 10,000 gallons. This resulted in a fraction of 0.006 for runoff, which reflects the greater storm duration which permitted greater infiltration.

The same procedure was applied for estimating runoff during a rainy period from April 22 through 24. During this time approximately 1.51 inches of rain fell over 31 hours. the total precipitation amount in the basin was approximately 3.7 million gallons. The average flow above base conditions was 885 gpm for 87 hours or 4.6 million gallons. The flow through gage stations S-01 was greater than the input from precipitation indicating increased contribution to surface water flow from ground water runoff and snow melt. This was calculated after a period of prolonged precipitation with spring snow melt occurring in the area. The soils had likely reached their field capacity and most rainfall resulted in direct runoff to streams. In fact, the Marshy Area, which represents the local discharge area for the unnamed swale network upgradient of S-01, was observed to be completely inundated at this time.

The runoff from the areas underlain by sandier soils, including the Landfill Area, may consist chiefly of interflow in the upper soil horizon due to the relatively high permeability of the kame sand. (See Appendix 22, Geotechnical Properties of Soils). Little overland runoff was observed in the Landfill Area.

3.3.3. Estimates of Stream Flow Dilution

Graphs depicting the flow rates in the five gaging stations during the dry month and the wet month are presented in Appendix 4. As would be expected, the flow rates increased in the downstream direction from station S-01 to S-05. The following summarizes the range in flow rates observed during the two periods:

Station number	Range in flow/dry season (gpm)	Range in flow/wet season (gpm)
S-01	3 to 27	300 to 1,130
S-02	3 to 16	500 to 1,700
S-03	18 to 407	2,400 to 7,950
S-04	34 to 403	5,000 to 14,000
S-05	5,000 to 20,000	41,000 to 51,000

The dilution rate from the unnamed stream to Barney Brook during dry conditions was about 5:1 to 30:1 times. This was calculated by dividing the receiving stream flow by the contributing stream flow. The dilution rate during wet conditions was about 4:1 to 5:1. The dilution rate from Barney Brook into the Walloomsac River, South Stream during dry conditions was about 40:1 to 125:1. The dilution rate during wet conditions was about 3:1 to 8:1. The higher dilution rates noted during dry conditions are attributable to the greater relative fluctuation of small stream flows in response to precipitation.

3.3.4. Ground Water Flow Into Marshy Area From Landfill Area

The ground water flow maps presented in Figures 16 and 17 indicate that the landfill materials around the Former Lagoon Area are unsaturated. Nevertheless, some leaching of residues has apparently occurred to the water table with continued migration along flow paths into the Marshy Area. This is evidenced by the detection of volatile constituents in shallow wells located in the Marshy Area.

Since ground water head measurements indicated discharge of shallow ground water to the unnamed stream along the eastern face of the landfill, the length along the stream bracketed by TCE contours shown on Figures 34A and 34B was taken to be the length upon which affected ground water from the landfill would discharge to the unnamed stream.

To estimate the flux of shallow ground water into the Marshy Area and the unnamed stream from the source area in the Landfill Area, hydraulic parameters developed in the field program were used with an equation incorporating Darcy's formula. The formula is: $Q=KIA$

Where:

- Q = ground water flow through a cross sectional area of an aquifer in gallons per day (gpd)
- K = hydraulic conductivity in gallons per day/square foot (gpd/sf)
- I = hydraulic gradient in feet per feet (ft/ft)
- A = cross section of the aquifer in square feet (sf)

To estimate the cross sectional area of kame sand and ablation till units through which ground water flows into the Marshy Area, an evaluation of flow potentials was made utilizing hydraulic data from wells W-02, W-03 and W-03 T in the Marshy Area. An upward flow potential has been observed from ablation till well W-03 T to W-03 in kame sand and also from well W-04 D to W-04 S. The upward flow may be occurring from the top of the lodgement till at a depth of 30 feet in the area since the K value was similar between the shallow till and the Marshy Area kame sand. Conservatively estimating, upward flow potentials may occur to a depth of 40 feet in the lodgement till in the Marshy Area. This means that ground water in the upper 40 feet of saturated material beneath the Landfill Area may recharge the unnamed stream during typical base flow conditions. The length along the unnamed stream that receives potentially impacted ground water recharge from the Landfill Area was estimated to be 600 feet, (W-12 S1 area south to S-01) as determined from the horizontal extent of TCE concentrations shown on Figures 34A and 34B.

The stream was observed to be losing to ground water in the area of P-03 midway along this transect. Therefore, the estimation of recharge along the entire length of the unnamed stream in this area is a conservative one because it assumes recharge where at one point (P-03) some discharge of surface water to ground water was noted.

The area (A) in the equation was estimated to be 600 by 40 feet, or 24,000 sf. The average hydraulic conductivity (K) for wells in the Marshy Area from Table 4 is 1.4 gpd/sf. The average hydraulic gradient was estimated to be 0.1 ft/ft from the Landfill Area to the Marshy Area. The resulting flow to the unnamed stream during base flow conditions was calculated to be about 2.3 gpm. This estimate was developed to calculate the potential loading of residues from source areas to the stream. The flow rate at station S-01 during the dry season ranged from 3 to 15 gpm, with an average rate of about 10 gpm.

A comparison of ground water flow maps for April and June 1993 on Figures 16 and 19, respectively, indicates similar hydraulic gradients

beneath the Landfill Area. April was considered to be a wet month with flows in the unnamed stream at station S-01 ranging from 309 to 1,130 gpm. During wetter periods with higher rates of surface runoff and shallow interflow to the stream, the discharge of deeper ground water may remain relatively constant. This suggests that dilution of surface water in the unnamed stream by runoff may be significant (100:1 to 600:1) although increased runoff will probably flush more constituents into the stream as well.

3.3.5. Surface Water Sampling

Two complete rounds of surface water sampling were performed during the Phase 1A RI field program. A Limited Sampling was performed during the Interim Sampling Program between the Phase 1A and 1B RI programs. A Sample Analysis Inventory (Table 35) presents the sample locations, area of the Site (upstream, Landfill Area, or downstream), and analyses performed for each sample. Results of the sampling by area indicating the range of results for all analyzed parameters are presented in Tables 31 to 33. Detected VOCs, SVOCs and PCBs, as well as inorganics which exceeded regulatory levels are presented in Table 19. Laboratory data sheets for all samples are included in Appendix 15. A description of both programs follows.

Phase 1A RI - Surface Water Sampling Program

Objectives and Methods. The objective of the surface water sampling was to evaluate the effects of the Former Lagoon Area and Landfill Area on the surface water quality in the drainage swales, the unnamed stream, and in Barney Brook. Surface water samples were collected on two occasions, once in late September 1992, at the start of the Phase 1A RI field program, and once again in mid April 1993 at its completion.

The September 1992 sampling round was representative of dry weather flow conditions and the April 1993 round was representative of wet weather flows. Samples were collected from locations corresponding to those noted in the RI Work Plan with the exception of SW-03. This sampling point was relocated approximately 10 to 20 feet downstream of a temporary well access road constructed between sampling events that covers the original SW-03 sampling location. The relocated SW-03 is shown on Figure 2.

The original location (sampled during Round 1) was located 15 feet upstream of the new SW-03 in Swale 2-3, directly beneath the temporary well access road. The road was constructed similar to the access road West of the Landfill Area. Although surface water quality may have been

temporarily impacted by disturbance of sediments during the road construction, surface water sampling of Round 2 occurred a sufficient length of time after completion of the road to allow surface water quality to return to ambient conditions.

Prior to initiation of the surface water and sediment sampling program, a weir structure was installed in Swale #2 for purposes of surface water flow measurement. Since proper operating conditions are critical to the accuracy of a weir structure, a distance of 1-1/2 feet was required from the weir crest to stream bottom for flow measurement. To attain this condition, a portion of the swale bottom was hand excavated. Installation of the weir was not expected to adversely effect the representativeness of VOC concentrations, since free fall conditions have been observed at many points along the stream, due to rocks, logs and other natural obstructions.

Samples collected during the November 1993 sampling event were used to compare to previous data. Surface water field logs are included in Appendix 25. The sampling locations are shown on Figure 2. Locations were staked, surveyed and labeled. Samples were collected using procedures as described in the RI Work Plan and shipped to OBG Laboratories, Inc. for analyses. Samples were analyzed for parameters as indicated in Appendix 15 and Table 35.

Based on the RI Work Plan, select surface water samples were analyzed for VOCs by USEPA Method 524.2. The reason some samples were submitted for USEPA Method 524.2 analysis was due to the method's lower detection limits. The results of the 524.2 analyses are located in Table 16 of Appendix 15. The remaining samples were analyzed for VOCs by USEPA Method 8240. The results of the 8240 analyses are located in Table 15 of Appendix 15.

Surface water sampling locations SW-01A, SW-08 and SW-013 were dry during the Fall sampling event, and SW-01A was also dry during the Spring sampling event, as indicated on the Surface Water and Sediment Sampling Field Logs in Appendix 25. Therefore, surface water samples were not collected at these locations during the dry periods. Results of field analysis, including pH, specific conductivity, temperature and dissolved oxygen, are provided on the Sampling Logs.

Results. The surface water sampling results have been organized into three areas: upstream of the Landfill Area, in the vicinity of the Landfill Area, and downstream of the Landfill Area. The surface water samples collected in each of the three areas are as follows:

- upstream samples collected at SW-01A, 01B, 08, and 013
- Landfill Area vicinity samples collected at SW-02 and SW-09 through SW-012
- downstream samples collected at SW-03 through SW-07, SW-014, and SW-015

Results of volatiles, semi-volatiles, pesticides/PCBs and inorganics analyses are presented in Tables 15 through 19 of Appendix 15, respectively. VOCs, semi-volatiles and PCB/pesticides which were detected are summarized by sample location on Table 19. The VOC concentrations detected in the surface water samples during Rounds 1 and 2 are illustrated on Figure 29. The validated data from these investigations were compared to Vermont Water Quality Standards (VT WQS) for Class B Waters as well as USEPA Ambient Water Quality Guidelines, as a frame of reference for development of ARARs in subsequent phases of the RI/FS program. The surface water quality standards are located on Table 39. The USEPA Ambient Water Quality Guidelines reflect recommendations on acceptable limits for aquatic life and human health protection. They are designed to offer guidance to states in developing and revising water quality standards. Since Vermont has developed surface water quality criteria, the federal guidelines were used for comparative purposes only in the review of site surface water data.

Analysis of surface water samples SW-01 B, SW-02, SW-03 and SW-10 for VOCs by USEPA Method 524.2 was completed as part of the RI Work Plan. These samples were previously analyzed for VOC analysis by USEPA Method 8240. Therefore, VOC data exist from both analytical methods for these sampling points.

Based on the Method 8240 analytical results (9/22/92 and 9/23/92 samples) and Method 524.2 results (9/29/92 samples), surface water contaminant concentrations may differ significantly on a weekly basis during low flow conditions. Several parameters which were detected by Method 8240 were detected at higher concentrations in samples analyzed by Method 524.2 collected the following week. Acetone and carbon disulfide were detected at higher concentrations in samples collected the first week (i.e., 9/22/92 and 9/23/92 samples for Method 8240 analysis). Surface water quality can vary depending on storm water runoff (i.e., dilution) and in some cases transport of contaminants.

The following is a discussion of the surface water sampling results obtained from the three areas described above. Comparison of Round 1 and Round 2 data indicate that VOC and inorganic concentrations are higher for

samples collected during low flow (dry) conditions (Round 1). At most locations (i.e., except SW-06 and SW-07) copper concentrations were higher in wet (Round 2) conditions.

Upstream Water Samples. Upstream surface water sample SW-013 was located in Drainage Swale #1 along the Hillside Area, samples SW-01 A and SW-08 were located in Drainage Swale #2 northeast of the Landfill Area and SW-01 B was located in Drainage Swale #3 east of the Landfill Area.

Results of the analyses performed on samples from these locations are as follows:

- Upstream surface water VOC concentrations detected, included carbon disulfide (10 ug/l) at SW-01 B by Method 8240 and 0.5 ug/l by Method 524.2.

- Upstream surface water semi-volatile concentrations were not detected.

- Upstream surface water PCB/pesticide concentrations were not detected.

- Upstream inorganic analytes detected included aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, potassium, silver, sodium, vanadium, and zinc. Arsenic (SW-08) was the only inorganic detected at a level in excess of the Vermont WQS. Iron, although present at 309000 ug/l at SW-08, was not observed to have a visual impact on the stream.

Landfill Area Vicinity. Surface water samples SW-02, and 09 through 12 were located in Swale #2 the Marshy Area southeast of the Landfill Area. Results of the analyses performed on samples from these locations are as follows:

- TCE was detected above VT WQS in all samples in this area ranging from 6 ug/l to 920 ug/l. Vinyl chloride and PCE were detected at all locations except SW-09, ranging in concentrations from 2 ug/l to 490 ug/l for vinyl chloride (2 ug/l VT WQS) and 3 ug/l to 97 ug/l for PCE (0.8 ug/l VT WQS). In addition, 1,1-DCE (0.033 ug/l VT WQS) was detected at 8 ug/l and 1,2-DCE was detected at 2600 ug/l at SW-02. Ethylbenzene (0.8 ug/l), o-xylene (1 ug/l), and 1,2,4-trimethylbenzene (3 ug/l) were detected at concentrations not exceeding VT WQS. The following VOCs were also detected: acetone (4-12 ug/l), 1,2-DCE (6-1300 ug/l), toluene (7-18 ug/l), 4-methyl-2-pentanone (3-14 ug/l),

bromodichloromethane (10 ug/l), dichlorodifluoro-methane (21 ug/l), carbon disulfide (1-2 ug/l), Cis-1,2-dichloroethene (8-2600) and 1,1,1-TCA (0.6 ug/l).

- Landfill Area vicinity semi-volatile concentrations were not detected.

- Landfill Area vicinity PCB/pesticide surface water concentrations were not detected.

- Landfill Area vicinity inorganics detected included: aluminum, arsenic, barium, calcium, cobalt, copper, iron, lead, magnesium, manganese, potassium, silver, sodium, vanadium, zinc and cyanide. An iron-type discoloration of the sediments in this area was observed. Arsenic SW-11 at 10 ug/l was in excess of the Vermont WQS of 2.2 ug/l.

Downstream Surface Water Samples. Surface water samples SW-03 through SW-07, SW-014, and SW-015 were collected downstream and to the southwest of the Landfill Area. The results of the analyses performed on samples from these locations are as follows:

- TCE and PCE were detected above VT WQS at SW-03, SW-014, and SW-015. Concentrations ranged from 6 ug/l to 270 ug/l for TCE (2.7 ug/l VT WQS) and from 3 ug/l to 19 ug/l for PCE (0.8 μg/l VT WQS). Vinyl chloride was detected above the 2 ug/l VT WQS at SW-03 and SW-015 from 2 ug/l to 120 ug/l. 1,1-DCE was detected at SW-03 at 2 ug/l (0.33 ug/l VT WQS). 1,2-DCE (780 ug/l) at SW-03; (140 ug/l VT WQS). Dichlorodifluoro-methane (4 ug/l) at SW-03; Cis-1,2-DCE (8-780 ug/l) at SW-03 and SW-15; trans 1,2-DCE (.6-5 ug/l at SW-03 and SW-15; carbon disulfide (1-230 ug/l) at SW-03, SW-04, SW-05, SW-14, SW-15; acetone (2-5 ug/l) at SW-03, SW-06, SW-14; 1,2-DCE (5-560 ug/l) at SW-03, SW-04, and SW-14; and toluene (2-3 ug/l) at SW-03 were detected.

- Downstream surface water semi-volatile concentrations were not detected.

- Downstream surface water PCB/pesticide concentrations were not detected.

- Downstream inorganics detected at all the sampling locations included: aluminum, antimony, barium, calcium, chromium, cobalt, copper, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, silver, and sodium. Mercury at SW-15 at 0.22 ug/l was in excess of the VT WQS of 0.144 ug/l.

Interim Surface Water Sampling. Interim surface water sampling was performed during the November 1993 (Round 3) and February 1994 (Round 4) ground water sampling events. The purpose of these programs was to further evaluate the effects of the Former Lagoon Area and Landfill Area on the surface water quality in the unnamed stream and Barney Brook. Surface water samples were collected in the areas listed below during the November round.

- unnamed stream within Marshy Area: SW-3, SW-11, SW-12, and SW-14
- unnamed stream downgradient of Marshy Area: SW-04, SW-07 and SW-15
- Barney Brook: SW-05, SW-06, SW-16, SW-17

Surface water sampling location SW-17 was the only location sampled in February 1994.

Surface water sample locations SW-16 and -17 were added to the original Phase 1A RI program. These two new locations and existing Phase 1A RI locations are presented on Figure 2. Surface water sampling results are presented by area. Analytical results are presented on Tables 15 through 19 of Appendix 15.

Samples were collected using procedures described in the RI work and shipped to Enseco Laboratories, Arvada, Colorado for analysis of VOCs (524.2) and metals. Results of field analysis, including pH, specific conductivity, temperature, and dissolved oxygen are provided on sampling logs presented in Appendix 25. Analytical results are as follows:

Round 3

Marshy Area. Surface water samples were collected at SW-03, SW-11, SW-12, and SW-14 within the Marshy Area.

- VOCs detected above detection limits included: TCE (90 ug/l), PCE (22 ug/l), vinyl chloride (21 ug/l), Cis-1,2-dichloroethene (210 ug/l) at SW-03; dichlorodifluoromethane (7 ug/l), 1,1-dichloroethene (20 ug/l), trans-1,2-dichloroethene (2 ug/l), TCE (ug/l), toluene (2 ug/l), vinyl chloride (140 ug/l), Cis-1,2-dichloroethene (190 ug/l) at SW-11; 1,1-dichloroethene (2 ug/l), TCE (110 ug/l), PCE (30 ug/l), vinyl chloride

(38 ug/l), Cis-1,2-dichloroethene (260 ug/l), xylenes (3 ug/l) at SW-12; TCE (70 ug/l), PCE (17 ug/l), vinyl chloride (13 ug/l), Cis-1,2-dichloroethene (170 ug/l) at SW-14. Concentrations of TCE, PCE, vinyl chloride and 1,1 DCE at SW-03, SW-11, SW-12 and SW-14 exceeded VT WQS.

- Inorganic analytes detected above the original detection limits at these surface water sampling locations included: aluminum, antimony, barium, beryllium, calcium, chromium, iron, lead, magnesium, manganese, potassium, sodium, and zinc. Arsenic (10 ug/l) at SW-11 was the only inorganic constituent to exceed VT WQS.

Unnamed Stream Downgradient of Marshy Area
Surface water locations sampled downstream of the Marshy Area and prior to Barney Brook included: SW-04, SW-07 and SW-15.

- VOCs detected included: TCE (8 ug/l), PCE (2 ug/l), Cis-1,2-dichloroethene (19 ug/l) at SW-04; Cis-1,2-dichloroethene (2 ug/l) at SW-07; TCE (40 ug/l), PCE (10 ug/l), vinyl chloride (4 ug/l), Cis-1,2-dichloroethene (100 ug/l) at SW-15. Concentrations of TCE, PCE and vinyl chloride at SW-04 and SW-15 exceeded VT WQS.

- Inorganic analytes detected above detection limits at these sampling locations included: calcium, iron, magnesium, and manganese. Inorganic concentrations did not exceed VT WQS.

Barney Brook. Surface water samples locations sampled within Barney Brook included: SW-05, SW-06, SW-16, and SW-17.

- VOCs were not detected at these locations

- inorganic analytes detected above the required detection limits at these locations included: antimony, calcium, iron, manganese, and silver; inorganics concentrations did not exceed VT WQS

Round 4
Surface water was collected at sample location SW-17 during the fourth round of sampling. Results are as follows:

- VOCs detected included TCE at 1.1 ug/l (2.7 ug/l VT WQS)

- inorganic analytes detected above detection limits included: calcium, iron, and manganese

In summary, upgradient samples collected for VOC analyses during the Phase 1A program detected only carbon disulfide. Arsenic was also detected at a concentration exceeding the VT WQS. In the vicinity of the Landfill, TCE, PCE, vinyl chloride and 1,1-DCE exceeded the VT WQS. Several other VOCs were detected, but at concentrations below the VT WQS. Aluminum, iron and manganese in the vicinity of the landfill exceeded the VT WQS. Downgradient samples also detected TCE, PCE, vinyl chloride and 1,1-DCE above VT WQS. In addition, mercury at one location exceeded the VT WQS.

The Interim Sampling program focused on the surface water in the Marshy Area, the unnamed stream downgradient of the Marshy Area and Barney Brook. Marshy Area surface water detected TCE, PCE, vinyl chloride and 1,1-DCE at levels exceeding VT WQS. TCE, PCE and vinyl chloride also exceeded the VT WQS in samples from the unnamed stream downgradient of the Marshy Area. Arsenic (in one Marshy Area sample) was the only inorganic which exceeded the VT WQS.

No VOCs were detected in samples from Barney Brook in Round 3. In Round 4, however, TCE was detected, but at a concentration below the VT WQS.

A comparison of results between dry and wet periods indicates that generally VOC and inorganic concentrations were higher for samples collected during low flow (dry) conditions. However, at most locations, copper concentrations were higher during higher flow (wet) conditions.

Analytical results for the surface water sampling, presenting the range of concentrations for analyzed parameters by area (upstream, landfill vicinity, and downstream) are included on Tables 31 to 33.

3.3.6. Sediment Sampling

Sediment samples were collected from drainage swales, unnamed stream, and Barney Brook during the Phase 1A RI program. A limited sampling program was performed during the interim ground water sampling event conducted in November 1993. A description of these sampling events follows.

Phase 1A RI - Sediment Sampling Program

Objective and Methods. The objective of the sediment sampling was to evaluate the effects of the Former Lagoon Area on the sediments in the drainage swales, the unnamed stream, and in Barney Brook. Sediment samples were collected from locations corresponding to those designated in the RI Work Plan, with the exception of SED-03. This sampling point was relocated approximately 10-20 feet downstream of the temporary well access road, constructed between sampling events, that covers the original SED-03 sampling location. The relocated SED-03 is shown on Figure 2.

The road was constructed similar to the access road West of the Landfill Area.

Prior to initiation of the surface water and sediment sampling program, a weir structure was installed in Swale #2 for purposes of surface water flow measurement. Since proper operating conditions are critical to the accuracy of a weir structure, a distance of 1-1/2 feet was required from the weir crest to stream bottom for flow measurement. During weir installation, approximately 30 feet of channel length was cleared by hand excavation to provide the proper operating conditions. The weir was installed in the same general area of SED-03, located downstream of SED-12 and upstream of SED-14.

During both the temporary access road construction and weir installation efforts were made to minimize disruption of the area. Sediment data are inconclusive for evaluating impacts of the two activities. Sediment quality tends to vary from location to location without specific trends in any area. Sediment characteristics can be affected by several factors, including fluctuation in stream flow and runoff.

Sediment samples were collected on two occasions, once in late September 1992, at the start of the Phase 1A RI field program, and once again in mid April 1993 at its completion. The September sampling round was representative of dry weather flow conditions and the April 1993 round was representative of wet weather flows. The sampling locations are shown on Figure 2.

Samples were analyzed for VOCs (USEPA Method 8240), semi-volatiles (USEPA Method 8270), and PCBs and pesticides (USEPA Method 8080). Inorganic analyses were performed according to the standard methods outlined in the RI Work Plan. Samples were collected using a clean stainless steel hand trowel or spoon as further described in the RI Work Plan. The sampling locations were staked, surveyed, and labeled. The samples were collected at a depth of 0 to 12 inches below the

sediment/surface water interface. Samples were then transferred directly into the appropriate sample container to minimize loss of volatiles. A sufficient volume of sample was collected to allow for potential splitting with the USEPA oversight contractor. Collection equipment was decontaminated between locations following the procedures set forth in the RI Work Plan.

The sediment sampling results have been organized into three areas similar to the surface water results: upstream of the Landfill Area, in the vicinity of the Landfill Area, and downstream of the Landfill Area. The sediment samples collected in each of the three areas are as follows:

Upstream Samples collected at SED-01 A, SED-01 B, and SED-08

Landfill Area vicinity collected at SED-02 and SED-09 through SED-012

Downstream samples collected at SED-03 through SED-07 and SED-013 through SED-015

Results. Sediment samples were collected, shipped to OBG Laboratories, Inc. utilizing chain-of-custody procedures and analyzed. A Sample Analysis Inventory (Table 35) presents the sample locations, area of the Site and analyses performed. Results are presented in Tables 20 through 23 of Appendix 15, respectively. VOCs, semi-volatiles and PCB/pesticides which were detected are summarized by sample location on Table 20.

There are no applicable federal or state regulatory standards against which sediment results could be directly compared. However, the NOAA has published sediment quality criteria which may be used to screen data for comparison purposes. NOAA has published the sediment quality guidelines based on constituent effects ranges.

A comparison of the NOAA Effects Range Low (ER-L) values versus the results of sediment sampling at the Site has been performed. Sediment concentrations that exceed NOAA guidance values represent a potential impact to the ecological receptors and will be further evaluated as part of the quantitative risk evaluation to be performed by USEPA.

A second set of screening guidelines has been prepared by the Ontario Ministry of the Environment. These guidelines are similar to the NOAA effects range and are published in "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario". Table 40 has been prepared to summarize the NOAA and Ontario Guidelines. Results of

comparing inorganic sediment levels at the Site to NOAA Guidelines have been included in Table 20. The analytical results are discussed below:

Upstream Sediment Samples. Upstream sediment samples SED-01 A and SED-08 were located in Drainage Swale #2 northeast of the Landfill Area and SED-01 B was located in Drainage Swale #3 east of the Landfill Area.

Results of the analyses performed on samples from these locations are as follows:

- The only upstream sediment VOC concentrations detected were levels of acetone at SED-01B (less than 1 ug/kg) and SED-08 (300 ug/kg).
- Upstream sediment semi-volatile concentrations were not detected.
- Upstream sediment PCB/pesticide concentrations were not detected.
- Upstream inorganic concentrations provide a range with which to compare metals concentrations detected in sediments at other locations at the Site. These ranges are:

Aluminum:	7220 mg/kg
Antimony:	ND
Arsenic:	1.1 to 6.0 mg/kg
Barium:	35.8 to 98.2 mg/kg
Beryllium:	.42 to 0.73 mg/kg
Cadmium:	ND
Calcium:	745 to 2910 mg/kg
Chromium:	3.6 to 8.4 mg/kg
Cobalt:	3.6 to 9.0 mg/kg
Copper:	2.7 to 6.6 mg/kg
Iron:	5950 to 78,900 mg/kg
Lead:	5.1 to 21.5 mg/kg
Magnesium:	585 to 1270 mg/kg
Manganese:	114 to 1170 mg/kg
Mercury:	ND
Nickel:	1.7 to 6.2 mg/kg
Potassium:	ND
Selenium:	ND to 3.0 mg/kg
Silver:	ND to 0.38 mg/kg
Sodium:	168 to 304 mg/kg
Thallium:	ND to 0.35 mg/kg
Vanadium:	5.9 to 10.2 mg/kg
Zinc:	21.4 to 49.8 mg/kg

Cyanide: ND

- Upstream sediment results did not exceed NOAA sediment guidelines.

Landfill Area Vicinity. Sediment samples SED-02 and 09 through 12 were located in the Marshy Area southeast of the Landfill Area. Results of the analyses performed on samples from these locations are as follows:

- Landfill Area vicinity sediment VOC concentrations detected were vinyl chloride at SED-02 (260 ug/kg), SED-010 (270 ug/kg) and SED-011 (430 ug/kg); acetone at SED-02 (390 ug/kg), SED-09 (210 ug/kg), SED-10 (270 ug/kg), SED-011 (280 ug/kg) and SED-012 (400 ug/kg); 1,2 - dichloroethene (total) at SED-02 (47 ug/kg), SED-010 (860 ug/kg), SED-011 (1,700 ug/kg) and SED-012 (150 ug/kg); 2 - butanone at SED-02 (58 ug/kg), SED-09 (52 ug/kg), SED-011 (73 ug/kg) and SED-012 (26 ug/kg); TCE at SED-010 (520 ug/kg), SED-011 (27 ug/kg) and SED-012 (11 ug/kg); toluene at SED-02 (190 ug/kg), SED-011 (180 ug/kg) and SED-012 (11 ug/kg); ethylbenzene at SED-02 (16 ug/kg) and SED-011 (12 ug/kg); xylene at SED-02 (64 ug/kg), SED-09 (18 ug/kg) and SED-011 (48 ug/kg); and PCE at SED-12 (72 ug/kg).

- Landfill Area vicinity sediment semi-volatile concentrations were not detected.

- Landfill Area vicinity PCB/pesticide sediment concentrations were detected at SED-02 which indicated levels of PCBs (Aroclor 1254 at 74 ug/kg). This concentration exceeded NOAA guidelines.

- Landfill Area vicinity inorganic concentrations were detected at one order of magnitude above upstream levels for the parameters shown at the following locations: aluminum - SED-02, SED-011 and SED-012; chromium - SED-09, SED-10 and SED-011; nickel - SED-02, SED-09, SED-11 and SED-12; and zinc - SED-09 and SED-11. Barium at SED-02, SED-09, SED-11, SED-12; beryllium at SED-02, cobalt at SED-11; copper at SED-09 and 11, manganese at SED-09 and SED-11, vanadium at SED-02, SED-09, SED-11 and SED-12.

- Landfill Area sediment results exceeded NOAA guidelines at the following locations and for the following parameters:

SED-09: Lead (39.7 mg/kg)
Mercury (0.18 mg/kg)
Zinc (130 mg/kg)

SED-11: Lead (60.2 mg/kg)
Mercury (0.37 mg/kg)
Nickel (59.8 mg/kg)
Zinc (176 mg/kg)

SED-12: Mercury (0.19 mg/kg)

The remainder of the inorganics were detected at concentrations within one order of magnitude of the upstream results.

Downstream Sediment Samples. Sediment samples SED-03 through SED-07, SED-013, SED-014 and SED-015 were collected downstream and to the southwest of the Landfill Area. The results of the analyses performed on samples from these locations are as follows:

- Downstream sediment VOC concentrations detected were acetone at SED-03 (79 ug/kg), SED-014 (30 ug/kg) and SED-015 (150 ug/kg); PCE at SED-04 (130 ug/kg), SED-07 (9 ug/kg) and SED-014 (21 ug/kg); and 1,2 dichloroethene (total) at SED-03 (35 ug/kg), and SED-04 (10 ug/kg).

- Downstream sediment semi-volatile concentrations detected were phenanthrene (620 ug/kg), fluoranthene (780 ug/kg), pyrene (600 ug/kg) and benzo(b)fluoranthene (480 ug/kg) in SED-05.

- The only downstream sediment PCB/pesticide detected was 4,4'DDT (6.4 ug/kg) at SED-05.

- Downstream sediment inorganic concentrations were detected at one order of magnitude above upstream levels for the parameters shown at the following locations: aluminum - SED-03; manganese - SED-04, SED-07, and SED-13; barium at SED-03; cobalt at SED-06; nickel at SED-03, SED-04, SED-06, SED-07, SED-14 and SED-15; vanadium at SED-03, SED-13 and SED-14.

  The remainder of the inorganics were detected at concentrations within an order of magnitude of the upstream results.

Surrogate recovery criteria specified in the QAPP were exceeded for sample SED-05 (Round 2). Surrogate recoveries and recovery criteria specified in

the QAPP are tabulated below for this sample. Non-detected sample results for both acid and base/neutral fractions were determined to be unusable (R) and detected results were approximated (J) in this sample due to these excursions.

Surrogate	% Recovery	% Recovery detected
nitrobenzene-d5	1.0	47.8 to 113.6
2-fluorophenol	4.0	56.1 to 102.0

Downstream sediment results exceeded NOAA guidelines at the following locations and for the following parameters:

SED-05: Mercury (0.16 mg/kg)

SED-06: Mercury (0.27 mg/kg)

SED-14: Mercury (0.31 mg/kg)

Interim Sampling Program

Objectives and Methods. The objectives of the Interim Sampling Program was to evaluate the seasonal effects of the Former Lagoon Area on the sediments along the unnamed stream within the Marshy Area.

Sediment samples were collected in November 1993 for metals, TOC and VOCs at sediment locations SED-11, SED-12 and SED-14. Sediment samples were collected as previously mentioned in the Phase 1A RI Sediment Sampling Program.

Sediment samples were collected and shipped to Enseco Laboratories utilizing chain-of-custody procedures and analyzed. Analytical results are presented in Tables 20 through 23 of Appendix 15. The analytical results are discussed below.

Results. Sediment samples SED-11 and SED-12 located north of the well access road within the Marshy Area indicated the following:

- VOCs detected included: acetone, (340 ug/kg), 2-butanone (59 ug/kg), methylene chloride (4.2 ug/kg), toluene (21 ug/kg) at SED-11; acetone (59 ug/kg), carbon disulfide (1.9 ug/kg), ethylbenzene (2.9 ug/kg), toluene (4.6 ug/kg), vinyl chloride (86 ug/kg), xylene (total)(2.5 ug/kg) at SED-12.

- TOC was measured at a concentration of 36,000 mg/kg at SED-11 and 16,000 mg/kg at SED-12.

- Inorganic results were compared to the historical range of concentrations detected for each analyte at upgradient sample locations SED-01 A. Inorganic analytes detected one order of magnitude above background concentrations included: copper, iron, manganese, nickel, zinc at SED-11; nickel at SED-12. Mercury (not detected in background sample SED-01 A) was detected one order of magnitude above the detection limit.

- SED-11 results exceeded NOAA guidelines for the following parameters:

  Lead (70.3 mg/kg)
  Mercury (0.37 mg/kg)
  Nickel (32.5 (mg/kg)
  Zinc (152 mg/kg)

Remaining analytes were detected below or within the same order of magnitude of background concentrations, not detected or detected below the detection limit.

Sediment sample SED-14 located south (downgradient) of the Marshy Area indicated the following:

- VOCs detected included: acetone (26 ug/kg), methylene chloride (2.5 ug/kg)

- TOC was measured at a concentration of 7,300 mg/kg

- inorganic analytes detected one order of magnitude above background concentrations included nickel

- the SED-14 results did not exceed NOAA Guidelines

Remaining analytes were detected below or within the same order of magnitude to background concentrations, below detection limits or not detected.

In summary, sediment samples were collected from drainage swales upstream of the landfill, in the vicinity of the landfill and downstream of the landfill. Upstream samples for VOC analysis identified only acetone.

Inorganics were detected at levels below NOAA sediment guidelines. In the vicinity of the landfill, TCE, PCE, vinyl chloride, acetone, 1,2-DCE, 2-butanone, toluene, ethyl benzene, and xylene wee detected. PCBs (Aroclor 1254) were also detected in one sample exceeding the NOAA sediment guidelines. Inorganics in the vicinity of the landfill samples detected lead, mercury, nickel and zinc at levels exceeding the NOAA sediment guidelines. Downstream sediment VOC concentrations identified acetone, PCE and 1,2-DCE. Several SVOCs were also detected in one sample, which also detected a pesticide compound (4,4'-DDT). Mercury was the only inorganic in the downstream samples which exceeded NOAA sediment guidelines.

During the Interim Sampling program, methylene chloride and carbon disulfide was detected in the landfill vicinity samples. These constituents were not detected in previous sampling. In addition, TCE, PCE and 1,2-DCE detected in the Phase 1A sampling were not detected in the Interim Sampling program at these locations. Inorganics detected at levels exceeding NOAA guidance in the Phase 1A sampling, also exceed the guidance levels in the Interim Sampling program.

In the downstream samples, sediment analyses were within the NOAA guidance for samples collected during the Interim Sampling program.

Analytical results of the sediment sampling, indicating the range of concentrations of analyzed parameters by area are presented on Tables 31 to 33.

3.3.7. Leachate Seep Sampling

Objectives and Methods. Previous site reconnaissance work and sampling efforts conducted by Geraghty & Miller and USEPA have indicated that leachate seeps were observed along the eastern toe of the Landfill Area. Three seeps were reported by VTDEC in a correspondence dated February 21, 1984. Visual observations during the LFI did not indicate the presence of active seeps. However, cold weather during the LFI resulted in frozen ground surface conditions and a lowered water table which may have precluded observation of potential seep locations under normal conditions.

The RI Work Plan included the observation of the previously-identified leachate seep locations, and the collection of leachate seep samples if observed. The objective of this effort was to characterize the constituents

in the leachate and to evaluate the potential impact on surface water and sediments.

The locations, identified in the RI Work Plan, were observed at a minimum of weekly throughout the Phase 1A RI field program. For much of this period, leachate seeps were not observed, as colder weather conditions prevailed.

On three occasions when leachate seeps were observed, samples were collected following the sampling protocol described in the RI Work Plan. A total of four samples were collected on three sampling dates. Sampling locations are shown on Figure 2 and the sampling field logs are included in Appendix 26. The sampling events are described as follows:

- In January 1993, a leachate seep was observed at LS-01, located on the north end of the slope of the Landfill Area, near well nest W-12. The seep was flowing at a rate of 1/4 to 1 gpm. A sample was collected on January 28, 1993 from LS-01 and analyzed for VOCs (USEPA Method 8240). On January 29, 1993, a second LS-01 sample was collected and analyzed for semi-volatile organic compounds (USEPA Method 8270) and inorganic analyses. There was insufficient leachate seep volume to analyze all analytical parameters specified in the RI Work Plan, but these analyses were performed on a subsequent sample (collected on June 4, 1993).

- On May 3, 1993, two additional seeps were observed and samples were collected, one from LS-02 located approximately 50 feet south of well nest W-22 and one on May 5, 1993 from LS-03 located approximately 25 feet from well nest W-04. These seeps were flowing at rates of 1/4 to ½ gpm. The distribution of the seeps was reasonably similar to that previously observed by VTDEC in February 1984, and the seeps were located at fairly equally spaced distances along the eastern toe of the Landfill Area. These samples were analyzed for parameters as indicated in Table 35. On May 5, 1993 a duplicate sample was collected from LS-03 and analyzed for VOCs, semi-volatiles, PCB/pesticides, and inorganics.

- On June 4, 1993, one seep sample was collected from LS-01 for PCB/pesticide analyses. These analyses were performed because of the insufficient sample volume from the January 28 sampling event.

Results. Analytical results from the leachate seep samples are included in Tables 24 through 27 of Appendix 15. VOCs and semi-volatiles which were detected are summarized by seep location on Table 21. There are no

applicable federal or state regulatory standards against which leachate seep results could be directly compared. However, NOAA Sediment Quality Guidelines (for sediments) and VT WQS (for surface water) have been used to evaluate sediments and surface water downgradient of the leachate seeps. Summaries of the analytical results are as follows:

The following describes the analytical results for each particular seep location:

- LS-01:
  VOCs Detected compounds include 32 ug/l, 1,2-DCE and 570 ug/l TCE

  Semi-volatiles Analyzed but not detected

  PCBs/ Pesticides Analyzed but not detected

  Inorganics lead, and zinc were detected at concentrations of 1.7 and 1,270 ug/kg, respectively

- LS-02:
  VOCs - Detected compounds include 21 ug/l acetone and 10 ug/l 1,2-DCE

  Semi -volatiles Analyzed but not detected

  PCBs/ Pesticides Analyzed but not detected

  Inorganics lead, chromium, zinc and nickel were detected at concentrations of 998, 43.1, 1,810 and 235 ug/l, respectively

- LS-03:
  VOCs Detected compounds include 1,800 ug/l 1,2-DCE, 26,000 ug/l TCE and 9,200 ug/l PCE

  Semi-volatiles 1,4-Dichlorobenzene at 15 ug/l

  PCBs/

Pesticides	Analyzed but not detected
Inorganics	lead, chromium, zinc and nickel were detected at concentrations of 225, 56.3, 236 and 390 ug/l, respectively

Concentrations of TCE (at LS-01 and LS-03), PCE (at LS-03), lead (at LS-02 and LS-03), and nickel (at LS-02 and LS-03) exceeded the VT WQS. LS-02 appears to be contributing nickel, iron and zinc, which may be impacting sediment quality at SED-09 and SED-11. Concentrations of lead and zinc (at SED-09) and lead nickel and zinc (at SED-09) and lead, nickel and zinc (at SED-11) exceeded the NOAA Sediment Quality Guidelines. The highest inorganic concentrations were detected at LS-02 and LS-03 locations. LS-03 exhibited the highest concentrations of VOCs and appears to be contributing VOCs to the Marshy Area. Due to concentrations of VOCs at SBW-21 and LS-01, the possibility of another source area existed. Test pitting activities conducted in this area during the Phase 1B program did not identify another source.

3.4. Air Quality Assessment

Objectives and Methods

This section presents the results of the air quality assessment performed at the Site. The objective of the air quality assessment, as defined in the RI Work Plan, was to evaluate whether site-related residues are being transported from the Site via air transport. The scope of the air quality assessment was to collect environmental air samples at designated locations for volatile and semi-volatile compound analysis and to measure certain meteorological parameters relevant to the assessment program. The air quality assessment was performed during invasive activities to meet two objectives: 1) to identify if invasive activities are contributing to airborne releases, and 2) to observe if releases to off-site locations are taking place.

Environmental air samples were collected on October 14, 1992 for approximately 8 hours during an invasive site activity at the six locations specified in the RI Work Plan. Two environmental air monitoring stations were established downwind of the Site (AS-05 and 06), two stations upwind of the Site (AS-02 and 04), and two stations at the site of invasive activity (AS-01 and 03) (See Figure 2). The locations of the downwind and upwind samples were based upon historical meteorological data obtained for the Site.

In accordance with the RI Work Plan, sampling was performed to simulate invasive work conditions. The sampling was to be performed during active installation of a soil boring/monitoring well in the former Lagoon Area, and from a soil boring/monitoring well where elevated PID readings were obtained in comparison to other borings/wells in the immediate area. Both of these conditions were satisfied by sampling during installation of boring/well SBW-18. It should be noted that, for planning and coordination purposes, O'Brien & Gere indicated in a letter dated October 6, 1992, that sampling would occur at SBW-14 and SBW-15. On the sampling day, SBW-14 and SBW-15 were not being installed, however, SBW-18 was being installed. Therefore, air samples were collected at SBW-18, which yielded the highest PID readings during soil boring/monitoring well installation program.

In addition to the air sampling, a meteorological station was established at the Site to provide data on the wind direction and speed, temperature, and pressure. The meteorological data were used to identify the up- and down-wind sampling stations and to correct the air sampling volumes to Standard Temperature and Pressure (STP).

One of the conditions of the conditionally approved RI Work Plan was the need to finalize the Standard Operating Procedures (SOPs) to be utilized for air monitoring. Prior to conducting air monitoring at the Site, O'Brien & Gere worked closely with USEPA to establish the full detail required by USEPA and to develop the SOP's, including numerous discussions with USEPA staff and O'Brien & Gere's subcontractor, Pace Laboratories. A series of discussions were held in September and early October 1992 between O'Brien & Gere and USEPA. Pace's analytical SOP was provided to USEPA for review on October 2 and the environmental SOP faxed for review on October 8, 1992. Comments were received from USEPA and forwarded to Pace for review and subsequent revision of their analytical SOPs. The analytical SOPs were not finalized prior the sampling. However based on the verbal revisions from the USEPA the air monitoring was conducted.

Volatile Compounds. Volatile organic air samples were collected on a carbon molecular sieve (CMS) sampling device attached to a personal air sampling pump. The sampling pumps were pre-calibrated to a flow rate of approximately 0.04 liters per minute (lpm) according to the SOP for the collection of environmental air samples.

The air samples were collected at a height equivalent to the human breathing zone. A field blank and a duplicate sample were collected in

accordance with the sampling method. The duplicate sample entailed an additional air sampling station within 12 inches from an existing sampling station. The samples were collected continuously over a period of approximately 8 hours.

Following sample collection, the personal air sampling pumps were post-calibrated according to the SOP for the collection of environmental air samples. The pre- and post-calibration data are presented in Table 41. The pre- and post-calibration flow rates did not differ by more than 8%. As provided in USEPA Method TO-2, Section 10.2.7, flow variation of greater than 10% indicates a suspect sample. Therefore, the variability in the flow rates is not expected to invalidate the air sampling results. The average flow rate and the sampling day's average temperature and average barometric pressure were used to determine the total sampling volume for each sample.

The samples were placed in a laboratory supplied airtight vessel and shipped via overnight mail to Pace Laboratories, Golden, Colorado, in a cooler at a temperature of approximately 4°C. The samples and blank were analyzed by gas chromatography/ mass spectrometry (GC/MS), following USEPA Method TO-2, according to the laboratory TO-2 SOP.

Semi-Volatile Compounds. Semi-volatile organic air samples were collected on a glass fiber filter followed by a sorbent tube containing 100 milligrams (mg) of XAD-2 with a 50 mg XAD-2 backup. The sampling media was attached to a personal air sampling pump. The sampling pumps were pre-calibrated to a flow rate of between approximately 0.02 to 0.05 lpm according to the SOP for the collection of environmental air samples.

The air samples were collected at a height equivalent to the human breathing zone. A field blank and a duplicate sample were collected in accordance with the sampling method. The duplicate sample entailed an additional air sampling station within 12 inches from an existing sampling station. The samples were collected for approximately 8 hours.

As with the volatile organic air samples, following semi-volatile sample collection, the personal air sampling pumps were post-calibrated according to the SOP for the collection of environmental air samples. The pre- and post-calibration data are presented in Table 41. The pre- and post-calibration flow rates did not differ by more than 5%, which is the criteria for variability specified in the air sampling SOP. The average flow rate and the sampling day's average temperature and average barometric pressure were used to determine the total sampling volume for each sample.

The samples were wrapped in aluminum foil and shipped via overnight mail to Pace Laboratories in a cooler at a temperature of approximately 4°C. The samples and blank were analyzed by gas chromatography/mass spectrometry (GC/MS) according to the analytical SOP provided to USEPA.

Meteorological Data. On-site meteorological monitoring was conducted during the environmental air monitoring program. The following meteorological parameters were monitored:

- horizontal wind speed and direction
- ambient temperature
- atmospheric pressure

These parameters were measured continuously using a meteorological station. The meteorological station was located in the approximate center of the Landfill Area.

Observations

Sampling stations are shown on Figure 2. Sampling station AS-01 was located inside the Landfill Area and exclusion zone, and downwind of the invasive activities. While samples were being collected, a diesel powered drill rig was installing monitoring well SBW-18, approximately 10 feet away from the station. The fugitive emissions originating from the internal combustion of the drill rig's engine were in line with the wind pattern and may have been collected on the AS-01 samples.

Sampling stations AS-02 and AS-04 were located upwind of the invasive activities, in a heavily forested section of the Site. There were no observable sources of fugitive emissions at these locations.

Sampling station AS-03 was located inside the Landfill Area and downwind of the invasive activities. In addition, the station was downwind of the meteorological station's gas powered generator and upwind of a dirt road that was traveled by numerous vehicles. The fugitive emissions originating from the internal combustion of the drill rig's engine, the generator, and other vehicles on the dirt road may have been collected on the AS-03 samples. A duplicate sampling station, AS-07, was established at this location.

Sampling stations AS-05 and AS-06 were located downwind of the invasive activities, also in a forested section of the Site. In addition, the stations were downwind of a dirt road that was traveled by numerous vehicles. The

fugitive emissions originating from the internal combustion engines of the vehicles on the dirt road may have been collected on the AS-05 and AS-06 samples.

The wind speed and direction and its variability during the air sampling period is presented in Appendix 21.

Results. The results of the environmental air monitoring are presented in Tables 42 and 43, These tables provide the respective sample locations, and the parameter concentration, based on the volume of air collected. Results are presented in units of micrograms per cubic meter of air (ug/m^3). In accordance with the air sampling SOP, the tables present the Occupational Safety and Health Administrations (OSHAs) Permissible Exposure Limits (PELs), the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limiting Values (TLVs), and the State of Vermont's Hazard Limiting Value Annual Averages (HLVAAs) for the listed parameters. OSHA PELs are regulatory 8-hour work place exposure limits. ACGIH TLVs are guidelines used to assist in the control of worker health hazards and are not to be used as legal standards. The data generated by this sampling project may be compared with the OSHA PELs and ACGIH TLVs to evaluate on-site worker exposures. State of Vermont HLVAAs are based on annual concentrations of specific compounds at a long term human receptor location. The sampling data were compared with the Vermont HLVAAs to provide a frame of reference from which to evaluate the air sampling data. The data were further evaluated by comparing the upwind and downwind results. The air sampling results cannot be used to evaluate compliance with the State of Vermont HLVAAs, since the sampling was conducted using a different averaging time. However, the State of Vermont HLVAAs were used to qualitatively assess the air sampling results.

The temperature, wind direction, wind speed, and barometric pressure strip chart is provided in Appendix 21. The approximate temperature during the sampling was 10°C, the winds were generally out of the southeast at approximately 2 miles per hour (mph), and the barometric pressure was approximately 788 mm Hg. It should be noted that based on site observations of the wind direction, including tree top swaying and exhaust smoke from the drill rig, the wind direction was primarily from the southeast. The meteorological station's wind direction sensor appears to have been reversed by 180 degrees. Therefore, the strip chart identifies the direction the wind was flowing toward. The standard temperature and pressure correction (STP) ranged from 1-2 liters over a 20 liter sample. The STP correction was conducted in accordance with the Generalized Gas Law. The sampling survey sheets are provided in Appendix 27.

The volatile and semi-volatile organic compound results were well below comparable OSHA PEL and ACGIH TLV levels. In addition, the results were generally below the State of Vermont HLVAAs, with the following exceptions:

- carbon tetrachloride
- tetrachloroethene
- trichloroethene

In accordance with the RI Work Plan and the sampling methods, a sampling volume of approximately 20 liters was collected. However, the concentration-based method detection limit was in some instances higher than the State of Vermont's HLVAA. This was due to the sampling volume specified in the sampling methods. The following parameters detection limits were higher than the State of Vermont's HLVAA:

- 1,1,2,2-tetrachloroethane
- 1,1,2-trichloroethane
- 1,2-dichloroethane
- 1,2-dichloropropane
- benzene
- bromoform
- bromomethane
- chloroform
- methylene chloride
- tetrachloroethene
- trichloroethene
- vinyl chloride
- benzo(a)pyrene
- bis(2-chloroethyl)ether
- dimethylphthalate
- di-n-butylphthalate
- hexachloroethane
- naphthalene
- nitrobenzene
- pentachlorophenol
- phenanthrene
- pyrene

Although the measured levels of carbon tetrachloride, tetrachloroethene, and trichloroethene and concentration-based detection limits of the above listed compounds are above the State of Vermont HLVAA's, these

compounds may not be indicative of an impact to human health for the following reasons:

- Individuals on the Site, such as members of the gun club, would only be exposed to these substances for a short duration (acute exposure). Therefore, the OSHA PELs and ACGIH TLVs would be an appropriate comparison for those individuals.

- The closest long term human health receptor location is approximately 1200 feet from the Site. The dilution of the compounds in question from the Site to the receptor location is such that the concentration would be well below the Vermont HLVAAs.

Concentrations of 2-butanone, carbon disulfide, m,p-xylene, o-xylene, and toluene were detected at the air monitoring stations. The detected concentrations of these parameters were below the State of Vermont's HLVAA.

The blank samples submitted to the laboratory contained 1,1,1-trichloroethane, benzene, methylene chloride, trichlorofluoromethane, and di-n-butylphthalate above the method detection limits at varying levels as listed in Tables 42 and 43. The samples were corrected according to the USEPA Region I Blank Correction Method, as described in the Data Validation Report, Appendix 1.

The upwind and downwind air sampling results were within an order of magnitude of each other and the variation between the upwind and downwind air sample results were less than 0.1 (ug/m^3). Therefore, no significant off-site emissions were detected.

It should be noted that air monitoring results obtained during sampling are representative of the site under specific conditions of when the sampling took place and would be expected to vary under different site and meteorological conditions. For example, on hotter days, with lower barometric pressures, emissions would tend to be higher. Conversely, emissions will tend to decrease on colder days and higher barometric pressures.

In summary, an air quality assessment was conducted which consisted of collecting environmental air samples at designated locations upwind and downwind of the potential source areas for volatile and semi-volatile compound analysis. The air quality assessment was conducted to evaluate whether site-related residues are being transported from the Site via air transport under the specified sampling conditions. Specific site-measured

meteorological parameters were applied in determining exact monitoring locations and calculating air sample volumes. This assessment is based on the analytical results of the environmental air samples collected during a site visit on October 14, 1992. The following are the specific conclusions of this assessment:

- 30 volatile and 13 semi-volatile organic compound results were below the OSHA PEL as shown on Tables 42 and 43.
- 30 volatile and 13 semi-volatile organic compound results were below the ACGIH TLV as shown in Tables 42 and 43.
- 12 volatiles and 1 semi-volatile organic compound results were below the State of Vermont's HLVAA's.
- 3 volatiles organic compound results were above the State of Vermont's HLVAA's.
- 12 volatile and 10 semi-volatile organic compound concentration-based results were slightly above the State of Vermont's HLVAA's.
- Upwind and downwind air sampling results were similar.

The objective of the air quality assessment was to evaluate whether site-related residues are being transported from the Site via air transport. Based on the results of the air sampling, it is concluded that significant concentrations of site-related residues are not being transported from the Site via air transport at concentrations that would impact public health.

4. Nature and extent of contamination

4.1. Sources of Contamination

The objective of the Sources of Contamination portion of the Site RI Report is to identify suspected sources of contamination in the Study Area, evaluate the nature and extent of impacts emanating from suspected source areas, and provide sufficient physical and chemical specific information to allow evaluation of appropriate remedial alternatives. In addition, data were obtained to allow USEPA to conduct a risk assessment and evaluate if source areas exhibit chemical residues above ARARs (Appendix 28).

This section discusses first the characterization of various principal source areas for contaminants identified in soils within and around the landfill. The principal source areas include the Former Lagoon Area, the Landfill Area outside the lagoon cells, the Soil Staging Area, and the Marshy Area adjacent to the landfill. The Hillside Area and the Bend in the Road were initially suspected of representing potential source areas but have been shown in this study not to be areas of concern. Discussions are presented by area of concern for the distribution of contaminants in surface soils, soil gas, and subsoils.

This section then presents a discussion of secondary source areas which are defined as those areas which have been affected by migration of residues from principal source areas and now may act essentially as sources of impact to presently unaffected media. These areas include the uppermost ground water system in the kame sand and ablation till beneath the landfill and the Marshy Area and surface water and sediments in the unnamed stream system.

Finally, the nature (including type and phase distribution) of contaminants and volume estimates of affected media will be discussed by principal areas of concern for future use in the evaluation of remedial alternatives. A discussion is provided in Section 4.2 concerning the migration potential of residues through the ground water system to unaffected hydrologic zones identified in the Site hydrogeology section of this report.

The following provides a detailed description of each suspected or confirmed source area based on the information gathered to date.

Bend In The Road
This area is located in the northwest corner of the Site across from the current sand quarry and was a suspected area of plater sludge disposal. The area was also used for staging of automobiles and various industrial machinery, components, some of which still exist in this area.

Hillside Area
This area is located along a logging road on the slope of Harmon Hill east of the Marshy Area and across from the landfill. Due to the logging operations, this area was suspected of containing potential low level volatiles or petroleum residues due to the operation of machines in the logging area. Metals excursions in surface soil were noted for some metals. These results are not much higher than background surface soil results and are for the most part within the ranges of soils in the northeastern U.S.

Soil Staging Area
This area is located just north of the landfill and the Site access road in the vicinity of the loam staging area. Historical information has indicated that fuel tanks were stored, cleaned, and salvaged in this area. This area was suspected of containing petroleum-based residues and solvents.

Landfill Area
The Landfill Area is the primary location for past disposal of waste materials. The landfill is bounded to the north by the access road, the west by the Bennington/Woodford town lines, and to the east and south by the Marshy Area. The landfill includes the Former Lagoon Area on its southern periphery and also includes areas where drums were suspected to have been buried (west side) and an area
where industrial waste including batteries, sludge and construction/demolition waste was suspected to have been buried (east-central area).

Former Lagoon Area
The Former Lagoon Area is located along the southern edge of the landfill. Waste materials disposed of in this Former Lagoon Area consisted of lead plater wastes, lead plater sludge, battery processing waste, and waste solvents. The wastes were disposed of in two unlined bermed cells. The oldest cell (Cell 1) is the smaller of the two cells. The newest cell (Cell 2) consists of some industrial waste and some municipal waste. A portion of the waste in Cell 2 appears to have been affected by spillage from dumping

when Cell 1 was filled in and used as a staging area to off-load waste into Cell 2. Discussions of the Former Lagoon Area and Landfill Area will be presented separately due to the distinct impact each has on the local environment.

Marshy Area

The Marshy Area is located to the east and southeast of the landfill. This area has been designated as a regulated wetland and includes a system of surface water drainage (the unnamed stream system). Migration of constituents to this area has occurred via primarily surface water runoff, leachate, and ground water pathways. Shallow soils, surface water and sediments hence exhibit the same type of contaminants as that found in the landfill and Former Lagoon Area.

These areas of concern are presented on Figure 2. To assist in the discussion of the distribution of contaminants around the Site, figures depicting the detected concentrations of organic and inorganic compounds by various media have been developed and are shown on Figures 26 through 35. These figures depict summaries of detected organic constituents by media and the highest inorganic detections from the combined sampling efforts. The following describes the results of the soil and soil gas analyses by area of concern.

4.1.1. Soils and Vadose Zone

The following investigations were performed to characterize the surface, subsurface soils and vadose zone at the Site:

- Soil Gas Sampling
- Surface Soil Sampling
- Soil Borings
- Test Pit Installation

Soil Gas Sampling

A soil gas survey was performed to augment soil gas data collected in the LFI and in prior studies. The soil gas survey included 22 soil gas and 4 ground water headspace samples. Soil gas data were used to tentatively identify the presence and nature of subsurface VOCs in soil gas and generate spatial data to aid in the selection of locations for surface soil samples and soil borings.

The following provides the results of the soil gas information relative to each area of concern:

- Hillside Area: VOCs (TCE, PCE and toluene) were detected in the shallow, intermediate, and deep intervals tested (1-7 feet). Due to obstructions, only one sample was obtained at the deep interval at SG-7. Based on the soil gas data obtained as indicated in Table 34, the results of ground water sampling at W-23 T and W-24 T and ground water flow patterns in the area, it is likely that the low level VOCs are a result of a minor isolated surface source.

- Soil Staging Area: Detectable concentrations of VOCs were observed in 10 of the 11 samples. Calibrant compounds detected in samples collected from the Soil Staging Area included TCE, PCE, trans-1,2-dichloroethene (t-1,2-DCE), 1,2-dichloroethane (1,2-DCA), 1,1,1-trichloroethane, (1,1,1-TCA), benzene, toluene, ethylbenzene, and xylene. The chromatographic pattern for samples collected in this area was consistent with that of a petroleum hydrocarbon residue. The detection of BTEX compounds and their distribution in this area is consistent with information concerning the salvaging of fuel tanks reportedly done in this area.

  During the Phase 1B RI program, PID analyses were conducted in soil borings and shallow soil samples of the Soil Staging Area. The purpose of this effort was to delineate the horizontal and vertical extent of petroleum and solvent residues in this area.

  Data were collected from four soil borings and seven shallow soil sampling points located in a 200 to 300-foot diameter around the elevated soil gas sampling locations SG-11, SG-12 and SG-13 conducted in the Phase 1A RI program. These eleven sampling points were the locations of soil sampling during Phase 1B in this area.

  The results of the PID testing indicated most soils exhibited headspace volatile concentrations of 9 to 12 ppmv in this area. Localized higher concentrations of 54 ppmv, 110 ppmv, and 90/280 ppmv were noted at SS-1 (0 to 6 inches), SS-2 (0 to 6 inches), and SB-23 (0 to 2 feet), respectively. VOCs were detected in a lower, more diffuse pattern around this immediate area chiefly in the interval of 0 to 2 feet.

- Landfill Area: Results of the soil vapor screening on the landfill are summarized on Figure 32. Total VOC concentrations detected in the twenty soil vapor samples in and around the landfill ranged from less than 0.004 to 294.35 ppmv. The highest total VOC concentrations were observed in samples SV-9, SV-2, SV-6, SV-4, SV-3, and SV-5, along north to south survey transect number 6. Samples SV-2 and SV-3,

located in the immediate vicinity of the Former Lagoon Area, exhibited detectable levels of PCE and TCE as well as degradation products, 1,1-DCE, 1,1-DCA and 1,2 DCA. Samples SV-4, SV-5 and SV-6, situated in the Landfill Area north of the Former Lagoon Area, exhibited detectable levels of chlorinated and aromatic compounds. Sample SV-6 was situated in the immediate vicinity of the soil staging pile. VOC concentrations decreased to near detectable limits along a line situated parallel to, and west of, the initial transect (west of landfill).

The soil gas and PID screening surveys served to verify the results obtained previously by Geraghty & Miller and to further define the area of study for the remedial investigation. PCE and TCE, were the major constituents observed in and around the Former Lagoon Area, along with the potential degradation products of these compounds. Some localized areas of these constituents were also detected in the landfill. Aromatic hydrocarbons were detected in the northern portion of the Landfill Area. The VOC residues were observed at the highest concentrations in the landfill from the access road south to the Former Lagoon Area and the adjacent Marshy Area.

The concentrations of VOCs dropped off to near detection limits rapidly to the east and south, after crossing the unnamed stream and tributary system. In the westerly direction from the landfill, concentrations of near detection limits were achieved along a transect situated one hundred feet from, and parallel to, the initial transect through the landfill. Concentrations near detection limits were observed to the north of the landfill approximately three hundred feet north of the access road.

Surface Soil Sampling

Thirty surface soil samples were collected from six areas of concern and background at a depth of generally 0 to 12 inches. Detected concentrations of VOCs, semi-volatiles and PCBs/pesticides in the surface soil sampling are presented on Figures 26 and 27 for visual comparison in Table 17. The range of concentrations in surface soils of each analyzed parameter is presented by area in Tables 24 to 29. Complete analytical results are presented in Appendix 15 and are summarized below:

- Background Area (3 samples): The only VOC detected was acetone. Inorganic levels were consistent for the three samples and were used to provide a range against which to compare inorganic levels for surface soils elsewhere at the Site. The locations of these samples (SP-17, 18, and 19) is in an area believed to be unaffected by landfilling or other activities located east of the Site along a path.

- Landfill Area South of Access Road (9 samples): VOCs and PCB/pesticides were detected (PCE and 4,4-DDE) at one location. Semi-volatiles concentrations were detected above the method detection limits at one location which contained coal-tar derivatives (phenanthrene, fluoranthene, and pyrene). No specific information has been presented which indicates the disposal of coal-tar products. However, it is likely that asphalt debris may have been disposed of in the landfill at some time over the years. Calcium, lead and nickel were detected at concentrations up to two orders of magnitude above background concentrations. Several inorganics, including aluminum, barium, chromium, cobalt, copper, calcium, iron, magnesium, manganese, potassium, sodium, vanadium and zinc were also detected at concentrations one order of magnitude above background levels. The remainder of the inorganics were detected at concentrations at or within an order of magnitude of background.

- Soil Staging Area (2 samples): VOCs, (acetone and xylene) were detected in this area. Barium, cadmium, cobalt and manganese were detected at concentrations one order of magnitude above the background levels. The remainder of the inorganic analytes were detected at concentrations within an order of magnitude of background.

- Marshy Area (20 samples): VOCs (TCE, PCE, ethylbenzene, and toluene) were detected in surface soil samples at a number of locations. A number of other VOCs (1,2-DCE, vinyl chloride, and acetone) were also detected at several locations. The presence of volatile constituents in the Marshy Area decreased substantially to the north, south, and east further away from the influence of the landfill. Semi-volatiles and PCB/pesticides were not detected. Lead and nickel were detected at concentrations up to two orders of magnitude above background levels. Several other inorganics including aluminum, arsenic, barium, calcium, chromium, copper, cobalt, iron, magnesium, manganese, potassium, nickel, vanadium, sodium, and zinc were detected at concentrations one order of magnitude above background levels.

  The nature and distribution of VOCs in surface soils in this area likely indicates the migration of VOCs from the Former Lagoon Area via the shallow ground water and leachate seep pathways. In addition, surface runoff from the Landfill and Former Lagoon Areas may have had an impact on the quality of surface soils in the Marshy Area adjacent to the landfill.

Most of the detected constituents were found between the eastern/southern toe of the landfill and the unnamed stream to the east which formed a hydraulic barrier to further eastward migration of surface and ground water runoff from the landfill.

Constituent concentrations also decreased to the south in this segment of the Marshy Area as evidenced by the results of the most recent sampling in SP-23 to SP-30.

- Hillside Area (2 samples): The only VOCs detected were 1,2-DCE and acetone. Inorganics were detected at concentrations within one order of magnitude above background levels.

- West of Landfill Area (3 samples): The area West of the Landfill is not considered a suspected source area for disposal of waste materials. Surface soil samples were collected and analyzed from this area, however, to evaluate the potential presence of contamination and for use in the risk assessment.

  These samples were collected from a wooded area where no disposal activities are suspected to have occurred. The only VOC detected was acetone. Inorganic compounds were detected at concentrations within an order of magnitude of background levels.

Summary of the Surface Soil Sampling Program. The results of this program indicated that little or no impact to surface soils was observed in the Hillside Area and the forested area West of the Landfill Area. Some inorganic constituents were detected in the Landfill Area and Soil Staging Area, as would be expected due to the scattered debris observed on the landfill. VOCs and semi-volatiles were detected on Landfill Area surface soils and surface soils in the Soil Staging Area. The highest VOC and metal concentrations were detected in the Marshy Area, most likely due to its proximity to the Former Lagoon Area and the migration of impacted surface and ground water into the Marshy Area from the lagoon.

Soil Borings and Test Pits

Sixty-five soil boring samples and 14 test pit samples were collected from the following areas:

- Landfill Area south of access road

- Monitoring well locations outside the landfill including: upgradient of landfill, West of Landfill Area, Hillside Area, Marshy Area, and the Bend in the Road.

The results for each area are presented on Table 18 and are summarized as follows:

- Former Lagoon Area. The boring conducted within the newest Cell 2 of the Former Lagoon Area (SBW-15) encountered layered kame sand, silty clay, and possibly sludge material. Strong solvent odors and elevated PID readings were noted. The fill material was eight feet thick in this depression. One other nearby boring encountered kame sand fill, likely attributable to a portion of the bermed area surrounding the Lagoon cells (SBW-14), and another encountered the kame sand/silt layers similar to those in the Former Lagoon Area (SBW-18).

  The test pit program and soil boring W-TP-12 in the Former Lagoon Area in Phase 1B RI provided further definition of lagoon constituents and boundaries. The same materials were observed in test pits as was observed in the borings described above. Analytical results from borings and test pits indicated that VOCs are present in the fill and underlying sandy soils of the Former Lagoon Area, and that PCBs, metals including lead, nickel, cadmium, and chromium, and semi-volatiles are also present. The concentrations of mercury and zinc at TP-13 are higher than other landfill samples. The concentration of lead in TP-11 located near the Lagoon Area are also much higher than other landfill samples. The source of these metals is likely batteries disposed near TP-13 and Sludge in TP-11.

  An indication of non-aqueous phase petroleum or solvent based liquids (NAPLs) was observed in sludge material encountered in TP-11. The NAPL may have been incorporated into the sludge and may not be mobile. Visual observations of soils in SBW-15 suggested that NAPLs may have been present at that location again in sludge material. No other indications of NAPLs were observed in or below the Former Lagoon Area.

  Analytical results from fill material in the Former Lagoon Area presented in Table 18 indicate the presence of TCE and PCE up to 6,900,000 ug/kg and 8,100,000 ug/kg, respectively in the fill material encountered in the 2 to 6-foot interval of Lagoon Cell 2. Elevated TCE concentrations were also detected in the sludge at a depth of 16 inches in Lagoon Cell 1.

  In the boring for TP-12, no detectable TCE was noted from 0 to 16 feet because secondary fill was added in the lagoon at a later date. At 20 to 22 feet, the sludge resulted in a TCE concentration of 54,000 ug/kg.

Kame sand was present from 22 to 26.5 feet and loose ablation till from 26.5 to 28.5 feet which was saturated. A 10-fold rise was noted in the ablation till as opposed to the kame sand. The till sample contained a somewhat higher percentage of fines and pebbles, however, the density was similar to the overlying sand. The somewhat lower porosity and permeability of the ablation till from 26.5 to 28.5 feet may have concentrated VOCs compared to the kame sand above. Otherwise the function of the ablation till in affecting the vertical migration of VOCs in the area cannot be speculated further.

Other compounds detected in the vicinity of the Former Lagoon Area (Cell 2) included DCE, acetone, 2-butanone, 4-methyl-2-pentanone, toluene, naphthalene, and bis(2-ethylhexyl)phthalate. PCB Aroclor 1260 was detected in boring SBW-15, in Cell 2 of the Former Lagoon Area at a concentration of 25 mg/kg, at the 4 to 6-foot interval. VOC concentrations generally decreased in the deeper sample intervals located in kame sand at depths of between 8 and 16 to 22 feet below the lagoon material. VOC concentrations decreased somewhat in the kame sand below the Lagoon. Lead and nickel were detected at concentrations up to five and three orders of magnitude, respectively, above background levels.

- Landfill Area and Soil Staging Area. In the remainder of the Landfill Area and Soil Staging Area, detected VOC and inorganic levels in soils were much lower and much more localized than in the Former Lagoon Area with the exception of mercury at TP-13 located in the northeast landfill area where batteries were disposed. Volatile concentrations in soil borings and test pits located in the remainder of the landfill (SBW-20, SBW-21, SBW-17, TP-8, TP-13, TP-14, and TP-19) were for the most part relatively low compared to the Former Lagoon Area. Average total VOC concentrations in soils analyzed were three to four orders of magnitude lower.

  In boring SBW-21 located in the east-central part of the landfill, lead was detected in fill. Some lead was also detected in nearby test pits TP-7 and TP-8. Lead, nickel, and zinc residues were also detected in ground water of SBW-21. In TP-13, conducted in the area where batteries were disposed, elevated lead, mercury, and zinc were detected at 2 to 4 feet.

  In TP-19 located on the west side of the landfill where buried drums were located, TCE concentrations were detected at 2.1-9.1 mg/kg in kame sand below the fill material. The source for the TCE is probably a localized release of TCE associated with drum disposal in this area.

Slightly elevated lead and nickel were detected in this pit in kame sand at a depth of 20 to 22 feet.

No pesticides were detected in the landfill samples. PCBs were detected in other soil borings in and around the Former Lagoon Area, most at concentrations below 1 mg/kg. PCBs were detected in samples from SBW-15, 4 to 10 feet (370-25,000 ug/kg); SBW-16, 2 to 4 feet (270 ug/kg); SBW-17, 6 to 8 feet (170 ug/kg); SBW-18A, 4 to 14 feet (100-880 ug/kg); SBW-19, 4 to 6 feet (660-1,200 ug/kg); and SBW-20, 6 to 8 feet (180 ug/kg). Mercury, silver, sodium, and zinc were detected in the landfill borings and test pits at concentrations up to two orders of magnitude above background levels. The remaining inorganic analytes were detected at concentrations one order of magnitude above background levels with the exception of aluminum, arsenic, calcium and magnesium.

The levels of inorganics outside of the Former Lagoon Area in some portions of the landfill were associated with concentrations of construction/demolition waste, some localized industrial waste i.e. batteries, drums and other metallic objects mixed in with the municipal waste. The distribution of inorganics in the landfill is somewhat random throughout the identified landfill boundaries. Areas of elevated concentrations of site-related residues (landfill related materials in solid/liquid phase) with respect to the remainder of the landfill were found in the east-central landfill (SBW-21, TP-7, TP-8), the northeast landfill (TP-13, TP-18), and the western landfill boundary (TP-19).

- Monitoring Wells Outside the Landfill. With the exception of the Marshy Area, a limited amount of soil quality data were gathered from wells outside the landfill. Most data were gathered from background wells. No samples were submitted from wells West of the Landfill because sample submittal criteria were not met. Submittal criteria included elevated PID headspace readings, positive UV response or visual signs of suspect materials.

  In the original upgradient soil boring (SBW-13/W-01 S1 and W-01 B), 7 ug/kg of TCE was detected at the 32 to 34-foot depth interval. PID readings were 0 and 0 ppmv at this interval, but were slightly elevated from 36 to 48 feet.

  The available data from soil borings and other sampling done outside the landfill (including the Soil Staging Area) indicates that concentrations

in these areas are not representative of areas of concern as discussed below.

Bend in the Road. Ten test pits were installed in the Bend in the Road to an average depth of 5 feet to evaluate this area as a possible former site for the disposal of lead plater sludge. Reworked natural soil was present to a depth of approximately 3 feet; this soil was underlain by undisturbed kame sand. No discoloration, separate-phase liquids, or ground water were observed. Minor amounts of debris were observed in these pits. Metals concentrations in the soils from the Bend in the Road were within an order of magnitude of background concentrations. Only lead detected at 39.2 mg/kg at BRP-1 approached an order of magnitude above the 4.2 mg/kg background level. Since the only reported activity at this location was the staging of old cars prior to salvage, the lead detected may be indicative of leaded gasoline residue.

Hillside Area. In the soil borings from the Hillside Area, acetone at 72 ug/kg was detected in boring W-23 T. No inorganic analysis was conducted on subsurface soils in this area. These results along with surface soil results and soil gas data indicate that this area does not represent a source of concern.

Marshy Area. VOCs were prevalent in the soil borings conducted in the Marshy Area. Samples collected from W-04B (AB) from 0 to 11 feet exhibited detectable TCE concentrations of 33 to 100 ug/kg, with the highest concentrations at a depth of 5 to 7 feet. PCE concentrations at this location ranged from 11 to 32 ug/kg with the highest concentration also occurring at a depth of 5 to 7 feet. TCE and PCE concentrations decreased with depth below the 5 to 7 foot interval in samples from W-04T). Samples collected from a depth of 19 to 21 feet in an adjacent boring (W-04T) also exhibited concentrations of TCE and PCE which were below those found in the 5 to 7 foot interval of W-04B(AB). However, a duplicate sample collected from W-04B (AB) at the 19 to 21 foot interval exhibited TCE and PCE concentrations of 150 and 52 ug/kg, respectively, which would indicate an increase in concentration with depth into the till. The reason for the increase in VOCs in the duplicate sample from 19 to 21 feet is not clear. Since soil samples for VOC analysis could not be homogenized, some differences may be observed in split sample results. Similar to the results noted at W-TP-12, the mechanism responsible for the increase in VOCs in the upper ablation till as opposed to the kame sand cannot be affirmatively identified. In W-22 T boring TCE increased from 53 to 100 ug/kg at 0 to 10 feet to 170 ug/kg in 17 to 19 feet. TCE, PCE, and 1,2-DCE were present, chiefly in the kame sand occurring in the upper 10 to 14 feet, at

concentrations up to 320 ug/kg, 340 ug/kg, and 620 ug/kg, respectively. Vinyl chloride was also present up to 110 ug/kg (2 to 4-foot and 6 to 8-foot interval), in boring W-11 S1. Vinyl chloride was not detected in boring W-04 S1.

No staining or discoloration of subsurface soils was noted in the soil that was observed at the soil boring locations. Some minor sheens were noted in surface water.

Analysis conducted in the ablation till in the Marshy Area indicate VOC concentrations in the ablation till decreased by about an order of magnitude from the kame sand above. The VOC results in kame sand were 76 to 1,048 ug/kg and were 25 to 202 ug/kg in ablation till. The total VOC concentrations in kame sand soils in the Marshy Area ranged from 76 to 1,048 ug/kg. VOC concentrations in the ablation till ranged from 25 to 202 ug/kg.

No metals analysis was conducted for subsoils in the Marshy Area as stated in the Phase 1A RI Work Plan because no obvious visual staining was noted.

In summary, the principal source area for VOC, semi-volatile, and inorganic residues at the Site is the Former Lagoon Area containing Lagoon Cells 1 and 2. These materials occur chiefly in association with reported industrial sludge and liquid disposal in these two cells. The volume of industrial waste materials and other affected materials in the lagoon cells was estimated to be 1,700 cubic yards based on the horizontal and vertical dimensions depicted on the cross section in Figure 11. The area of each lagoon cell shown on Figure 15 was multiplied by an average depth of 8.5 feet (Lagoon Cell 2) and 20 feet (Lagoon Cell 1) to develop volume estimates. The area of Lagoon Cell 2 was estimated to be 3,168 square feet and Lagoon Cell 1 was estimated to be 960 square feet, resulting in volumes of 27,000 cubic feet and 19,200 cubic feet, respectively.

The concentrations of contaminants in both soil and ground water decrease from the Former Lagoon Area toward the Marshy area, indicating the source of contaminants in the Marshy Area is most likely the Former Lagoon Area. VOC residues in shallow soils are lower than that in shallow ground water in the Marshy Area indicating the VOC contaminants in the soil matrix have been adsorbed from the ground water by the soil particles. Leachability testing of the Marshy Area soils was not performed under this investigation, therefore, the impact of residual VOCs in the soil on future ground water cannot be quantified. Without significant changes in

soil/ground water chemistry, the desorption of contaminants to the aqueous phase would be unlikely. However, it is likely that due to the saturated conditions that exist in this area for much of the year, the soil and ground water would need to be treated as a contiguous unit.

The depression noted in the ablation till surface at well nest W-08 west of the lagoon does not appear to have concentrated VOC constituents due to relatively low VOC concentrations in shallow ground water in W-08 S1.

The other sources of contamination in the landfill were found to be much lower in concentration relative to lagoon materials and were identified at several locations based on available data. TCE, lead and nickel were identified in the buried drum area on the west side of the landfill. Since residues were detected in kame sand below the fill material, the exact point of release was not identified. Sampling of a drum contents in TP-19 revealed vinyl chloride, 1,2-dichloroethene, 4-methyl-2-pentanone, toluene and xylene.

TCE, lead, zinc, and mercury were identified at location TP-13 in the northeast corner of the landfill and at SBW-21, TP-7, and TP-8 in the east/central portion. Semi-volatiles and PCBs were detected at locations within the landfill. Inorganics were identified several orders of magnitude above background at other locations in the landfill. As such, the Landfill Area outside of the lagoon cells and south of the access road contains several accumulations of waste materials at lower, but varying concentrations compared to the Former Lagoon Area. This type of waste distribution is expected given the history of operations at the landfill.

Finally, petroleum and solvent residues in the former tank salvaging area diminished outside of the immediate area around the W-07 nest and SB-23. The extent of contamination was identified at shallow depths (0-2 feet) in a diffuse pattern extending for an approximate 50 foot radius around this point.

4.1.2. Ground Water

The ground water characterization section describes the distribution of solute plumes in the Study Area resulting from the identified waste sources. It also discusses the phase distribution of residues in the ground water system and the migration potential of the solute plumes.

Maps were developed to assist in evaluating the distribution of the related materials in ground water. These maps included contours of organic

parameters and inorganic parameters in the shallow zone (kame sand/ablation till). Additionally, vertical comparisons were made in well nests to evaluate potential vertical migration. It should be noted that inorganic results for unfiltered ground water will soon be compared against results from USEPA's low flow purging and sampling technique employed for all on-site wells.

A comparison of the TCE concentrations detected in shallow ground water in November 1993 shown on Figure 35 was similar to that in May and June 1993 shown on Figure 34A and 34B. The only difference noted was no detectable TCE at well W-07 S1 in the Soil Staging Area. Additionally, an evaluation of the TCE distribution was made for the kame sand and ablation till in February 1994 along with that for total VOCs. Virtually no VOCs were detected in weathered and competent bedrock units indicating essentially no migration of VOCs to these units.

No change in the shape or downgradient edge of the total VOC/TCE plume was noted. TCE was chosen for this assessment because it is the most ubiquitous VOC in the study area and is present in the leading edge of the VOC plume to permit evaluations of downgradient plume migration.

An evaluation was also made of the BTEX distribution and semi-volatiles distribution in the Study Area. This review indicated that the BTEX concentrations were limited to shallow units below the lagoon and soil staging area and SVOCs primarily to the Lagoon and Marshy Areas.

The plume distribution is probably attributable primarily to releases from the Former Lagoon Area with contributing releases from the western and east-central side of the landfill. Contributions from the tank salvaging area are assumed to be relatively small where BTEX compounds were noted.

Assuming a plume area in the shallow zone to be that similar to the 10 ug/l TCE boundary, the area of affected ground water in the shallow zone was estimated to be 115,000 square feet based on the November 1993 data. Assuming an average saturated thickness of the affected kame sand/ablation till to be 25 feet and a porosity of 0.25, the volume of impacted ground water was estimated to be 5.4 million gallons. An area of 150,000 square feet was calculated from the Phase 1A RI data which included some TCE detections at well W-07 S1. This plume volume was calculated to be 7 million gallons.

In order to evaluate the distribution of the inorganic plume in the shallow zone, the total lead was contoured for shallow wells as shown in Figure 36 and the specific conductance was contoured as shown in Figure 37.

The total lead and the elevated specific conductance plumes are similar to the TCE plume maps indicating that the shallow inorganic plume is distributed in a similar fashion to the organic plume.

Evaluations of constituent trends, with respect to seasonality and other parameters, should be performed as part of the LTMP.

Volume calculations for potential trace levels of residual solutes in the lodgement till and weathered bedrock were not made due to the limitations of the data, and the impracticality of evaluating feasible recovery or in-situ treatment options for these units of very low transmissivity.

Indications of NAPL were apparent in some of the Former Lagoon Area sludges. In addition, concentrations of TCE were detected above the solubility limit in the Marshy Area suggesting the possibility of NAPLs. Although ground water quality data suggest the presence of NAPL directly beneath the lagoon cells and in the Marshy Area within the kame sand, none was observed to date.

A comparison of VOC solute concentrations in shallow ground water in the Marshy Area with soil concentrations indicates the presence of comparable constituents, and that ground water concentrations are about one order of magnitude higher than the soils. A cursory review of the data suggests that the Marshy Area soils have been impacted by transport of VOCs through the ground water pathway during periods of high ground water.

4.1.3. Surface Water, Sediment and Leachate Seeps

Surface Water Sampling. The objective of the surface water sampling was to evaluate the effects of the Former Lagoon Area on the surface water quality in the drainage swales, the unnamed stream, and in Barney Brook. Surface water samples were collected on four occasions. Two of these sampling events occurred during dry weather flow conditions (September 1992 and April 1993). The other two sampling events occurred during wet weather flow conditions (November 1993 and February 1994.) In most cases, VOC and inorganic concentrations were higher in samples collected during dry weather flow conditions. Samples were collected from three upstream locations, five locations near the Landfill Area, and eight

downstream locations in the first two events, and from 11 downstream locations in the third event, and from one downstream location in Round 4.

In the upstream locations, semi-volatiles, and PCB/pesticides were not detected. The only VOC detected was carbon disulfide at one location. Several inorganic analytes were detected. However, only arsenic exceeded Vermont WQS.

In the Landfill Disposal Area locations, several VOCs were detected, including: TCE, PCE, vinyl chloride and 1,2-DCE which were at levels above Vermont WQS. The presence of VOCs in these samples was similar to those in ground water in the Marshy Area which indicates that the Landfill Area is impacting surface water quality. Semi-volatiles and PCB/pesticides were not detected. Inorganics detected included aluminum, arsenic, barium, antimony, calcium, cobalt, copper, lead, magnesium, potassium, sodium, silver, vanadium, zinc, cyanide, iron and manganese. Chromium, which was detected in upstream samples, was not detected in samples from this area. However, cyanide was detected in this area.

In the downstream locations, several samples contained VOCs exceeding Vermont WQS; levels decreased with distance downstream. Decreasing concentrations suggest that the impact to surface water quality originates in the Landfill Area and is reduced as the stream flows toward Barney Brook. Semi-volatiles and PCB/pesticides were not detected. Inorganics detected included: aluminum, antimony, calcium, iron, magnesium, potassium, sodium, barium, chromium, lead, mercury, nickel, cyanide and others. Mercury and nickel were not detected upstream of this area. At the furthest downstream sampling location in Barney Brook, SW-05, carbon disulfide was detected at 33 ug/l. In further downstream sampling conducted in Barney Brook in November 1993 and February 1994, only TCE at 1.1 ug/l was detected in SW-17 in February 1994.

Sediment Sampling

The objective of the sediment sampling was to evaluate the effects of the Former Lagoon Area on the sediments in the drainage swales, the unnamed stream, and in Barney Brook. Sediment samples were collected on the same three occasions, in September 1992, during dry weather flow conditions, in April 1993, during wet weather flows and in November 1993 during wet conditions. Sediment sampling locations corresponded to those used for the surface water sampling.

In the upstream locations, the only VOC detected was acetone. Semi-volatiles and PCB/pesticides were not detected. Inorganic concentrations appear to be consistent.

In the Landfill Area locations, several VOCs were detected similar to surface water. Semi-volatiles were not detected. PCBs were detected at SED-02. Inorganic concentrations were present within one order of magnitude above upstream levels for several parameters.

In the downstream locations, VOCs were detected at several locations. PCBs were not detected. Semi-volatiles and 4,4'-DDT were detected at SED-05. Aluminum, manganese, barium, cobalt, nickel and vanadium were detected at some locations at one order of magnitude above upstream levels. The constituent concentrations again decreased significantly downstream to non-detectable levels in the lower reaches of the unnamed stream and Barney Brook.

Leachate Seep Sampling

Previous investigations indicated that leachate/seeps were occasionally observed along the eastern toe of the landfill. On three occasions when leachate/seeps were observed during the Phase IA, samples were collected. Detected VOCs included: TCE, PCE, and DCE. Acetone was also present. 1,4-dichlorobenzene was detected. PCB/pesticides were not detected in the leachate/seep samples. The leachate/seep samples contained metals including: lead, chromium,
aluminum and arsenic. Other inorganic compounds detected included magnesium and manganese. Most organic and inorganic constituents appear to be migrating from seeps occurring at LS-02 and LS-03, although some leaching also occurs at LS-01. Analytical results suggest that migration of these constituents has impacted the Marshy Area, since the unnamed stream was found to contain metals and VOCs.

4.1.4. Air

The air monitoring results were below the OSHA PELs and the ACGIH TLVs, indicating that on-site work exposures are below regulatory and recommended limits. Although the measured levels of some site related compounds and concentration-based detection limits of several other compounds were above the Vermont HLVAA, these compounds would not pose a human health risk for the reasons described in Chapter 3. Based on the results of the air sampling, it was concluded that significant concentrations of site-related residues were not being transported via air at concentrations that would impact public health.

4.2. Nature and Extent of Contamination

The primary source of concentrated volatile and inorganic contaminants are the two lagoon cells. The volume of industrial waste materials and other affected materials is estimated to be 1,700 cubic yards. Additional impacted soils exist below the lagoon cells to the water table. Based upon PID screening and analytical data, the soil impact below Cell 2 appears to extend at least to 5 to 10 feet below the base of the Former Lagoon Area and about 4 feet into the water table.

Based on cross section G-G' (Figure 11), concentrated residues from the lagoon cells have migrated vertically into the underlying kame sand to a depth of 22 feet and ablation till to a depth of 26.5 feet at W-TP-12. VOC concentrations were detected at higher concentrations just below the ablation till surface than in the overlying kame sand at this location. This occurrence may be the result of lower porosity and permeability associated with the ablation till as compared to the more well sorted kame sand above, which may concentrate VOC solutes. These residues have also migrated laterally eastward at somewhat lower concentrations into the Marshy Area.

The boundaries of the landfill have been evaluated with borings, test pits, electromagnetic surveys, and visual observations as shown on the fill contour map in Figure 14. The distribution of volatile, semi-volatile, and inorganic constituents within the Landfill Area indicates that localized areas contain residues similar in nature to those detected in the Former Lagoon Area, but lower in concentration.

The nature and extent of ground water impacts has been characterized for the various hydrogeologic strata except the dense lodgement till at the Site. The nature of the impacts of the shallow ground water in the Marshy Area has been characterized and is consistent with Site disposal history and waste material. Waste residues include primarily metals (predominantly lead, nickel, and chromium) and VOCs (TCE, PCE, DCE).

The horizontal extent of impacts has been characterized in the shallow ground water system (kame sand and ablation till). Based upon the apparent hydraulic connection between the shallow ground water and the unnamed stream, the horizontal extent of shallow ground water VOC and inorganic impact is believed to encompass an area ranging from 115,000 to 150,000 square feet, as shown by the TCE iso-concentration map (Figure

35). The volume of impacted ground water in the shallow zones was estimated to be 5.4 to 7 million gallons.

Ground water quality data indicated that the eastern side of the unnamed stream, opposite the Marshy Area, was largely un-impacted, consistent with the hydrogeologic model that the stream is an effective discharge boundary for shallow ground water. Much lower levels of VOCs are present in the ground water to the south and southwest of the Former Lagoon Area. Analytical results indicate that a much more dilute portion of the VOC plume exists adjacent to the landfill to the south and southwest of the Former Lagoon Area. No migration of constituents was identified further west of the Landfill.

The organic residues appear to be confined chiefly to the shallow zones. An evaluation of inorganic concentrations in unfiltered samples from well nest W-04 in the Marshy Area was conducted to assess the vertical extent of inorganics. The results of this assessment indicated that inorganic residues in the kame sand and ablation till (W-04 S, W-04 D and W-04 T) were about an order of magnitude higher than that in weathered bedrock (W-04 SI, W-04 DI) and competent bedrock (W-04 B).

The vertical extent of VOC and metals impacts to the ground water has been characterized based on the wells installed in the overburden, ablation till, weathered bedrock, and competent bedrock strata at the Site. Data from ablation till wells and bedrock wells indicate that ground water impacts in the till strata are not present except in the Marshy Area and below the Lagoon Area, where constituents were detected in the uppermost ablation till strata.

The VOC data in soils of the Marshy Area indicate a slight decrease in the ablation till.

With regard to metals, select metal concentrations in well nest W-04 were compared for wells W-04 S and W-04 D (kame sand), W-04 T (ablation till) W-04 SI (shallow weathered bedrock , W-04 DI (deep weathered bedrock) and W-09 B (competent bedrock). The nest was chosen due to its proximity to the Former Lagoon Area.

The results for filtered and unfiltered metals indicated a general decrease in metal concentrations from the kame sand and ablation till as compared to weathered bedrock. This information agrees with the VOC distribution.

The information collected from the various sampling events support the possibility of the lodgement till acting as a confining strata preventing

downward migration of chemical constituents. VOCs were not detected in the ground water in the weathered and competent bedrock wells. The competent and weathered bedrock ground water contained some inorganic levels above regulatory standards. These levels were also present in the upgradient weathered bedrock well W-01 DI. The inorganics may have been impacted by particulates in the unfiltered ground water samples in weathered bedrock as discussed in Chapter 3. This will be further assessed using the low-flow purging and sampling technique in supplemental sampling events.

Therefore, in summary, the vertical extent to which VOCs and inorganics are present is estimated to be principally to an average depth 25 feet within the horizontal boundaries shown on Figures 34A and 34B, the TCE iso-concentration map. Depths are greater in the Marshy Area (40 feet) and shallower below the Landfill Area (10 to 15 feet).

The nature and extent of surface water/sediment impacts has been characterized, and the constituent levels in the unnamed stream and Barney Brook have been assessed. VOCs were present in the surface water samples from Marshy Area drainage swales and from the unnamed stream. The only VOC detected in the samples from Barney Brook was carbon disulfide at SW-05 (35 ppb). Metals (aluminum, chromium, nickel and zinc) were present in the sediment samples from the Marshy Area drainage swales, and were not present in the samples from the unnamed stream. Therefore, the extent of VOC impact appears to be limited to the Marshy Area drainage swales around the landfill and the unnamed stream near the landfill, while the extent of metals impact is within the Marshy Area drainage swales.

4.3. Constituent Migration

Constituent migration from the principal source areas, Former Lagoon Area and Landfill Area occurs primarily through the shallow ground water pathway (kame sand and ablation till). The shallow ground water receives the waste residues by leaching of precipitation through impacted soil in the source areas. Residues are then transported via the shallow ground water in the kame sand and ablation till to the Marshy Area.

Precipitation also collects within the bermed area of Lagoon Cell 2 and provides the hydraulic mechanism for vertical migration of residues to the water table. The shallow ground water in the kame sand and, the ground water in the upper ablation till strata contain metals and VOCs. Horizontally, very little migration of constituents was noted to the west of the landfill. This is attributable to a ground water divide which is located beneath the landfill. Most impacted ground water flows toward the Marshy Area.

Percolation of precipitation also contributes to the leachate/seeps occasionally observed at the Site. Analytical results from leachate/seeps and monitoring wells confirmed that migration of constituents occurs via the ground water and surface water pathways, as the unnamed stream was found to contain metals and VOCs.

Most organic and inorganic migration through seeps appears to be occurring at locations LS-02 and LS-03 located on the eastern and southern sides of the landfill. Some leaching of organic and inorganic compounds is occurring also at LS-01. Based on the dilution and mixing provided by the unnamed stream, VOC levels in the water are non-detectable by the time the stream discharges into Barney Brook, however, one sample taken at SW-05, which indicated that presence of carbon disulfide (33 ug/l). Carbon disulfide was the only VOC detected in this sample and was detected on only one occasion.

Ground water concentrations of VOCs in and around the Former Lagoon Area and Marshy Area are in some cases above solubility limits, indicating the potential existence of a DNAPL source in the Former Lagoon Area. The presence of DNAPLs can have a significant influence on achieving ground water cleanup standards and must be evaluated when selecting appropriate remedial actions. According to a recent USEPA publication entitled "Dense Non-Aqueous Phase Liquids, A Workshop Summary" (February 1992), dense NAPLs represent long-term sources of ground water contamination often prohibiting achievement of ground water cleanup levels. If DNAPL is present, once the residual saturation of the soil pores is overcome by the DNAPL, the fluid will likely migrate through the saturated zone until a stratigraphic zone of lower permeability is encountered. The gradient of the top of a lower permeable boundary, such as the till may affect the movement of the possible DNAPL.

At the Site, the top of the ablation till and very dense lodgement-type till layers was further evaluated since these may represent stratigraphic zones upon which possible DNAPLs may tend to accumulate in the subsurface beneath the Former Lagoon Area. An evaluation of the distribution of

VOCs in soils and ground water in the Marshy Area indicates preferential migration of VOCs in the kame sand and ablation till and the potential occurrence of DNAPL in this unit. Due to its density, the lodgement till surface may be the preferred horizon for possible DNAPL accumulation based upon the amount of any DNAPL released and physical properties of the till. Ground water wells have been installed at the base of the ablation till (top of lodgement till) to monitor for this occurrence.

The lodgement till surface represents the top of the lodgement till where the N value as interpreted from blow counts from standard penetration tests was greater than 100 per 12 inches. The "N" value is a measure of compaction (ASTM Method D 1586-84, Section 7.3). The lodgement till surface also slopes toward the Marshy Area, suggesting that the movement of concentrated waste residues from the Former Lagoon Area will be toward the Marshy Area.

Downward migration of organic and inorganic site-related materials appears to be very limited or non-existent below the ablation till.

Analytical data from Site monitoring wells and the residential wells indicate that VOC residues from the Site are confined to the Landfill Area and Marshy Area and do not appear to be migrating toward the residential wells. Since the shallow organic and inorganic plumes appear to be confined horizontally by local shallow discharge boundaries (unnamed stream), and a ground water divide just west of the landfill, constituent velocities and migration rates were not estimated. The disposition of these plumes will be evaluated as part of the LTMP. Based on site hydrogeology, a pathway of the site-related contaminants to shallow residential wells and Ryder Spring does not appear likely. Further evaluation of the residential wells and Ryder Spring will be performed as detailed in the LTMP.

5. Contaminant fate and transport

5.1. Objectives

This section presents an evaluation of the fate and transport of the Site contaminants. The evaluation expands upon the extent of Site contamination as discussed in Chapter 4.

The objective in evaluating the fate of Site contamination is as follows:

- summarize the extent to which site specific contaminants have migrated or are expected to migrate from the source areas

- discuss the fate and transport aspects of Site contaminants based on known transport processes

Site-related inorganic and organic contaminants have been detected in environmental media principally in shallow hydrologic units at the Burgess Brothers Site. Organic compounds represent a higher concern to the environment due to greater relative concentrations.

Contaminant concentrations were evaluated relative to background concentrations. The convention of one order of magnitude above background was typically used to indicate that a contaminant is site related. In the case of organics, detections were considered to be above background.

The VOCs that were most prevalent in ground water and surface water on-site were TCE, PCE, acetone, vinyl chloride, and 1,2 DCE. The inorganics of concern were lead, nickel, chromium, zinc and mercury. There were no SVOCs detected in surface water and relatively low SVOCs were detected in ground water in the Marshy Area above regulatory limits. No PCBs or pesticides above regulatory limits in surface or ground water.

5.2. Fate and Transport of VOCs in Ground Water and Surface Water

Because VOCs are mobile, they tend to migrate long distances in ground water depending on the flow lines of the hydrologic system. Typically, VOCs delineate the extent of a solute plume at landfills, as is the case at the Burgess Brothers Site (Figure 34A, 34B, and 35). VOCs are likely to biodegrade or photodegrade in soil and surface water environments (Callahan etal., 1979).

As discussed above, the most frequently detected site-related VOC indicator analytes are TCE, PCE, vinyl chloride, 1,2-DCE and acetone. The site VOC indicator analytes are characterized by relatively high vapor pressure and solubility.

The site VOC indicator analytes are more dense than water. These compounds can undergo vapor or liquid phase migration with ground water, sink in the ground water system, or volatilize from ground water to subsurface soil of the vadose zone and eventually escape to the atmosphere.

The following summarizes analyte specific transport criteria for volatiles:

Chlorinated Aliphatics (PCE, TCE, 1,2-DCE, Vinyl Chloride). Chlorinated aliphatics present in exposed soils would tend to volatilize to the air. Additionally, since many chlorinated aliphatics have relatively high water solubility, residues in soils may migrate to ground water. At high concentrations, higher density, lower solubility chlorinated aliphatics (PCE, TCE) may form DNAPLs in ground water, potentially acting as long term sources of ground water contamination. Chlorinated aliphatics present in surface waters tend to volatilize rapidly, and are not likely to partition to sediments. Aliphatics volatilize less readily in ground water. In air, vapors can undergo photodegradation, and at high concentrations, can become adsorbed to particulates. In general, chlorinated aliphatics are not known to bioconcentrate or bioaccumulate in terrestrial or aquatic biota, and therefore do not biomagnify through trophic levels in terrestrial or aquatic ecosystems.

Chlorinated aliphatics may degrade by both biological and non-biological mechanisms in all media described above. In most environmental settings, non-biological transformations are relatively minor processes compared with biological degradation. The general degradation pathway for chlorinated aliphatics identified is as follows: PCE to TCE to 1,2-DCE to vinyl chloride. Each step of the pathway represents the sequential removal of a chlorine from the molecule. Degradation can occur under anaerobic

and aerobic conditions in water and soils. Anaerobic degradation of chlorinated aliphatics has been documented in field studies, and there is evidence of aerobic degradation as well. Biodegradation can occur through several mechanisms including reductive dehalogenation, enzymatic oxidation and hydrolysis. There is now evidence that chlorinated hydrocarbons can undergo redox-independent elimination and hydrolysis in highly oxidized ground waters. It is important to note that some aliphatics can be completely mineralized to water and CO2, without the formation of persistent intermediates.

Acetone. Acetone is readily volatilized or biodegraded in aerobic surface water and soil environments where there is little potential for bioaccumulation. Acetone is not strongly adsorbed in soil. In ground water environments, acetone may be more persistent since more anaerobic conditions may prevail and microbial degradation may be limited. Acetone can be relatively mobile in ground water since sorption of acetone is unlikely except in inter-layer complexes with clay soils (Howard, 1990).

Typically organic compounds are unlikely to persist in surface water environments. The processes of volatilization, photodegradation and biodegradation will remove organic compounds from surface environments. Sorption of organic compounds may retard migration. Organic compounds, however, are likely to sorb significantly only to small particle soils. Therefore, VOCs may be transported in ground water.

Subsurface soils in suspected disposal areas at the Site contain volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

Organic compounds are migrating with ground water flow at the Site as discussed in Section 4.3. The migration is principally through shallow ground water from the Former Lagoon Area and Landfill Area into the Marshy Area, with subsequent discharge to surface water. Migration of VOCs west of the Site appears to be minimal. Additionally, migration of VOCs to underlying weathered bedrock is limited to trace amounts in shallow intermediate bedrock. No VOCs have been detected in competent bedrock beneath the Site with the exception of trace 1,2 DCE in W-01 B on one event. Sorption and complexation with subsurface soil retard migration. Solubility, volatility and other chemical specific properties as well as soil characteristics such as organic matter content, mineral type and particle size influence the degree of subsurface transport.

5.3. Fate of Semi-Volatile Organic Compounds in Ground Water and Surface Water

The most frequently detected SVOCs in ground water at the Site were isomers of dichlorobenzene and phenolic compounds including phenol and methyl phenol. SVOCs exhibit similar environmental fate and transport properties to those of VOCs. However, SVOCs are larger molecules and therefore are less volatile and more readily partition to soil or sediments. SVOCs are not expected to migrate to the extent of VOCs in the shallow ground water system or surface water as has been observed at the Site.

Phenolic compounds are not strongly sorbed by either mineral surfaces or soil organic matter. Phenols are reportedly oxidized by certain bacteria and yeasts. The low log octanol/water partition coefficient indicates that phenols are not likely to be bioaccumulated. Phenol will likely be rapidly photodegraded under atmospheric conditions in an anaerobic ground water environment.

5.4. Fate and Transport of Pesticides/PCBs in Ground Water and Surface Water

Pesticides and PCBs are not considered to be contaminants of concern in ground water or surface water at the Site. Trace quantities of PCBs were detected in the surface and subsurface soil samples sporadically across the Site, most notably in the Former Lagoon Area.

Pesticides and PCBs were not detected above the quantitation limits in the site ground water or surface water. Based on these data, the small quantities of pesticides and PCBs detected at the Site do not indicate the presence of pesticide or PCB source areas which would result in impacts to ground water or surface water/sediments at the Site.

5.5. Fate and Transport of Metals

5.5.1. Fate of Metals in Ground Water

The most common metals in ground water at the Site are chromium, lead, mercury, nickel and zinc.

Metals contained in the subsurface and in sediments exist predominantly in reduced states under anaerobic conditions. Subsurface media typically contain low levels of organic matter and therefore sorption of metals may not be significant. Since ground water oxygen levels are typically low, significant metallic oxide and hydroxide precipitate formation is unlikely. Landfill environments also typically lack oxygen due to heavy biological and chemical oxygen demands. Metals can be leached from landfills in a reduced and mobile condition and maintained in dissolved forms. Soluble reduced metals can be transported in reduced oxidation states through subsurface media by ground water.

5.5.2. Fate of Metals in Surface Leachate Seeps

Metals in surface waters and leachate seeps at the Site are expected to partition to sediments. The predominant fate process governing the behavior of metals in aquatic systems are precipitate formation via. annellated organic complexes. In addition, sorption to inorganic and organic suspended and bottom particulates immobilizes metals.

Seeps at the Site act as a transport mechanism for metals. Infiltration of rainwater and snow melt can produce events or areas of temporarily high seepage volume and contaminant loading. Leachate seeps contain reduced iron, aluminum and chemical analogous metals, such as zinc and nickel. These metals oxidize upon contact with the atmosphere. The combination of oxygen with metals in leachate yields iron, aluminum and other metallic oxides and hydroxides which precipitate and form an impenetrable barrier to dissolved gases at the sediment/surface water interface.

5.5.3. Fate of Metals in Surface Water/Sediments

The following discussion focuses on specific processes affecting the environmental fate of metals and the association of immobilized metals with iron, aluminum and TOC in sediments. Similar processes can lead to accumulation of these metals when present in surface soils.

Complexation with Organic Carbon. A predominant fate process for metals such as nickel, zinc, lead and mercury in aquatic systems is accumulation in sediments via the formation of chelation complexes with humic materials. The functional groups of the humic acid component of TOC dissociate as pH rises in aquatic systems and become available as ligands for complexation with metal cations. The neutral pH of surface waters at

the Site will tend to produce ligands. This relationship between metals and TOC suggests complexation with organic ligands is an important fate process of metals in sediments. Furthermore, organic complexes enlarge, become thermodynamically and kinetically more stable, and decrease in solubility and bioavailability over time (Cotton and Wilkinson 1980). Therefore binding with humic materials can reduce toxicity in aquatic systems (Tan, 1993). Thus metals in aquatic environments with near neutral to basic pH, such as those at the Site, would be expected to be found, precipitated and immobilized in sediments.

Annellation and Co-Precipitation with Oxide and Hydroxide Precipitates. The environmental fate of metals in sediments may also be closely linked to the fates of iron and aluminum via annellation and co-precipitation. Due to proximate atomic radii and similar outer electron configuration, the chemical behavior of iron, aluminum, zinc and nickel are analogous (Bohn etal., 1985). Zinc and nickel atoms can undergo isomorphic substitutions with iron and aluminum containing mineral (Cotton and Wilkinson, 1980). Likewise, zinc, nickel, and lead can co-precipitate with, or incorporate into iron and aluminum oxides, hydroxides and sulfates. Therefore, annellation and co-precipitation are important fate processes at the Site.

Sorption. Sorption is another important fate process of metals in natural waters. Aqueous phase metal species exhibit an affinity for inorganic as well as organic suspended solids and bottom surfaces (Cotton and Wilkinson 1979, Bodek 1988). Metals including zinc, nickel, lead and especially mercury, will be sorbed to humic and mineral materials. Sorption leads to settling and deposition of metals in sediments. Physical and chemical sorption processes could therefore remove much of the leached metals in surface water runoff at the Site.

A potential future site condition which may affect the mobility of metals in surface water and sediments is a change in the pH of the surface water. A decrease in surface water pH will increase the solubility of metals and, therefore, increase their mobility. Examples of site and environmental conditions which may result in a decrease in surface water pH include: snow thaw, decreases in dissolved oxygen concentration resulting from a decrease in surface water flow and increases in loading rates of contaminants during snow thaw and/or heavy rain periods.

5.5.4. Fate Summaries of Metals of Concern

The following sections briefly describe the important fate processes for individual metals of concern. Metals at the Site are expected to be immobilized in sediments.

Lead. Complexation with Soil Organic Matter (SOM) and sorption to SOM and mineral surfaces are the dominant processes that remove lead from surface waters and deposit it to sediments at the Site. Benthic microbes may accumulate and remobilize sediment bound lead; however, lead is not readily biomagnified and concentrations in biota decrease with trophic level (Callahan etal., 1979). Lead concentrations in downstream sediments at the Site are the same order of magnitude as background levels and lead was not detected in surface water samples.

Mercury. Most mercury in natural aquatic systems is transported by sediments. Adsorption to particle surfaces is the primary transport process. Mercury can be biotransformed into volatile methylated forms, yet, sediments are a sink for biotransformed mercury. Re-suspension of sediments can release methylated mercury compounds to the water column (Callahan etal., 1979). However, mercury was not detected downstream in water at the Site.

Nickel. Although nickel is one of the more mobile heavy metals, complexation and sorption processes dominate the environmental behavior of nickel. Nickel has an affinity for mineral and organic complexes (Callahan etal., 1979). Nickel is partitioned to sediments primarily by incorporation into the structure of iron and manganese oxides and hydroxides (Lee, 1975). Nickel was not detected in surface water at any downstream locations at the Site.

Zinc. Zinc, in the aquatic environment, is sorbed to iron and manganese oxide and hydroxide as well as other mineral and organic materials. These complexes are subsequently precipitated to sediments. When in high concentrations, zinc can precipitate to form zinc sulfate (Callahan etal., 1979). No zinc was detected in surface water samples at the Site. Zinc is expected to remain immobilized in sediments.

Chromium. Chromium in anoxic sediments is expected to exist primarily in the trivalent oxidation state. In turbid waters sorption to suspended solids may occur. In waters/sediments with high total organic carbon concentrations, sorption and chelation can also prevent chromium release to surface water. Although chromium ligands with humic materials are soluble in acidic environments (ATSDR, 1991), in most neutral pH surface waters chromium residues are expected to be relatively immobile.

- Annellated chromium complexes are expected to increase in thermodynamic and kinetic stability, and decrease in solubility and bioavailability over time (Cotton and Wilkinson 1980). Therefore, physical and chemical fate processes such as burial, oxidation-reduction, complexation, annellation, precipitation, co-precipitation, solidification, sorption and chelation tend to eventually eliminate potential chromium effects in sediments with respect to impacts to aquatic biota.

5.6. Summary of Contaminant Fate and Transport

VOCs including TCE, PCE, acetone, vinyl chloride and 1,2-DCE along with inorganics (lead, nickel, chromium, zinc and mercury) have been identified as the most frequently detected indicator analytes at the Site. VOCs can migrate within the ground water system, particularly from DNAPLs which can potentially act as long term sources of contamination, or can volatilize from ground water to subsurface soils of the vadose zone. VOCs can undergo biological degradation under both anaerobic or aerobic conditions, and can be transformed by non-biological methods as well.

Metals can be leached from soils in a reduced and mobile state and maintained in dissolved forms. These soluble metals can then be transported through subsurface media by ground water. Metals in surface water and leachate, when combined with oxygen can form precipitates that form an impenetrable barrier to dissolved gases at the sediment/surface water interface. Metals can also accumulate in sediments via the formation of chelation complexes with humic materials.

Organic compounds are migrating with ground water at the Site, principally through shallow ground water from the Former Lagoon Area and Landfill Area into the Marshy Area. The shallow ground water is subsequently discharged to the surface water. The RI results suggest that a correlation exists between elevated metals and the VOC contaminant plume in the shallow kame sand below the Landfill Area and Marshy Area. Sorption and complexation with subsurface soil tends to retard migration of these contaminants.

In summary, transport of metals in subsurface ground water environments can occur, but can be affected by low permeable units such as the lodgement till and weathered bedrock. Metals and transport in stream sediments is also affected by various chemical and biological phenomena

described above. These processes appear to be occurring at the Burgess Brothers Site because migration of metals in subsurface ground water and surface water has been limited.

6. Further actions

6.1. Superfund Accelerated Cleanup Model Program

The Burgess Brothers Superfund Site Steering Committee and USEPA-Region I are currently proceeding under USEPA's Superfund Accelerated Clean-up Model (SACM) program. The Steering Committee has submitted an Engineering Evaluation/Cost Analysis (EE/CA) for source control measures which meet response action objectives outlined by the USEPA.

The response action objectives (RAOs) are focused on the Landfill Area and Marshy Area and include:

Landfill Area RAOs

- prevent, to the extent practicable, direct contact with and ingestion of soil/debris within the landfill and beneath the landfill
- prevent, to the extent practicable, the potential for water to infiltrate through the landfill debris mass and reduce the resultant leachate generation;
- control, to the extent practicable, surface water run-off to minimize erosion
- control landfill gas so that methane gas does not present a fire or explosion hazard; prevent, to the extent practicable, the inhalation of landfill gas containing hazardous substances, pollutants or contaminants to the extent necessary to meet state and federal standards
- prevent, to the extent practicable, the saturation of the landfill debris mass from upgradient ground water
- prevent, to the extent practicable, the migration of impacted ground water and leachate beyond the boundary of compliance

Marshy Area RAOs

- prevent to the extent practicable, the migration of contaminants from the soils and sediments in the Marshy Area to the ground water
- prevent to the extent practicable, direct contact with and ingestion of soil and sediments in the Marshy Area
- prevent to the extent practicable, ecological impacts from constituents in the Marshy Area

Remedial technologies anticipated to be addressed by the EE/CA include the following:

- capping of the landfill
- leachate and gas management/control and treatment
- remediation of the Former Lagoon Area
- surface water drainage improvement/erosion and control measures
- remediation of the sediments/surface water in the Marshy Area
- site management and control

Ground water impacts at the Site will be addressed following completion of a health-based risk assessment to be performed by the USEPA. Data from the RI conducted at the Site will be used in performing the risk assessment.

6.2. Developing and Screening of Remedial Action Alternatives

Preliminary alternatives for remediation of Site ground water were developed and screened, based on the data compiled during performance of the RI. The objective of the Alternatives Evaluation was to develop a range of remedial options that protect human health and the environment, based on available information and standards such as Standards, Criteria and Guidelines and Applicable or Relevant and Appropriate Requirements.

The results of the Alternatives Evaluation are summarized in a separately bound report entitled Alternatives Evaluation - Ground Water, August 1994

by O'Brien & Gere Engineers, Inc. The remediation of Site ground water are addressed in the Alternatives Evaluation-Ground Water document, while the EE/CA deals with source control measures.

6.3. Evaluation of Background Conditions in Ground Water

Due to concentration of inorganics in ground water samples from areas thought to be unimpacted by historical site operations, additional ground water sampling will be performed. The sampling will be conducted using a low flow purging and sampling method recently approved by the USEPA. Particulates in the ground water samples may have impacted the unfiltered inorganic analyses and therefore, these results do not represent an accurate characterization of background ground water conditions. Since unfiltered ground water results are used for risk assessment purposes, the concentrations from the current samples may overstate the need for remedial action.

Sampling will be performed in supplemental sampling programs. The results of the supplemental sampling will be validated evaluated and incorporated into this RI as an addendum.

7. Summary and conclusions

7.1. Summary

7.1.1. Physical Characteristics

The focus of this RI was a two to three-acre area of the sixty-acre property. This area, as depicted in Figure 2, consists of a Landfill Area, an approximately 4,200 square foot Former Lagoon Area, Marshy Area at the base of the Landfill Area, Hillside Area east of the Landfill Area and Marshy Area, Soil Staging Area north of the Landfill Area, and Bend in the Road located north west of the Landfill Area. There are a number of drainage swales and intermittent streams that discharge into an unnamed stream which flows along the base of the Landfill Area and into Barney Brook. A detailed study of the Site disposal and investigative history was completed. Climatology, topography and drainage, soils characteristics, surface water drainage, and ground water characteristics were evaluated for the Site and surrounding area. Current land use in the two to three-acre area is mainly excavation and staging of kame sand and gravel near the Soil Staging Area.

The landfill accepted primarily municipal-type refuse such as wood, newspaper, steel, cardboard and cinders. Disposal of wastes, now considered to be hazardous, reportedly occurred in lagoons at the Site beginning in approximately 1967-1968. The wastes that were disposed at the Former Lagoon Area include lead plater wastes, lead plater sludge, battery processing waste, and waste solvents. The wastes were disposed in two unlined bermed pits (the Former Lagoon Area). These pits were excavated into kame sand in the area.

7.1.2. Field Investigations

The following investigations were performed to evaluate the effects of the Former Lagoon Area and Landfill Area on air, surface water, surface and subsurface soils, ground water, and ecology at the Site:

- Geophysical Surveys

- Soil Vapor Surveys
- Surface Soil Sampling
- Soil Borings/Monitoring Well Installations
- Test Pit Installations
- Surface Water and Sediment Sampling
- Leachate Sampling
- Air Quality Study
- Ecological Assessment

Geophysical Surveys

Geophysical surveys conducted at the Site included: ground penetrating radar during the LFI; seismic refraction survey during the Phase 1A; and electromagnetic survey during the Phase 1B. In addition seismic, magnetometer, and gravity surveys were performed prior to the LFI in 1988.

The objective of these surveys was to evaluate depth to bedrock, constituent plumes, and landfill materials.

Soil Vapor Surveys

Two soil vapor surveys were performed during the RI. An initial survey was performed during the LFI to evaluate the areal distribution of subsurface VOCs in the vicinity of the Former Lagoon Area. A second survey was performed during the Phase 1A RI to evaluate the distribution of VOCs in the Hillside Area, tentatively identify chemical composition of subsurface VOCs, and further evaluate VOCs detected at the Soil Staging Area.

Surface Soil Sampling

Shallow surface soils were collected during the LFI to evaluate VOCs in the Marshy Area and Hillside Area. Additional samples were collected during the Phase 1A and Phase 1B RI to evaluate the migration of constituents from the Former Lagoon Area and Landfill Area to the Marshy Area and to evaluate potential for ingestion and possible contact exposure for human or ecological receptors.

Soil Boring/Monitoring Well Installations

Sixty soil borings were performed to facilitate ground water monitoring well installation and/or characterize subsurface soils.

Monitoring wells were installed in the shallow kame sand, ablation till, shallow and deep weathered bedrock, and competent bedrock to characterize constituents within the various water bearing zones.

Test Pit Installations
Test pitting programs were performed during the Phase 1A and Phase 1B RI field programs. Six test pits were performed during the Phase 1A RI to evaluate the location of the northern perimeter of the landfill. In addition ten test pits were performed along the Bend in the Road to evaluate if plater sludge had been deposited in this area. Test pitting performed during the Phase 1B RI consisted of fourteen test pits for the purpose of defining the landfill (northeast corner) and Former Lagoon Area boundaries and evaluate EM anomalies.

Surface Water and Sediment Sampling
Surface water and sediment sampling was performed during the Phase 1A RI and Interim Ground Water Sampling program. The purpose of this program was to evaluate the effects of the Former Lagoon Area and Landfill Area on the surface water and sediment quality in the drainage swales, the unnamed stream and in Barney Brook.

Leachate Sampling
Leachate seep sampling was performed along the toe of the landfill during the Phase 1A RI field program. The objective of this effort was to characterize the constituents in the leachate and to evaluate the potential impact on surface water and sediments.

Air Quality Study
An Air Quality Assessment was performed during the Phase 1A RI field program. The objective of this program was to evaluate whether site-related residues are being transported from the Site via air transport.

Ecological Assessment
An ecological assessment was completed at the Site during the Phase 1A RI program. The objectives of this program included: identifying major terrestrial and aquatic habitants and associated wildlife, identifying exposure point contaminant concentrations in the affected media; and qualitatively evaluating the risk to exposed resident wildlife species.

7.1.3. Conceptual Hydrogeologic Site Model

As stated in the SOW, a Conceptual Site Model (CSM) for the hydrogeology of the Site is developed and refined to describe the characteristics of the study area and anticipated pathways of constituent migration from known or suspected source areas. The development and continued refinement of the CSM through the Site characterization phase

assists in identifying risks posed by Site-related residues and the evaluation and selection of a Site remedy.

Site hydrogeology has been described in detail in Chapter 3, based on information obtained throughout the RI. The nature and extent of contamination, including identification of suspected source areas has been presented in Chapter 4. Fate and transport of site-related residues was discussed in Chapter 5.

7.2. Conclusions

This Remedial Investigation Report contains the results of the Phase 1A and Phase 1B RI. Specific conclusions drawn from these investigations, consistent with the objectives of the RI, are discussed below.

In accordance with the RI Work Plan for the Site, the objectives were to:

- define the source(s), nature, extent, and distribution of contaminants released
- provide sufficient information to identify and quantify potential exposure pathways, migration potential and fate and transport of site-related materials
- provide sufficient information to assess the risks to human health and the environment
- provide sufficient information to evaluate remedial alternatives, conceptually design remedial actions, select a remedy, and issue a record of decision

The primary source area is the Former Lagoon Area. Based on analytical data collected during the RI, the nature of wastes in the Former Lagoon Area are consistent with the known disposal history of waste sludges from battery production and spent solvents. The vertical and horizontal extent of the source has been identified through completion of the RI activities. Residues from the lagoon cells have migrated into the underlying kame sand a distance of several feet and then into the adjoining Marshy Area.

Other areas identified within the Study Area as being suspected or confirmed source areas included:

- Bend in the Road
- Hillside Area
- Soil Staging Area
- Landfill Area
- Marshy Area

The following conclusions with respect to these areas is presented below:

Bend in the Road Area. No evidence of or concentrated waste materials were observed, therefore, no further action in this area is required.

Hillside Area. This area appears to be a small localized surface source associated with machinery storage and does not appear to be an area of concern.

Soil Staging Area. Petroleum and solvent residues are limited primarily to the area in the proximity of well cluster W-07, with lower concentrations in shallow soils around W-07. This area appears to be a localized source area, resulting from tank salvaging operations conducted in this area.

Landfill Area. Inorganics associated with disposal of construction/demolition waste and some industrial wastes (batteries, solvents) were identified in the northeast section near the Woodford/Bennington town line. VOCs at lower levels than in the Former Lagoon Area were also found in these areas. Shallow ground water in the kame sand and ablation till in the immediate vicinity of the landfill has been impacted from disposal in the Lagoon Area. The landfill appears to be a source of solvents and metals which has impacted shallow ground water beneath the landfill and Marshy Area, and surface water/seeps.

Marshy Area. Due to the slope of topography and ground water flow potentials, residues from the lagoon cells and landfill have migrated into the Marshy Area and then into the unnamed stream. Contamination appears to be confined to the kame sand and ablation till units in this area.

The nature and extent of ground water contamination has been characterized for the various hydrogeologic strata at the Site.

Shallow Zone. Contaminants identified in the shallow ground water include primarily metals (predominantly lead, manganese, zinc, nickel, and chromium), and VOCs (TCE, PCE, DCE). Based upon the apparent hydraulic connection between the shallow ground water and the unnamed stream the horizontal extent of shallow ground water VOC impact encompasses an area ranging from 115,000 to 150,000 square feet. The

inorganic plume appears to be coincident with the organic plume. The volume of impacted ground water in the shallow zone is estimated to be 5.4 to 7 million gallons.

Ablation Till Strata. Ground water impacts were identified in the Marshy Area, where contaminants were detected in the uppermost ablation till strata. Information collected from various sampling matrices in the Marshy Area supports the possibility of the underlying lodgement till and weathered bedrock acting as a confining strata, minimizing downward migration of chemical constituents.

Competent and Weathered Bedrock. VOCs were essentially not detected in the competent and weathered bedrock wells. The competent and weathered bedrock did contain metals at levels exceeding regulatory standards, however, these levels were present in the upgradient wells. A low flow purging and sampling program will be initiated to re-evaluate inorganic concentrations at the Site.

The vertical extent to which VOCs and metals are present is estimated to be principally to an average depth of 25 feet within the horizontal boundaries defined. Depths are greater in the Marshy Area (40 feet) and shallower below the landfill (10 to 15 feet).

The nature and extent of surface water/sediment impacts has been characterized, and the contaminant levels in the unnamed stream and Barney Brook have been assessed. VOCs were present in the surface water samples from Marshy Area drainage swales and from the unnamed stream. The only VOC detected in the samples from Barney Brook was carbon disulfide which was detected in only one sample on only one occasion. Metals (aluminum, chromium, nickel and zinc) were present in the sediment samples from the Marshy Area drainage swales, and were not present in the samples from the unnamed stream. Therefore, the extent of VOC impact appears to be limited to the Marshy Area drainage swales around the landfill and the unnamed stream near the landfill, while the extent of metals impact is within the Marshy Area drainage swales.

Health and environmental impacts of Site ground water will be evaluated by a risk assessment to be performed by USEPA. Data from this RI Report will be utilized to perform the risk assessment. The Conceptual Site Model developed and refined throughout the RI program describes the anticipated pathways of constituent migration from known or suspected source areas.

Respectfully submitted,

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Appendix 2

In the course of evaluating well log data that was supplied by Ms. Tammy Leno of VTDEC's Water Supply Division during the LFI, variable thicknesses of till overlying weathered to competent bedrock were indicated. This was evidenced in the well logs developed for Gorham Heights located about 0.5 to 1 mile southwest of the Site. Competent bedrock was indicated to be about 20 to 120 feet below grade in these wells. The following lists the well records for those wells located within 0.25 mile of the Site as provided to O'Brien & Gere during the LFI:

- John Williams (Burgess Road) - clay and hard pan to 22 feet, gravel and white quartz rock to 40 feet.

- F.D. Frantz (Burgess Road) - clay and hardpan to 320 feet, limestone from 320 to 370 feet.

- Mary Albrycht (Route 9) - dirt to 2 feet, granite from 2 to 323 feet.

The above information was difficult to interpret due to the nature of the descriptions and language used by the drillers. As recognized by Jerris in his review of 317 well logs, interpretation of the well logs was very difficult due to the wide range of terminologies used by drillers and their informal training in geology. The above information was originally interpreted to mean that the till layer was variable in thickness and that the bedrock was decayed in some areas. In other areas, the competent bedrock surface was interpreted to lie close to the ground surface or the base of the till layer. As the course of the drilling program continued, it became evident that the ocher layer was continuous, and very thick below the till layer.

Another list of water well records was provided to O'Brien and Gere in August, 1993 and January 5, 1994 from the VTDEC Division of Water Supply. This list contained a detailed tabular summary of data that was not included in the first package obtained during the LFI. A summary of well records within 1 mile of the Site is shown on Table 1 (in the column entitled "Overburden Depth", a (-) sign indicates that depths were not provided; therefore, an estimation of the weathered bedrock thickness cannot be made in these wells), and maps showing the wells around a one-mile radius of the

Site are presented in Appendix 2. The Site is located in the center of the figures in Appendix 2. The average overburden thickness as reported by drillers on these logs is 50 feet. A total of 10 of the 58 wells in the area included extended casing lengths (greater than 50 feet) to seal off deteriorated rock. This small number of wells in the group with extended lengths of casing was not indicative of a continuous layer of weathered rock 180 to 360 feet thick similar to that found at the Site.

TABLE 1

ACRONYMS & ABBREVIATIONS

ACGIH TLV's	American Conference of Governmental Industrial Hygienists Threshold Limit Values
ACOE	Army Corps of Engineers
ARAR	Applicable of Relevant and Appropriate Requirements
ASTM	American Society of Testing Materials
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BTX	Benzene, Toluene, Xylene
Burgess Brothers	Burgess Brothers, Inc.
Cro	coefficient of run-off
CSM	Conceptual Site Model
DCA	dichloroethane
DCE	dichloroethene
decon	decontamination
DNAPL	dense, non-aqueous phase liquid
DOT	Department of Transportation
EA	Ecological Assessment
EE/CA	Engineering Evaluation/Cost Analysis
EM	electromagnetic
frac	fractionating
fps	feet per second
FWS	US Fish and Wildlife Service
GMNF	Green Mountain National Forest
GPM	Gallons per minute
GPR	Ground Penetrating Radar
H&A	Haley & Aldrich, Inc.

Table 1 (Continued)

HRG	Hager-Richter Geoscience, Inc.
I	Hydraulic Gradient
ISCR	Initial Site Characterization Report
k	Permeability Constant
K	Hydraulic Conductivity
LFI	Limited Field Investigation
LTMP	Long Term Monitoring Plan
MCL	Maximum Contaminant Levels
MSL	Mean Sea Level
N	Porosity
NAPL	Non-aqueous Phase Liquid
ND	Not Detected
NNHP	Nongane and Natural Heritage Program
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities list
NWI	National Wetland Inventory
OBG Engineers	O'Brien & Gere Engineers, Inc.
OSHA PELs	Occupational Safety and Health Administration Permissible Exposure Limits
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PGWs	Primary Ground Water Standards
PID	Photoionization Detector
POWZ	palustrine, open water, intermittently exposed/permanent
ppb	Parts per billion
ppm	Parts per million
ppmv	Parts per million by volume
PVC	Polyvinyl Chloride

Table 1 (Continued)

R	Data not available
RAO	Response Action Objectives
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RTE	rare, threatened or endangered
SACM	Superfund Accelerated Clean-up Model
SCS	Soil Conservation Survey
SG	Soil gas
SI	Shallow intermediate
Site	Burgess Brothers Superfund Site
SOW	Statement of Work
TAL	Target Analyte List
TCA	Trichloroethane
TCE	Trichloroethene
TOC	Total Organic Compounds
USEPA	US Environmental Protection Agency
USFS	US Forest Service
USGS	United States Geologic Survey
UV	Ultraviolet
V_H	water velocity
VC	Vinyl Chloride
VFWD	Vermont Department of Fish and Wildlife
VOC	Volatile Organic Compounds
VT	Vermont
VTDEC	Vermont Department of Environmental Conservation
VT HLVAA's	State of Vermont Hazard Limiting Valve Annual Average
WET	Wetland Evaluation Technique

File Ref: Abbrev.

Table 2

CHRONOLOGY OF INVESTIGATIVE STUDIES

BURGESS BROTHERS SUPERFUND SITE

NO.	TITLE/TYPE OF INVESTIGATION	MEDIUM	AUTHOR	DATE
1.	Leachate and surface water sampling program	Leachate and surface water	Vermont Department of Environmental Control (VTDEC)	1984
2.	Private water supplies sampled	Water supplies	VTDEC	8/84
3.	Preliminary Assessment	Site	VTDEC	3/85
4.	Preliminary Hydrogeologic Investigation	Ground water, subsurface soil conditions	Geraghty & Miller (G&M)	7/85
5.	Morgan Spring Study	Ground Water	Wagner, Heindel & Noyes	7/85
6.	Hydrogeologic Investigation	Ground Water	Geraghty & Miller	2/86
7.	HRS Assessment	Site	NUS	9/87
8.	Ground water sampling program	Ground water	G&M	3/88
9.	Surface water sampling program	Surface water	Roy F. Weston Inc. (Weston) - contractor to USEPA	2/89
10.	Site Investigation	Site	USEPA	3/89
11.	Ground water and surface water sampling program to update available data	Surface water and ground water	G&M	3/89
12.	Soil gas survey and soil sampling activities - soil samples split with G&M for analysis	Soil	Weston	4/89
13.	Summary Report of 1988 Hydrogeologic Investigation	Ground water, subsurface conditions	G&M	5/89

Table 2 (Continued)

NO.	TITLE/TYPE OF INVESTIGATION	MEDIUM	AUTHOR	DATE
14.	Summary of water and soil sampling activities of 3/89 and 4/89	Surface water and soil	G&M	10/89
15.	Private water supplies sampled	Water supplies	VTDEC	5/91
16.	Limited Field Investigation	Site	O'Brien & Gere	12/91-2/92

PRIVATE WELL RECORDS THE BENNINGTON AREA

Scorce: VTDEC Division of Water Supply Updated List of Well Records (August 6, 1993)

Wells Located in Vicinity of Burgess Brothers

WELL NO.	OWNER	OVER BURDEN THICK-NESS	CASING LENGTH	WELL DEPTH
8	J.Gravel	30	30	30
11	C.Sauer	5	22	140
21	C.Green	7	20	350
22	R.Diamond	30*	350	350
30	McCaughen	18*	120	120
31	J.Guitti	20	25	140
32	A.Howe	6	10	170
33	L.Carpenter	18	30	130
36	L.Gauthier	100	104	155
37	P.Jones	95	98	310
42	H.Browe	100	100	100
45	L.Combs	115	117	170
46	H.Browe	135	135	135
50	Bennington	43	-	47
56	Mattison	33	18	335
65	Farvey Co.	50	60	170
66	C.Forrest	8	20	350
69	G.Bruneau	55	65	80
75	R.Getty	not given	118	118
81	P.Murphy	15	65	185
83	Rose	10	20	60
113	Vermont	5	20	200
116	O&G,Inc.	50*	360	375
117	R.Guetti	160	170	200
133	Morrissey	55	65	300
135	Jard Co.	36	32	36
140	Donovan	85	95	610
144	Stepp	8	20	400
146	Brien	80	80	280
150	J.Williams	22	35	40
156	E.Louzons	50	45	60
162	G.Comer	65	65	70
168	S.Eddington	60	64	225
169	T.Bashora	50	53	300
170	Gannelies Rest.	35	40	61
174	R.Robinson	95	90	95
186	Triangle Co	43	42	43

Table 3 (Continued)

WELL NO.	OWNER	OVER BURDEN THICK-NESS	CASING LENGTH	WELL DEPTH
252	D.Berry	21	42	380
272	W.Frantz	80*	365	370
274	R.Dewey	70	98	105
281	M.Albaycht	2	20	323
294	Paran Acres	90	96	140
295	Paran Acres	33	87	102
296	Paran Acres	20	46	47
297	Paran Acres	0	100	142
298	E.Mattison	not given	101	104
299	E.Mattison	73	101	102
300	Paran Acres	not given	116	120
307	P.Becker	95	97	162
308	R.Pembroke	30	135	182
309	R.Roberts	not given	55	55
314	Paran Acres	0	77	80
323	W.Bolton	not given	68	82
325	E.St.John	80	161	170
332	J.Maccioli	62	60	68
333	J.Maccioli	60*	238	240
335	R.Delisle	not given	155	160
336	A.Heekin	not given	160	165
340	P.Mooney	5	20	180
352	E.Trite	30*	245	320
360	R&M Hewitt	130	131	132
361	E.Cowen	20	32	540
398	P.Leray	40	100	300
406	P.Becker	78	164	180
423	J.Griffs	165	165	502
426	Bennington	30*	161	357
427	Bennington	30*	161	502
430	Bennington	30*	161	502
431	Bennington	30*	165	180
-	Dickinson	3' dia.	shallow concrete	24
	Average:	50'		

NOTES:

- Average depth of overburden in 58 wells is 50 feet.
- A total of 10 of the 58 wells had extended casing lengths below the base of the overburden indicating a highly weathered bedrock as indicated by an (*).
- See Appendix 6 for Water Well Locations related to the Site.

Source: VTDEC Division of Water Supply Updated List of Well Records (August 6, 1993)

Table 4

MONITORING WELL SPECIFICATIONS
PHASE IA/IB SITE CHARACTERIZATION
BURGESS BROTHERS SUPERFUND SITE
WOODFORD AND BENNINGTON, VERMONT

Well Number	Ground Elevation	Top of Inner Casing Elevation	Top of Protective Casing Elevation	Well Depth from Ground Surface	Screened Interval Elevation	Hydraulic Cond. (ft/day)	Ground Water Elevations											
							1/19/92	10/29/92	4/15/93	4/23/93	4/30/93	6/18/93	6/21/93	7/7/93	7/27/93	11/22/93	02/23/94	7/05/94
(Shallow Water Table Wells - Kame Sand Deposit)																		
W-1	1148.01	-	1150.2	21.00	1142.01 - 1127.01	0.19	1144.61	-	-	-	-	-	-	-	1141.74	1136.59	1141.29	1140.89
W-1/S1	1120.89	1122.69	1122.93	12.00	1116.89 - 1108.89	0.09	-	-	1114.97	1116.33	1115.76	1113.97	1114.14	1113.26	1113.04	1113.45	1113.22	1114.37
W-2	1082.25	1083.79	1084.27	18.00	1074.25 - 1064.25	0.08	1083.66	1082.49	1083.79	1084.11	1083.79	1083.75	1083.57	1083.05	1082.97	1082.79	-	1083.74
W-3	1079.28	1081.81	1082.01	17.00	1072.28 - 1062.28	0.04	1082.54	1079.46	1080.11	1080.39	1080.13	1079.76	1079.86	1079.53	1079.52	1079.68	-	1079.45
W-4S	1078.48	1079.18	1079.38	5.50	1077.98 - 1072.98	WD	1077.80	1078.24	1078.58	1078.88	1078.42	1078.22	1078.26	1078.23	1078.15	1078.3	-	1078.26
W-4D	1079.00	1081.01	1081.25	15.50	1068.50 - 1063.50	0.14	1080.77	1079.78	1080.91	1081.00	1079.00	1080.34	1080.37	1080.26	1079.82	1080.07	-	1080.30
W-5	1080.77	1083.01	1083.18	14.00	1078.77 - 1066.77	0.35	1080.58	1080.41	1080.81	1081.03	1080.66	-	1080.63	1080.46	1080.40	1080.66	-	1080.47
W-6S	1078.26	1079.40	1079.51	6.00	1077.26 - 1072.26	0.45	1078.81	-	1079.30	1078.62	1078.42	-	1078.45	1078.20	1078.15	1078.36	-	1078.19
W-6D	1078.66	1080.43	1080.92	18.50	1067.16 - 1062.16	0.05	1079.90	-	1079.73	1079.91	1079.16	-	1079.45	1078.96	1078.80	1078.71	-	1079.01
W-7/S1	1116.58	1117.43	1117.74	15.00	1111.58 - 1101.58	0.09	-	-	1110.32	1111.08	-	1110.12	1110.21	1109.38	1108.39	1108.81	1108.91	1110.50
W-8/S1	1108.30	1110.10	1110.38	25.00	1093.30 - 1083.30	0.01	-	-	-	1089.13	-	1090.92	1090.85	1090.26	1089.49	1088.80	1087.62	1090.86
W-9/S1	1078.84	1078.95	1079.35	10.00	1078.84 - 1068.84	0.29	-	-	1074.55	1075.19	1074.38	1073.43	1074.01	1072.84	1072.74	1073.93	1074.33	1073.00
SBW-10	1129.70	1131.58	1131.91	18.00	1123.70 - 1113.70	0.12	-	-	-	-	1020.49	1120.06	1120.11	1120.04	1119.69	1118.39	-	1121.72
W-11/S1	1083.60	1085.01	1085.19	8.00	1080.60 - 1075.60	0.56	-	-		1081.91	1081.83	1081.79	1081.8	1081.75	1081.70	1081.70	1081.73	1081.77
W-12/S1	1096.40	1098.26	1098.3	8.00	1093.40 - 1088.40	0.10	-	-	1096.06	1096.0	1096.01	1096.05	1096.08	1096.01	1096.05	1095.99	1095.98	1096.09
W-22/S1	1089.00	1090.63	1090.97	9.00	1085.00 - 1080.00	0.02	-	-	1087.93	1088.08	1088.01	1087.83	1087.91	1087.71	1087.65	1087.62	1087.69	1087.87
W-25/S1	1086.60	1089.22	1089.32	10.00	1084.60 - 1078.60	0.07	-	-	1085.36	1086.00	1088.51	1083.23	1083.64	1082.02	1081.01	1082.47	1083.31	1082.81
W-27/S1	1112.80	1114.41	1114.71	19.00	1103.80 - 1093.80	0.17	-	-	-	-	-	-	-	-	-	-	-	1096.73
(Shallow Water Table Wells - Base Of Landfill)																		
SBW-20	1112.20	1114.35	1114.65	18.00	1104.20 - 1094.20	DRY	-	-	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
SBW-21	1111.70	1113.41	1113.67	18.00	1103.70 - 1093.70	0.02	-	-	1096.21	1096.25	1096.28	1096.15	1096.15	1096.12	1096.05	1096.11	1096.27	1096.55
(Shallow Water Table Wells - Base Of Fill Within Former Lagoon Area)																		
SBW-15	1099.30	1100.93	1101.3	7.00	1097.30 - 1092.30	DRY	-	-	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
(Shallow Water Table Wells - Kame Sand Deposit Within Former Lagoon Area)																		
W-TP-12	1111.2	1112.62	1112.95	28.50	1092.70 - 1082.70	0.55	-	-	-	-	-	-	-	-	-	-	-	1090.09
(Ablated Glacial Till Deposit)																		
W-3T	1079.81	1081.58	1081.74	27.00	1052.81 - 1052.81	0.04	-	-	1080.88	1081.14	1080.96	1080.41	1080.50	-	1080.05	1080.13		1080.33
W-4T	1079.00	1080.35	1080.68	28.5	1050.50 - 1050.50	0.08	-	-	-	-	-	-	-	-	-	-	-	1079.77
W-22T	1087.7	1089.91	1090.2	30.00	1057.70 - 1057.70	0.03	-	-	-	-	-	-	-	-	-	-	-	1088.15
W-23T	1096.80	1099.57	1099.74	8.10	1095.70 - 1090.70	0.70	-	-	-	1097.75	1097.73	-	1097.29	1097.23	1094.46	1093.79	-	1096.91
W-24T	1089.11	1091.01	1091.15	15.80	1083.31 - 1073.31	0.06	-	-	-	1088.41	1088.31	-	1088.39	1088.31	1088.15	1088.22	-	1088.20
W-26T	1091.30	1093.65	1093.77	20.00	1081.30 - 1071.30	0.06	-	-	-	-	-	-	-	-	-	-	-	1079.37
W-27T	1113.0	1114.75	1115.00	35.00	1088.00 - 1078.00	0.07	-	-	-	-	-	-	-	-	-	-	-	1099.22

Note: 1. Elevations relative to mean sea level.
2. WD = well damaged
3. Wells W-1,-2,-3,-4S,-4D,-5,-6S and -6D installed by Geraghty & Miller, Inc.(1985)
4. Units = feet
5. T = Wells installed in glacial till
6. Ground water elevations for 1/19/92 taken from Limited Field Investigation, Burgess Brothers Superfund Site, O'Brien & Gere Engineers, Inc, September 1992.
7. Ground water elevations referenced were taken from top of inner casing except for W-1 referenced from outer casing.
8. Actual depth to water measurements are presented in Appendix 2E.
9. Wells W-TP-12, W-01DI, W-04T, W-22T, W-26T, W-27T, W-27/S1 installed by O'Brien & Gere Engineers, Inc. May - June 1994. Remaining wells installed by O'Brien & Gere Engineers September 1992 - June 1993.

Table 4 (Continued)

MONITORING WELL SPECIFICATIONS
PHASE IA/IB SITE CHARACTERIZATION
BURGESS BROTHERS SUPERFUND SITE
WOODFORD AND BENNINGTON, VERMONT

Well Number	Ground Elevation	Top of Inner Casing Elevation	Top of Protective Casing Elevation	Well Depth from Ground Elevation	Screened Interval Elevation (ft)	Hydraulic Conductivity (ft/day)	Ground Water Elevations								
							4/22/93	4/30/93	6/18/93	6/21/93	7/7/93	7/27/93	11/22/93	02/23/94	7/05/94
(Shallow Intermediate Wells – Weathered Bedrock Deposit)															
W-4SI	1083.93	1085.52	1086.06	110.00	983.93 – 973.93	0.32	–	–	1076.41	1077.23	1076.41	1075.20	1072.96	1075.68	1077.07
W-7SI	1116.90	1118.48	1118.49	117.00	1009.90 – 999.90	0.07	–	–	–	1070.20	1069.85	1069.11	1065.83	1067.37	1070.72
W-8SI	1109.91	1111.07	1111.07	130.00	989.91 – 979.91	0.05	1089.13	–	1074.62	1074.48	1073.55	1072.12	1068.01	1071.47	1074.45
W-9SI	1076.81	1078.83	1078.94	108.00	978.81 – 968.81	0.49	–	–	1070.63	1070.53	1068.94	1068.65	1065.96	1068.72	1070.47
W-25SI	1088.88	1090.54	1090.88	128.00	970.88 – 960.88	0.04	1077.09	–	1075.04	1074.99	1073.96	1072.67	1069.04	–	1074.78
(Deep Intermediate Wells – Weathered Bedrock Deposit)															
W-01DI	1148.50	1150.25	1150.51	234.50	939.00 – 914.00	<0.001	–	–	–	–	–	–	–	–	1081.54
W-4DI	1084.09	1085.62	1086.12	155.00	939.09 – 929.09	<0.01	–	–	–	1081.06	1079.96	1078.43	1074.78	1078.97	1080.83
W-7DI	1116.62	1117.87	1118.33	236.00	890.62 – 880.62	<0.001	–	–	896.92	899.77	899.89	903.74	918.59	910.26	907.21
W-25DI	1088.38	1090.24	1090.71	201.00	897.38 – 887.38	0.13	1075.99	–	–	1072.03	1070.92	1069.37	1064.94	1068.78	1071.83
(Competent Bedrock)															
W-1B	1121.00	1123.06	1123.56	340.00	832.00 – 781.00	0.46	1074.47	–	–	1068.41	1066.27	1063.99	1056.81	1064.04	1067.60
W-04B	1083.93	1085.89	1086.19	475.00	658.93 – 608.93	2.45	–	–	–	1069.74	1067.51	1065.18	1057.77	1065.29	1068.94
W-08B	1109.51	1110.57	1110.72	448.00	711.51 – 661.51	2.88	–	–	–	1068.27	1066.10	1063.88	1056.81	–	1067.48
W-9B	1077.10	1078.65	1079.09	466.00	661.10 – 611.10	0.88	–	–	–	1069.33	1069.76	1064.84	1057.36	1064.99	1068.58

Note: 1. Elevations relative to mean sea level.

2. WD = well damaged

3. Wells W-1,-2,-3,-4S,-4D,-5,-6S and -6D installed by Geraghty & Miller, Inc.(1985)

4. Units = feet

5. T = Wells installed in glacial till

6. Ground water elevations for 1/19/92 taken from Limited Field Investigation, Burgess Brothers Superfund Site, O'Brien & Gere Engineers, Inc, September 1992.

7. Ground water elevations referenced were taken from top of inner casing except for W-1 referenced from outer casing.

8. Actual depth to water measurements are presented in Appendix 2S.

9. Wells W-TP-12, W-01DI, W-04T, W-22T, W-26T, W-27T, W-27/S1 installed by O'Brien & Gere Engineers, Inc. May – June 1994. Remaining wells installed by O'Brien & Gere Engineers September 1992 – June 1993.

MARSHY AREA: STREAM ELEVATION DATA
LOW FLOW CONDTIONS
PHASE IA SITE CHARACTERIZATION
BURGESS BROTHERS SUPERFUND SITE
WOODFORD AND BENNINGTON, VERMONT

Date	Stream Piezometer Number	Well Number	Ground Elevation	*Well Depth	Top Of Casing Elevation	Elevation Of Water		
						Surface Water Unnamed Stream	Ground Water Table	Piezometer Stream Bed
10/08/92	P-01		1075.60	3.5	1077.90	1075.39		1075.68
		Stilling Well	1076.70	0.5	1081.38	1076.33		
	P-02		1079.33	3.5	1081.58	1079.09		1079.59
	P-03		1082.06	3.5	1084.68	1082.32		1082.19
		W-02	1082.25	18.00	1084.27		1082.38	
		W-03	1079.28	17.00	1082.01		1079.31	
		W-04S	1078.48	5.50	1079.38		1078.08	
		W-04D	1079.00	15.50	1081.25		1079.49	
		W-05	1080.77	14.00	1083.18		1080.30	
10/15/92	P-01		1075.60	3.5	1077.90	1076.71		1075.64
		Stilling Well	1076.70	0.5	1081.38			
	P-02		1079.33	3.5	1081.58	1079.65		1079.14
	P-03		1082.06	3.5	1084.68	1082.23		1082.34
		W-02	1082.25	18.00	1084.27		1082.43	
		W-03	1079.28	17.00	1082.01		1079.38	
		W-04S	1078.48	5.50	1079.38		-	
		W-04D	1079.00	15.50	1081.25		1079.60	
		W-05	1080.77	14.00	1083.18		1080.35	
10/22/92	P-01		1075.60	3.5	1077.90	1075.92		1075.46
		Stilling Well	1076.70	0.5	1081.38	1076.36		
	P-02		1079.33	3.5	1081.58	1079.72		1079.22
	P-03		1082.06	3.5	1084.68	1082.28		1082.37
		W-02	1082.25	18.00	1084.27		1082.48	
		W-03	1079.28	17.00	1082.01		1079.41	
		W-04S	1078.48	5.50	1079.38		-	
		W-04D	1079.00	15.50	1081.25		1079.70	
		W-05	1080.77	14.00	1083.18		1080.41	
10/29/92	P-01		1075.60	3.5	1077.90	1075.46		1075.93
		Stilling Well	1076.70	0.5	1081.38	1076.38		
	P-02		1079.33	3.5	1081.58	1079.26		1079.74
	P-03		1082.06	3.5	1084.68	1082.41		1082.28
		W-02	1082.25	18.00	1084.27		1082.49	
		W-03	1079.28	17.00	1082.01		1079.46	

Tabl (Continued)

MARSHY AREA: STREAM ELEVATION DATA
LOW FLOW CONDTIONS
PHASE IA SITE CHARACTERIZATION
BURGESS BROTHERS SUPERFUND SITE
WOODFORD AND BENNINGTON, VERMONT

		W-04S	1078.48	5.50	1079.38		1078.24	
		W-04D	1079.00	15.50	1081.25		1079.78	
		W-05	1080.77	14.00	1083.18		1078.00	
11/05/92	P-01		1075.60	3.5	1077.90	1075.65		1076.49
		Stilling Well	1076.70	0.5	1081.38	1076.41		
	P-02		1079.33	3.5	1081.58	1079.34		1079.78
	P-03		1082.06	3.5	1084.68	1082.43		1082.28
		W-02	1082.25	18.00	1084.27		1082.52	
		W-03	1079.28	17.00	1082.01		1079.50	
		W-04S	1078.48	5.50	1079.38		1078.26	
		W-04D	1079.82	15.50	1081.25		1079.82	
		W-05	1080.77	14.00	1083.18		1080.46	
11/12/92	P-01		1075.60	3.5	1077.90	1075.60		1076.13
		Stilling Well	1076.70	0.5	1081.38	1076.42		
	P-02		1079.33	3.5	1081.58	1079.38		1079.79
	P-03		1082.06	3.5	1084.68	1079.81		1079.71
		W-02	1082.25	18.00	1084.27		1082.59	
		W-03	1079.28	17.00	1082.01		1079.55	
		W-04S	1078.48	5.50	1079.38		1078.20	
		W-04D	1079.00	15.50	1081.25		1079.89	
		W-05	1080.77	14.00	1083.18		1080.48	
11/19/92	P-01		1075.60	3.5	1077.90	1075.58		1076.16
		Stilling Well	1076.70	0.5	1081.38	1076.54		
	P-02		1079.33	3.5	1081.58	1079.46		1079.85
	P-03		1082.06	3.5	1084.68	1082.48		1082.37
		W-02	1082.25	18.00	1084.27		1082.55	
		W-03	1079.28	17.00	1082.01		1079.53	
		W-04S	1078.48	5.50	1079.30		1078.18	
		W-04D	1079.00	15.50	1081.25		1079.86	
		W-05	1080.77	14.00	1083.18		1080.50	

Notes: 1.Well depths referenced from grade or stream bed., 2. Elevations relative to mean sea level.

Table 5B

MARSHY AREA: STREAM ELEVATION DATA
HIGH FLOW CONDTIONS
PHASE IA SITE CHARACTERIZATION
BURGESS BROTHERS SUPERFUND SITE
WOODFORD AND BENNINGTON, VERMONT

Date	Stream Piezometer Number	Well Number	Ground Elevation	*Well Depth	Top Of Casing Elevation	Elevation Of Water		
						Surface Water Unnamed Stream	Ground Water Table	Piezometer Stream Bed
04/05/93	P-01		1075.60	3.5	1077.90	1075.97		1076.58
		Stilling Well	1076.70	0.5	1081.38	1076.85		
	P-02		1079.33	3.5	1081.58	1079.51		Frozen
	P-03		1082.06	3.5	1084.68	1082.29		1082.12
		W-02	1082.25	18.0	1084.27		No	
		W-03	1079.28	17.0	1082.01			
		W-04S	1078.48	5.5	1079.38		Measurements	
		W-04D	1079.00	15.5	1081.25			
		W-05	1080.77	14.0	1083.18		Taken	
04/16/93	P-01		1075.60	3.5	1077.90	1076.18		1076.71
		Stilling Well	1076.70	0.5	1081.38	1077.04		
	P-02		1079.33	3.5	1081.58	1079.72		1079.98
	P-03		1082.06	3.5	1084.68	1082.33		1082.25
		W-02	1082.25	18.0	1084.27		1083.77	
		W-03	1079.28	17.0	1082.01		1080.11	
		W-04S	1078.48	5.5	1079.38		1078.48	
		W-04D	1079.00	15.5	1081.25		1080.95	
		W-05	1080.77	14.0	1083.18		1080.78	
04/23/93	P-01		1075.60	3.5	1077.90	1076.92		1077.47
		Stilling Well	1076.70	0.5	1081.38	1077.27		
	P-02		1079.33	3.5	1081.58	1079.85		1080.15
	P-03		1082.06	3.5	1084.68	1082.51		1082.43
		W-02	1082.25	18.0	1084.27		1084.11	
		W-03	1079.28	17.0	1082.01		1080.39	
		W-04S	1078.48	5.5	1079.38		1078.65	
		W-04D	1079.00	15.5	1081.25		1081.24	
		W-05	1080.77	14.0	1083.18		1081.00	

Table 5b (Continued)

MARSHY AREA: STREAM ELEVATION DATA
HIGH FLOW CONDTIONS
PHASE IA SITE CHARACTERIZATION
BURGESS BROTHERS SUPERFUND SITE
WOODFORD AND BENNINGTON, VERMONT

Date	Stream Piezometer Number	Well Number	Ground Elevation	*Well Depth	Top Of Casing Elevation	Elevation Of Water		
						Surface Water Unnamed Stream	Ground Water Table	Piezometer Stream Bed
04/30/93	P-01		1075.60	3.5	1077.90	1075.95		1076.58
		Stilling Well	1076.70	0.5	1081.38	1076.84		
	P-02		1079.33	3.5	1081.58	1079.41		1079.80
	P-03		1082.06	3.5	1084.68	1082.19		1082.32
		W-02	1082.25	18.0	1084.27		1083.79	
		W-03	1079.28	17.0	1082.01		1080.13	
		W-04S	1078.48	5.5	1079.38		1078.42	
		W-04D	1079.00	15.5	1081.25		1079.00	
		W-05	1080.77	14.0	1083.18		1080.66	

Notes: 1. Elevations relative to mean sea level
2. Well Depths from grade or stream bed.

Table 6

MARSHY AREA STREAM AND GROUND WATER ELEVATION DATA

Phase IB Site Characterization

Burgess Brothers Superfund Site

Woodford and Bennington, Vermont

Stream Piezometer	Date	Ground Elevation	Top of Casing Elevation	Ground Water Elevation	Surface Water Elevation	Stream Stage
P-01	10/08/92	1075.60	1077.90	1075.68	1075.39	+
P-02	10/08/92	1079.33	1081.58	1079.59	1079.09	+
P-03	10/08/92	1082.06	1084.68	1082.19	1082.32	-
P-01	10/15/92	1075.60	1077.90	1075.64	1076.71	-
P-02	10/15/92	1079.33	1081.58	1079.14	1079.65	-
P-03	10/15/92	1082.06	1084.68	1082.34	1082.23	+
P-01	10/22/92	1075.60	1077.90	1075.46	1075.92	-
P-02	10/22/92	1079.33	1081.58	1079.22	1079.72	-
P-03	10/22/92	1082.06	1084.68	1082.37	1082.28	+
P-01	10/29/92	1075.60	1077.90	1075.93	1075.46	+
P-02	10/29/92	1079.33	1081.58	1079.74	1079.26	+
P-03	10/29/92	1082.06	1084.68	1082.28	1082.41	-
P-01	11/05/92	1075.60	1077.90	1076.49	1075.65	+
P-02	11/05/92	1079.33	1081.58	1079.78	1079.34	+
P-03	11/05/92	1082.06	1084.68	1082.28	1082.43	-
P-01	11/12/92	1075.60	1077.90	1076.13	1075.60	+
P-02	11/12/92	1079.33	1081.58	1079.79	1079.38	+
P-03	11/12/92	1082.06	1084.68	1079.71	1079.81	-
P-01	11/19/92	1075.60	1077.90	1076.16	1075.58	+
P-02	11/19/92	1079.33	1081.58	1079.85	1079.46	+
P-03	11/19/92	1082.06	1084.68	1082.37	1082.48	-
P-01	04/05/93	1075.60	1077.90	1076.58	1075.97	+
P-02	04/05/93	1079.33	1081.58	frozen	1079.51	+/-
P-03	04/05/93	1082.06	1084.68	1082.12	1082.29	-
P-01	04/16/93	1075.60	1077.90	1076.71	1076.18	+
P-02	04/16/93	1079.33	1081.58	1079.98	1079.72	+
P-03	04/16/93	1082.06	1084.66	1082.25	1082.33	-
P-01	04/23/93	1075.60	1077.90	1077.47	1076.92	+
P-02	04/23/93	1079.33	1081.58	1080.15	1079.85	+
P-03	04/23/93	1082.06	1084.68	1082.43	1082.51	-
P-01	04/30/93	1075.60	1077.90	1076.58	1075.95	+
P-02	04/30/93	1079.33	1081.56	1079.80	1079.41	+
P-03	04/30/93	1082.06	1084.68	1082.32	1082.19	+
P-01	05/03/94	1075.6	1077.9	1076.53	1075.98	+
P-02	05/03/94	1079.33	1081.58	1079.80	1079.23	+
P-03	05/03/94	1082.06	1084.68	1082.31	1082.21	+
P-01	05/11/94	1075.60	1077.90	1076.42	1075.87	+
P-02	05/11/94	1079.33	1081.58	1079.74	1079.23	+
P-03	05/11/94	1082.06	1084.68	1082.30	1082.18	+
P-01	05/19/94	1075.60	1077.90	1076.08	1076.52	-
P-02	05/19/94	1079.33	1081.56	1079.29	1079.77	-
P-03	05/19/94	1082.06	1084.68	1082.22	1082.42	-
P-01	05/26/94	1075.60	1077.90	1075.91	1076.44	-
P-02	05/26/94	1079.33	1081.58	1079.27	1079.82	-
P-03	05/26/94	1082.06	1084.68	1082.21	1082.30	-

NOTES: Elevations relative to mean sea level.

+ Indicates gaining stream.

- Indicates losing stream.

Units = feet.

Table 7

Comparison of Water Levels in Well Nests W01,04,08,09

BURGESS BROTHERS SUPERFUND SITE

WOODFORD AND BENNINGTON, VERMONT

Monitoring Date

Well No.	06/21/93	07/07/93	07/27/93
W-01 S1	1114.14	1113.26	1113.04
W-01 B	1068.41	1066.27	1063.99
W-04 S	1078.28	1078.23	1078.15
W-04 SI	1077.23	1076.41	1075.20
W-04 DI	1081.06	1079.96	1078.43
W-04 B	1069.74	1067.51	1065.18
W-08 S1	1090.85	1090.26	1089.49
W-08 SI	1074.48	1073.53	1072.12
W-08 B	1068.27	1066.10	1063.86
W-09 S1	1074.01	1072.84	1072.74
W-09 SI	1070.53	1069.94	1068.65
W-09 B	1069.33	1069.76	1064.84

↑ = vertical flow potential direction

Table 8

Identified Covertypes and Estimated Acreages in Study Area

Covertype	Acreage (Acres)
Borrow Pits	1.7
Landfill	.25
Open Field/Lawn	13
Mixed Hardwood Forest	100
Wetlands #1 #2 #3	1 0.05 0.5 0.4

Table 9

Dominant Vegetation of the Mixed Deciduous Forest Covertype

Species	Scientific Name
White Pine	*Pinus strobis*
American beech	*Fagus grandifolia*
Red Maple	*Acer rubrum*
White Birch	*Betula papyrifera*
Ash	*Fraxinus* spp.
Red Oak	*Quercus rubra*
Scotch Pine	*Pinus sylvestris*
Striped Maple	*Acer pensylvanicum*
Yellow birch	*Betula alleghaniensis*
Cinnamon Fern	*Osmunda cinnamomea*
Christmas Fern	*Polystichum acrostichoides*
New York Fern	*Thelypteris noveboracensis*
Club Moss	Lycopodium
Partridgeberry	*Mitchella repens*
Starflower	*Trientalis borealis*
Mayflower	*Maianthemum canadense*

Table 10

OBSERVED WETLAND VEGETATION

COMMON NAME	SCIENTIFIC NAME	WETLAND INDICATOR STATUS	WETLAND 1	WETLAND 2	WETLAND 3
Ash	*Fraxinus spp.*	FAC-OBL		x	x
Basswood	*Tilia americana*	FACU		x	
Willow	*Salix spp.*	FAC-OBL		x	
Beech	*Fagus grandifolia*	FACU		x	x
Elm	*Ulmus americana*	FACW		x	
Red Maple	*Acer rubrum*	FAC		x	x
Red Oak	*Quercus rubra*	FACU		x	
Witch Hazel	*Hamamelis virginiana*	FAC-		x	x
Yellow Birch	*Betula alleghaniensis*	FAC	x	x	x
American Black Currant	*Ribes americanum*	FACW	x		
Cinnamon Fern	*Osmunda cinnamonea*	FACW		x	x
Goldenrod	*Solidaga spp.*	FACU-OBL			x
Grasses	*Gramineae spp.*	FACU-OBL		x	
Interrupted Fern	*Osmunda daytoniana*	FAC			x
Jack-in-the-pulpit	*Arisaema triphyllum*	FACW	x		
New York Fern	*Thelypteris noveboracensis*	FAC	x		
Rough-leaf Goldenrod	*Solidago patula*	OBL		x	
Royal Fern	*Osmunda regalis*	OBL	x		x
Sedges	*Carex spp.*	FACU-OBL		x	
Sensitive Fern	*Onoclea sensibilis*	FACW	x	x	x

Wetland indicator status categories:

OBL - obligate wetland. Occur almost always (estimated probability >99%) under natural conditions in wetlands.
FACW - facultative wetland. Usually occur in wetlands (estimated probability 67-99%), but occasionally found in non wetlands.
FAC - facultative. Equally likely to occur in wetlands or non wetlands (estimated probability 34-66%).
FACU - facultative upland. Usually occur in non wetlands (estimated probability 67-99%), but occasionally found in wetlands.
(Categories are based on the Fish and Wildlife Service *National List of Plant Species That Occur in Wetlands*)

Table 11

RELATIVE RANKINGS FOR EACH EVALUATED CRITERIA

	Social Significance	Effectiveness	Opportunity
Ground Water Recharge	M	L	*
Ground Water Discharge	H	L	*
Floodflow Alteration	H	H	H
Sediment Stabilization	L	L	*
Sediment/Toxicant Retention	H	L	H
Nutrient Removal/Transformation	M	L	H
Production Export	*	M	*
Wildlife Diversity/Abundance	L	*	*
Wildlife D/A Breeding	*	L	*
Wildlife D/A Migration	*	L	*
Wildlife D/A Wintering	*	L	*
Aquatic Diversity/Abundance	L	L	*
Uniqueness/Heritage	L	*	*
Recreation	L	*	*

NOTE: "H" = High, "M" = Moderate, "L" = Low, "U" = Uncertain, and "*"s identify conditions where functions and values are not evaluated.

Table 12

SURFACE WATER CHARACTERISTICS
SEPTEMBER 1992

Location	Temperature °C	pH	Conductivity umhos	Dissolved Oxygen mg/l
Drainage Swale No. 4	DRY			
Drainage Swale No. 2 and 3	13.6	7.7	071	10.5
Confluence of Swales 2,3, and 4	12.1	7.4	189	10.8
Swale near well W-4	17.0	7.6	207	9.7
Unnamed Stream at access road	16.3	7.7	173	9.9
Barney Brook downstream of Unnamed Stream	16.2	6.4	175	9.9
Barney Brook upstream of Unnamed Stream	15.7	7.3	199	10.0
Unnamed Stream upstream of Barney Brook	16.6	7.3	171	9.9
Drainage swale No.4 , upstream	DRY			
Drainage swale No.4 , near coord. E4	12.0	7.2	277	10.8
Drainage swale No.4, near SP-13	12.6	7.6	173	10.7
Drainage swale No.4, upstream of swales 2 and 3	12.0	7.1	279	10.8
Unnamed structure near well W-04S	12.2	8.6	263	10.8
Swale 1 upstream	DRY			
Swale upstream of swale 1	17.4	7.8	305	9.6
Unnamed Stream between 04 and 013/014	16.7	7.8	189	9.9

Table 13

OBSERVED WILDLIFE

Common Name	Scientific Name
Amphibians	
Bullfrog	*Rana catesbeiana*
Red spotted newt	*Notophthalmus viridescens*
Wood frog	*Rana sylvatica*
Aves	
American Crow	*Corvus brachyrhynchos*
American robin	*Turdus migratorius*
Bank swallow	*Riparia riparia*
Black-capped chickadee	*Parus atricapillus*
Blue jay	*Cyanocitta cristata*
Buteos	*Buteo* spp
Eastern Bluebird	*Sialia sialis*
Eastern Phoebe	*Sayornis phoebe*
Killdeer	*Charadrius vociferus*
Ovenbird	*Seivrus aurocapillus*
Red eyed vireo	*Vireo olivaceus*
Red-winged blackbird	*Agelaius pheoeniceus*
Ring-necked pheasaant *	*Phasianus colchicus*
Ruffed grouse	*Bonasa umbellus*
Sparrows	*Spizella* spp.
Warblers	Parulidae
Waterfowl *	
Wild turkey *	*Meleagris gallopavo*
Mammals	
Bats *	
Eastern Chipmunk	*Tamias striatus*
Eastern gray squirrel	*Sciurus carolinensis*
Racoon	*Procyon lotor*
White-tailed deer	*Odocoileus virginianus*
Woodchuck	*Marmota monax*

* Information provided by Jim Sauer (Burgess Bros.)
Based on site visit, June 1992

Table 14

TYPICAL INHABITANTS OF A MIXED DECIDUOUS FOREST IN SOUTHERN VERMONT

COMMON NAME	SCIENTIFIC NAME
AMPHIBIANS	
American Toad	*Bufo americanus*
Blue-spotted Salamander	*Ambystoma laterale*
Bullfrog	*Rana catesbeiana*
Dusky Salamander	*Desmognathus fuscus*
Four-toed Salamander	*Hemidactylium scutatum*
Gray Treefrog	*Hyla versicolor*
Green Frog	*Rana clamitans*
Jefferson Salamander	*Ambystoma jeffersonianum*
Pickerel Frog	*Rana palustris*
Redbacked Salamander	*Plethodon cinereus*
Spotted Salamander	*Ambystoma maculatum*
Spring Peeper	*Hyla crucifer*
Spring Salamander	*Gyrinophilus porphyriticus*
Two-lined Salamander	*Eurycea bislineata*
Wood Frog	*Rana sylvatica*
REPTILES	
Brown Snake	*Storeria dekayi*
Common Garter Snake	*Thamnophis sirtalis*
Eastern Ribbon Snake	*Thamnophis sauritus*
Eastern Milk Snake	*Lampropeltis triangulum triangulum*
Green Snake	*Opheodrys sp.*
Milk Snake	*Lampropeltis triangulum*
Northern Ringneck Snake	*Diadophis punctatus edwardsi*
Midland Painted Turtle	*Chrysemys picta*
Racer	*Coluber constrictor*
Red-bellied Snake	*Storeria occipitomaculata*
Timber Rattlesnake	*Crotalus horridus*
Wood Turtle	*Clemmys insculpta*

COMMON NAME	SCIENTIFIC NAME
BIRDS	
American Crow	*Corvus brachyrhynchos*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratori*
American Woodcock	*Scolopax minor*
Barred Owl	*Strix varia*
Black-and-white Warbler	*Mniotilta varia*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Black-capped Chickadee	*Parus atricapillus*
Black-throated Blue Warbler	*Dendroica caerusescens*
Blue Jay	*Cyanocitta cristata*
Broad-winged Hawk	*Buteo platypterus*
Brown Thrasher	*Toxostoma rufum*
Brown Creeper	*Certhis familiaris*
Northern Cardinal	*Cardinalis cardinalis*
Canada Warbler	Wilsonia canadensis
Cedar Waxwing	*Bombycilla cedrorum*
Cooper's hawk	*Accipiter cooperii*
Downy Woodpecker	*Picoides pubescens*
Eastern Screech Owl	*Otus asio*
Eastern Wood-Peewee	*Contopus virens*
Great Crested Flycatcher	Myiarchus crinitus
Great Horned Owl	*Bubo virginianus*
Hairy Woodpecker	*Picoides villosus*
Least Flycatcher	*Empidonax minimus*
Long-eared Owl	*Asio otus*
Mourning Dove	*Zenaida macroura*
Northern Saw-whet Owl	*Aegolius acadicus*
Northern Harrier	*Circus cyaneus*
Northern Goshawk	*Accipiter gentilis*
Northern Flicker	*Colaptes auratus*

Table 14 (Continued)

TYPICAL INHABITANTS OF A MIXED DECIDUOUS FOREST IN SOUTHERN VERMONT (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
BIRDS (cont.)	
Ovenbird	*Seirus aurocapillus*
Pileated Woodpecker	*Dryocopus pileatus*
Pine Warbler	*Dendroica pinus*
Red-breasted Nuthatch	*Sitta canadensis*
Red-eyed Vireo	*Vireo olivaceus*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Ruby-throated Hummingbird	*Archilochus colubris*
Ruffed Grouse	*Bonasa umbellus*
Scarlet Tanager	*Piranga olivacea*
Sharp-shinned Hawk	*Accipiter striatus*
Whip-poor-will	*Caprimulgus vociferus*
White-breasted Nuthatch	*Sitta carolensis*
Wood Thrush	*Hylocicha mustelina*
Wood Duck	*Aix sponsa*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
MAMMALS	
Beaver	*Castor canadensis*
Bobcat	*Felis rufus*
MAMMALS (cont.)	
Deer Mouse	*Peromyscus maniculatus*
Eastern Chipmunk	*Tamais striatus*
Eastern Cottontail	*Sylvilagus floridanus*
Gray Fox	*Urocyon cinereoargenteus*
Gray Squirrel	*Sciurus carolinensis*
Hoary Bat	*Lasiurus cinereus*
Long-tailed Weasel	*Mustela frenata*
New England Cottontail	*Sylvilagus transitionalis*
Raccoon	*Procyon lotor*
Red Fox	*Vulpes vulpes*
Short-tailed Shrew	*Blarina brevicauda*
Northern Flying Squirrel	*Glaucomys Sabrinus*
Southern Flying Squirrel	*Glaucomys volans*
Striped Skunk	*Mephitis mephitis*
Virginia Opossum	*Didelphis virginiana*
White-footed Mouse	*Peromyscus leucopus*
White-tailed Deer	*Odocoileus virginianus*
Woodland Vole	*Microtus pinetorum*

Sources:

Burt and Grossenheider, 1976
Collins, 1981
DeGraaf, 1983
Whitaker, 1992

Table 15

TYPICAL INHABITANTS OF PALUSTRINE WETLANDS IN SOUTHERN VERMONT

COMMON NAME	SCIENTIFIC NAME
AMPHIBIANS	
Eastern American Toad	*Bufo americanus*
Gray Treefrog	*Hyla versicolor*
Green Frog	*Rana clamitans*
Jefferson Salamander	*Ambystoma jeffersonianum*
Dusky Salamander	*Desmognathus fuscus*
Spring Salamander	*Gyrinophilus porphyriticus*
Pickerel Frog	*Rana palustris*
Red Spotted Newt	*Notophthalmus viridescens*
Spotted Salamander	*Ambystoma maculatum*
Spring Peeper	*Hyla crucifer*
Two-lined Salamander	*Eurycea bislineata*
Wood Frog	*Rana sylvatica*
REPTILES	
Brown Snake	*Storeria dekayi*
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*
Eastern Milk Snake	*Lampropeltis triangulum*
Smooth Green Snake	*Opheodrys vernalis*
Midland Painted Turtle	*Chrysemys picta marginata*
Red-belly Snake	*Storeria occipitomaculata*
BIRDS	
Alder Flycatcher	*Empidonax alnorum*
American Goldfinch	*Carduelis tristis*
American Woodcock	*Scolopax minor*
Barred Owl	*Strix varia*
Black-crowned Night Heron	*Nycticorax nycticorax*
Common Grackle	*Quiscalus quiscula*
Common Snipe	*Gallinago gallinago*
Common Yellowthroat	*Geothlypis trichas*

COMMON NAME	SCIENTIFIC NAME
BIRDS (cont.)	
Hermit Thrush	*Catharus guttatus*
Northern Harrier	*Circus cyaneus*
Northern Waterthrush	*Seiurus noveboracensis*
Nashville Warbler	*Vermivora ruficapilla*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
Sedge Wren	*Cistothorus platensis*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Veery	*Catharus fuscescens*
Willow Flycatcher	*Empidonax traillii*
Wood Thrush	*Hylocichla mustelina*
MAMMALS	
Least Shrew	*Cryptotis parva*
Beaver	*Castor canadensis*
Black Bear	*Ursus americanus*
Bobcat	*Felis rufus*
Fisher	*Martes pennanti*
Gray Fox	*Urocyon cinereoargenteus*
Masked Shrew	*Sorex cinereus*
Meadow Jumping Mouse	*Zapus hudsonius*
Meadow Vole	*Microtus pennsylvanicus*
Mink	*Mustela vison*
Muskrat	*Ondatra zibethicus*
New England Cottontail	*Sylvilagus transitionalis*
Raccoon	*Procyon lotor*
Short-tail Shrew	*Blarina brevicauda*
Smoky Shrew	*Sorex fumeus*
Southern Red-backed Vole	*Clethrionomys gapperi*
Star-nosed Mole	*Condylura cristata*

Table 15 (Continued)

TYPICAL INHABITANTS OF PALUSTRINE WETLANDS IN SOUTHERN VERMONT (CONTINUED)

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
MAMMALS (cont.)			
Virginia Oppossum	*Didelphis virginiana*	White-tailed Deer	*Odocoileus virginianus*
Water Shrew	*Sorex palustris*		

Sources:

Burt and Grossenheider, 1976
Collins, 1981
DeGraaf, 1983
Whitaker, 1992

Table 16

OBSERVED MACROINVERTEBRATES

Location	Ephemeroptera	Plecoptera	Trichoptera	Odonata	Diptera	Oligochaeta
Main channel, upstream of landfill	0	0	14	0	11	2
Main channel, wetland 3	0	5	3	0	0	0
Main channel, wetland 2	0	1	0	2	0	0
Main channel, downstream of wetlands	0	0	2	0	0	0

Based on site visit, June 1992

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE SOILS

Location:	Constituents:	Concentrations:
Background Area	(SP-17, 18, 19)	
Volatiles:		
SP-19	Acetone	15 µg/kg
Inorganics:		
(See Table 4 of Appendix 15)		
Landfill Area	(SP-02, 03, 04, 05, 14, 22, 22 BLDUP) (SBW-13, 18, 21)	
Volatiles:		
SP-03	PCE	13 µg/kg
SP-22	TCE	13 µg/kg
	PCE	22 µg/kg
	Acetone	9 µg/kg
SP-22 BLDUP	TCE	15 µg/kg
	PCE	26 µg/kg
PCBs/Pesticides:		
SP-03	4,4'-DDE	62 µg/kg
Inorganics:		
(See Table 4 of Appendix 15)		
Soil Staging Area	(SP-01, SBW-10)	
SP-01	Acetone	8 µg/kg
	Xylene(total)	14 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE SOILS

Location:	Constituents:	Concentrations:
Marshy Area -	(SP-06, 07, 08, 09, 10, 11, 12, 13, 15, 16, 23, 24, 25, 26, 27, 28, 29, 30) (W-04B, W-12S1)	
Volatiles:		
SP-07	Vinyl Chloride	4,900 µg/kg
	Acetone	1,100 µg/kg
	Carbon disulfide	37 µg/kg
	1,1-DCE	48 µg/kg
	1,1-DCA	20 µg/kg
	1,2-DCE(total)	66,000 µg/kg
	2-Butanone	390 µg/kg
	1,1,1-TCA	21 µg/kg
	TCE	100 µg/kg
	Benzene	20 µg/kg
	4-Methyl-2-Pentanone	68 µg/kg
	PCE	380 µg/kg
	Toluene	15,000 µg/kg
	Ethyl Benzene	230 µg/kg
	Xylene	840 µg/kg
SP-08	Acetone	76 µg/kg
	TCE	380 µg/kg
	PCE	520 µg/kg
SP-09	Acetone	120 µg/kg
	Carbon disulfide	24 µg/kg
	2-Butanone	36 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE SOILS

Location:	Constituents:	Concentrations:
SP-10	Vinyl Chloride	17 µg/kg
	Acetone	280 µg/kg
	Carbon disulfide	11 µg/kg
	2-Butanone	92 µg/kg
	Toluene	1,700 µg/kg
	Ethyl Benzene	32 µg/kg
	Xylene(total)	110 µg/kg
	1-2, DCE (Total)	11 ug/kg
SP-11	Vinyl Chloride	8 µg/kg
	1,2-DCE(total)	1,700 µg/kg
	TCE	1,500 µg/kg
	PCE	5,300 µg/kg
	Toluene	13 µg/kg
SP-12	Acetone	44 µg/kg
	Toluene	9 µg/kg
SP-13	Acetone	220 µg/kg
	2-Butanone	67 µg/kg
	Toluene	98 µg/kg
SP-16	Acetone	12 µg/kg
	Toluene	11 µg/kg
SP-23	TCE	21 µg/kg
	PCE	99 µg/kg
SP-24	1,2 DCE (total)	20 µg/kg
	TCE	19 µg/kg
	PCE	22 µg/kg
SP-29	TCE	16 µg/kg

February 14, 1995

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE SOILS

Location:	Constituents:	Concentrations:
W-04S2	Acetone	170 µg/kg
	2-Butanone	44 µg/kg
Semi-Volatiles:		
SP-07	Acenaphthylene	910 µg/kg
	Phenanthrene	14,000 µg/kg
	Anthracene	1,500 µg/kg
	Fluoranthene	12,000 µg/kg
	Pyrene	12,000 µg/kg
	Benzo(a)anthracene	4,900 µg/kg
	Chrysene	6,100 µg/kg
	Benzo(b)fluoranthene	6,700 µg/kg
	Benzo(k)fluoranthene	4,900 µg/kg
	Benzo(a)pyrene	4,600 µg/kg
	Indeno(1,2,3-cd)pyrene	3,300 µg/kg
Hillside Area	(SP-20, 21)	
SP-21	Acetone	18 µg/kg
	1,2-DCE(total)	16 µg/kg
West of Landfill Area	(W-07 S2, 08 S2, 25 S2)	
W-07 S2	Acetone	8 µg/kg
W-08 S2	Acetone	11 µg/kg
Inorganics:	(See Table 4 of Appendix 15)	

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
Landfill Area	(SBW-10, SBW-14 through 21, TP-8 through 14, TP-19, W-22T)	
Volatiles:		
SBW-14 6-8'	TCE	60 µg/kg
	PCE	470 µg/kg
SBW-14 8-10'	TCE	16 µg/kg
	PCE	150 µg/kg
SBW-14 12-14'	TCE	12 µg/kg
	PCE	10 µg/kg
SBW-15 2-4'	TCE	2,400,000 µg/kg
	PCE	8,100,000 µg/kg
SBW-15 4-6'	TCE	6,900,000 µg/kg
	PCE	5,700,000 µg/kg
SBW-15 8-10'	PCE	540,000 µg/kg
SBW-16 4-6'	1,2-DCE(total)	9 µg/kg
SBW-16 8-10'	Acetone	48 µg/kg
SBW-17 12-14'	4-Methyl-2-Pentanone	19 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
SBW-18A 4-6'	TCE PCE	22 µg/kg 34 µg/kg
SBW-18A 8-10'	TCE PCE	3,200 µg/kg 13,000 µg/kg
SBR-18A 12'-14'	Acetone TCE	71 µg/kg 8 µg/kg
SBW-18A 12-14' (BLDUP)	Acetone TCE	150 µg/kg 13 µg/kg
SBW-19 4-6'	Toluene	140 µg/kg
SBW-19 6-8'	2-butanone Toluene	120 µg/kg 140 µg/kg
SBW-19 10-12'	2-butanone	18 µg/kg
SBW-20 20-22'	Acetone Toluene	74 µg/kg 10 µg/kg
SBW-21 12-14'	Acetone	20 µg/kg
SBW-21 20-22'	Acetone 1,2-DCE(total) TCE	97 µg/kg 17 µg/kg 14 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
Semi-Volatiles:		
SBW-15 2-4'	1,2-Dichlorobenzene	2,600 µg/kg
	1,3-Dichlorobenzene	1,400 µg/kg
	1,4-Dichlorobenzene	5,600 µg/kg
	Naphthalene	16,000 µg/kg
	2-Methylnaphthalene	6,900 µg/kg
	Phenanthrene	1,800 µg/kg
	Fluoranthene	1,400 µg/kg
	Bis(2-ethylhexyl)phthalate	19,000 µg/kg
	1,2,4-Trichlorobenzene	820 µg/kg
SBW-15 4-6'	1,3-Dichlrobenzene	1,100 µg/kg
	1,4-Dichlorobenzene	1,700 µg/kg
	1,2-Dichlorobenzene	1,300 µg/kg
	Naphthalene	4,300 µg/kg
	2-Methylnaphthalene	3,300 µg/kg
	Bis(2-EH)phthalate	3,400 µg/kg
SBW-15 8-10'	1,3-Dichlorobenzene	620 µg/kg
	1,4-Dichlorobenzene	1,100 µg/kg
	1,2-Dichlorobenzene	730 µg/kg
	Napthalene	1,300 µg/kg
	2-Methylnapthalene	900 µg/kg
	Di-n-butylphthalate	1,400 µg/kg
	Bis(2-EH)phthalate	2,100 µg/kg
SBW-16 4-6'	4-Methylphenol	1,100 µg/kg
SBW-17 6-8'	4-Methylphenol	2,900 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
SBW-17 12-14'	4-Methylphenol	1,000 µg/kg
SBW-18A 8-10'	1,3-Dichlorobenzene	1,200 µg/kg
	1,2,4-Trichbrotenzene	1,100 µg/kg
	2-Methylnaphthalene	710 µg/kg
	Bis(2-EH)phthalate	1,500 µg/kg
SBW-19 4-6'	4-Methylphenol	2,600 µg/kg
	Phenanthrene	570 µg/kg
SBW-19 6-8'	4-Methylphenol	1,200 µg/kg
SBW-20 12-14'	Bis(2-EH)phthalate	970 µg/kg
SBW-21 12-14'	Pyrene	460 µg/kg

Landfill Area - Test Pits

Volatiles:

TP-8-05 10-12'	TCE	14 µg/kg
	PCE	15 µg/kg
TP-9-05 6-8'	TCE	31 µg/kg
	PCE	200 µg/kg
TP-9-05 10'12'	TCE	8 µg/kg
	PCE	44 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
TP-10-05 2-4'	Cis-1,3-dichloropropene	44 µg/kg
	PCE	690 µg/kg
TP-10-05 2-4' BLDUP-05	PCE	2,000 µg/kg
TP-10-05 8-10'	PCE	13 µg/kg
TP-11-05 10-12'	1,2 DCE (total)	10,000 µg/kg
	TCE	36,000 µg/kg
	PCE	72,000 µg/kg
TP-11-05 17-19'	TCE	10 µg/kg
	PCE	40 µg/kg
TP-12-05 10-12'	PCE	11 µg/kg
TP-12-05 14-16'	PCE	11 µg/kg
TP-12-05 20.6-22.6	TCE	54,000 µg/kg
	PCE	1,000,000 µg/kg
BDSB-1 TP-12-05 20.6-22.6'	PCE	1,200,000 µg/kg
TP-12-05 22.6-24.6'	Vinyl chloride	120 µg/kg
	Acetone	20 g/kg
	1,2 DCE (total)	110 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
TP-12-05	Vinyl chloride	68 µg/kg
24.6-26.6'	Acetone	16 µg/kg
	1,2 DCE (total)	75 µg/kg
	TCE	45 µg/kg
	PCE	15 µg/kg
TP-12-05	1,2 DEC (total)	100 µg/kg
26.6-28.6'	TCE	420 µg/kg
TP-13-05	1,2, DCE (total)	9 µg/kg
0-2'	TCE	30 µg/kg
	PCE	10 µg/kg
TP-13-05	TCE	25 µg/kg
2-4'	PCE	11 µg/kg
TP-19-05	TCE	2,100 µg/kg
14-16'		
TP-19-05	TCE	9,100 µg/kg
20-22'		
W-4T	TCE	22 µg/kg
19-21'	PCE	9 µg/kg
W-4T	TCE	150 µg/kg
BLDUP		
19-21'	PCE	52 µg/kg
W-22T	Acetone	12 µg/kg
17-19'	1,2 DEC (total)	16 µg/kg
	TCE	170 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
Semivolatiles (Test Pits):		
TP-19-05 14-16'	Bis (2-ethylhexyl) phthalate	550 µg/kg
	Benzoic acid	630 µg/kg
	4-Chloroaniline	540 µg/kg
	2-Methylnaphthalene	420 µg/kg
TP-19-05 20-22'	Di-n-butylphthalate	550 µg/kg
	Bis (2-ethylhexyl) phthalate	3,400 µg/kg
	Napthalene	3,800 µg/kg
	2-Methylnophthalene	5,400 µg/kg
PCBs/Pesticides:		
SBW-15 4-6'	PCB-1260	25,000 µg/kg
SBW-15 8-10'	PCB-1260	370 µg/kg
SBW-16 2-4'	PCB-1254	270 µg/kg
SBW-17 6-8'	PCB-1254	170 µg/kg
SBW-18A 4-6'	PCB-1260	880 µg/kg
SBW-18A 8-10'	PCB 1254	590 µg/kg
SBW-18A 12-14'	PCB 1260	110 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
SBW-18A (BLDUP)	PCB 1260	100 µg/kg
SBW-19 4-6'	PCB-1254	660 µg/kg
	PCB-1016/1242	1,200 µg/kg
SBW-20 6-8'	PCB-1254	180 µg/kg
Background Wells	(W-01 S1, W-01B [SBW-13])	
W-01B 32-34'	Acetone	64 µg/kg
	TCE	7 µg/kg
Hillside Area	(W-23T, W-24T)	
W-24T 10-12'	Acetone	72 µg/kg
Marshy Area	(W-03 S2, W-04, W-11 S1, W-22 S1)	
W-03 S2 2-4'	Acetone	65 µg/kg
	1,2-DCE(total)	38 µg/kg
W-03 S2 6-8'	Acetone	96 µg/kg
	1,2-DCE(total)	87 µg/kg
	TCE	100 µg/kg
	PCE	270 µg/kg
W-03 S2 8-10'	Acetone	94 µg/kg
	1,2-DCE(total)	63 µg/kg
	TCE	100 µg/kg
	PCE	260 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
W-03 S2	Acetone	72 µg/kg
10-12'	1,2-DCE(total)	70 µg/kg
	TCE	110 µg/kg
	PCE	340 µg/kg
W-03 S2	Acetone	55 µg/kg
12-14'	TCE	12 µg/kg
W-04B (AB)	Methylene Chloride	9 µg/kg
0-3'	Acetone	54 µg/kg
	1,2-DCE(total)	13 µg/kg
W-04B (AB)	Acetone	24 µg/kg
3-5'	Carbon Disulfide	6 µg/kg
	TCE	39 µg/kg
	PCE	16 µg/kg
W-04B (AB)	TCE	100 µg/kg
5-7'	PCE	32 µg/kg
W-04B (AB)	Methylene Chloride	6 µg/kg
7-9'	Acetone	39 µg/kg
	TCE	33 µg/kg
	PCE	11 µg/kg
W-04B (AB)	Acetone	48 µg/kg
9-11'	TCE	72 µg/kg
	PCE	23 µg/kg
W-04B (AB)	Acetone	43 µg/kg
(BLDUP)	TCE	39 µg/kg
	PCE	12 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
W-04B (AB) 11-13'	Acetone	25 µg/kg
W-04B (AB) 15-17'	Acetone	37 µg/kg
W-11 S1 0-2'	Acetone	320 µg/kg
	2-Butanone	63 µg/kg
W-11 S1 2-4'	Vinyl Chloride	110 µg/kg
	Acetone	71 µg/kg
	1,2-DCE(total)	110 µg/kg
	4-Methyl-2-Pentanone	29 µg/kg
	Toluene	12 µg/kg
W-11 S1 4-6'	Vinyl Chloride	47 µg/kg
	Acetone	67 µg/kg
	1,2-DCE (Total)	210 µg/kg
	TCE	23 µg/kg
	4-Methyl-2-Pentanone	29 µg/kg
W-11 S1 6-8'	Vinyl Chloride	110 µg/kg
	Acetone	92 µg/kg
	1,2-DCE(total)	17 µg/kg
W-11 S1 8-10'	Vinyl Chloride	62 µg/kg
	Acetone	46 µg/kg
	1,2-DCE(total)	620 µg/kg
	TCE	320 µg/kg
W-22 S1 4-6'	Acetone	40 µg/kg
	TCE	53 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SOIL BORINGS AND TEST PITS

Location:	Constituents:	Concentrations:
W-22 S1 6-8'	Acetone	40 µg/kg
	TCE	74 µg/kg
W-22 S1 (BLDUP) 6-8'	DCE	92 µg/kg
	TCE	100 µg/kg
W-22 S1 8-10'	Acetone	82 µg/kg
W-22 S1 10-12'	Acetone	81 µg/kg
	TCE	6 µg/kg
Inorganics:	(See Table 8 of Appendix 15)	

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE WATER

Location:	Constituents:	Concentrations:
Upstream Samples	(SW-01A,01B,08,013)	
Volatiles (8240):		
SW-01B-01	Carbon Disulfide	10 µg/l
Volatiles (524.2):		
SW-01B-01	Carbon Disulfide	0.5 µg/l
Inorganics		
(See Table 19 of Appendix 15)		
Landfill Area	(SW-02, 09 through 012)	
Volatiles (8240):		
SW-02-01	Vinyl Chloride	190 µg/l
	Acetone	12 µg/l
	1,2-DCE	1,300 µg/l
	TCE	420 µg/l
	PCE	57 µg/l
	Toluene	18 µg/l
SW-09-01	Acetone	11 µg/l
	4-Methyl-2-Pentanone	11 µg/l
SW-09-02	1,2-DCE	8 µg/l
	TCE	6 µg/l
SW-10-01	1,2-DCE	10 µg/l
	TCE	12 µg/l
SW-10-02	1,2-DCE	6 µg/l
	TCE	19 µg/l

February 14, 1995

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE WATER

Location:	Constituents:	Concentrations:
SW-11-01	Vinyl Chloride	290 µg/l
	Acetone	12 µg/l
	1,2-DCE	770 µg/l
	TCE	390 µg/l
	4-Methyl-2-Pentanone	14 µg/l
	PCE	50 µg/l
	Toluene	17 µg/l
SW-11-02	Vinyl Chloride	170 µg/l
	1,2-DCE	240 µg/l
	Bromodichloromethane	10 µg/l
	TCE	67 µg/l
	PCE	11 µg/l
SW-12-01	Vinyl Chloride	130 µg/l
	1,2-DCE	710 µg/l
	TCE	220 µg/l
	PCE	28 µg/l
	Toluene	7 µg/l
SW-12-01 (BLDUP)	TCE	230 µg/l
	1,2 DCE	710 µg/l
SW-12-02	1,2-DCE	13 µg/l
	TCE	9 µg/l

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE WATER

Location:	Constituents:	Concentrations:
Volatiles (524.2):		
SW-02-01	Dichlorodifluoromethane	21 µg/l
	Acetone	4 µg/l
	Carbon Disulfide	2 µg/l
	Cis-1,2-DCE	2,600 µg/l
	1,1,1-TCA	0.6 µg/l
	TCE	920 µg/l
	4-Methyl-2-Pentanone	3 µg/l
	Ethyl Benzene	0.8 µg/l
	O-xylene	1.0 µg/l
	1,2,4-Trimethylbenzene	3 µg/l
	Vinyl Chloride	490 µg/l
	1,1-DCE	8 µg/l
	Trans-1,2-DCE	23 µg/l
	1,2-DCA	0.7 µg/l
	PCE	97 µg/l
	Toluene	18 µg/l
	m/p-xylene	2 µg/l
SW-02-02	Cis-1,2-DCE	10 µg/l
	TCE	7 µg/l
	Vinyl Chloride	2 µg/l
	PCE	4 µg/l
SW-10-01	Carbon Disulfide	1 µg/l
	Cis-1,2-DCE	8 µg/l
	TCE	10 µg/l
SW-10-01 (BLDUP)	Cis-1,2-DCE	77 µg/l
	TCE	24 µg/l
	Vinyl Chloride	4 µg/l
	Trans-1,2-DCE	0.6 µg/l
	PCE	3 µg/l

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE WATER

Location:	Constituents:	Concentrations:
SW-11-03	Dichlorodifluoromethane	7 µg/l
	1,2 Dichloroethene	2 µg/l
	trans-1,2-Dichloroethene	2 µg/l
	TCE	7 µg/l
	Toluene	2 µg/l
	Vinyl chloride	140 µg/l
	Cis-1,2-Dichloroethene	190 µg/l
	Xylenes (total	1 µg/l
	1,3,5-Trimethylbenzene	.5 µg/l
	1,2,4-Trimethylbenzene	.7 µg/l
SW-12-03	1,1-Dichloroethene	2 µg/l
	trans-1,2-dichloroethene	2 µg/l
	TCE	110 µg/l
	PCE	30 µg/l
	Toluene	1 µg/l
	Vinyl chloride	38 µg/l
	Cis-1,2-Dichloroethene	260 µg/l
	Xylenes (total)	3 µg/l
Downstream Samples (SW-03 through 07, 14, 15)		
Volatiles (8240):		
SW-03-01	Vinyl Chloride	49 µg/l
	Acetone	5 µg/l
	Carbon Disulfide	230 µg/l
	1,1-DCE	2 µg/l
	1,2-DCE	560 µg/l
	TCE	140 µg/l
	PCE	17 µg/l
	Toluene	2 µg/l
SW-04-01	Carbon Disulfide	6 µg/l

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE WATER

Location:	Constituents:	Concentrations:
SW-04-02	1,2-DCE	5 µg/l
SW-04-02 (BLDUP)	1,2-DCE	5 µg/l
SW-05-01	Carbon Disulfide	33 µg/l
SW-14-01	Acetone	5 µg/l
	Carbon Disulfide	17 µg/l
	1,2-DCE	220 µg/l
	TCE	50 µg/l
	PCE	7 µg/l
SW-14-02	1,2-DCE	11 µg/l
	TCE	8 µg/l
Volatiles (524.2):		
SW-03-01	Dichlorodifluoromethane	4 µg/l
	Acetone	2 µg/l
	Cis-1,2-DCE	780 µg/l
	TCE	270 µg/l
	Vinyl Chloride	120 µg/l
	1,1-DCE	2 µg/l
	Trans-1,2-DCE	5 µg/l
	PCE	19 µg/l
	Toluene	3 µg/l
SW-03-02	Cis-1,2-DCE	10 µg/l
	TCE	8 µg/l
	Vinyl Chloride	2 µg/l
	PCE	4 µg/l

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REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE WATER

Location:	Constituents:	Concentrations:
SW-03-03	1,1-Dichloroethene	1 µg/l
	Trans-1,2-dichloroethene	1 µg/l
	TCE	90 µg/l
	PCE	22 µg/l
	Vinyl chloride	21 µg/l
	Cis-1,2-dichloroethene	210 µg/l
SW-04-03	TCE	8 µg/l
	PCE	2 µg/l
	Cis-1,2-dichloroethene	19 µg/l
SW-06-02	Acetone	3 µg/l
SW-07-03	Cis-1,2-dichloroethene	2 µg/l
SW-14-03	trans - 1,2 - DCE	1 µg/l
	TCE	70 µg/l
	PCE	17 µg/l
	Vinyl Chloride	13 µg/l
	Cis-1,2-DCE	170 µg/l
SW-15-01	Carbon Disulfide	1.0 µg/l
	Cis-1,2-DCE	72 µg/l
	TCE	23 µg/l
	Vinyl Chloride	4 µg/l
	Trans-1,2-DCE	0.6 µg/l
	PCE	3 µg/l
SW-15-02	Cis-1,2-DCE	8 µg/l
	TCE	6 µg/l
	Vinyl Chloride	2 µg/l
	PCE	3µg/l

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WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SURFACE WATER

Location:	Constituents:	Concentrations:
SW-15-03	TCE	40 µg/l
	PCE	10 µg/l
	Vinyl chloride	4 µg/l
	Cis-1,2-dichloroethene	100 µg/l
SW-17-04	TCE	1.1 µg/l
SW-17-03 BLDUP	Cis-1,2-dichloroethene	100 µg/l

Inorganics:
(See Table 4 of Appendix 15)

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SEDIMENTS

Location:	Constituents:	Concentrations:
Upstream Samples	(SED-01A, 01B, 08, 013)	
Volatiles:		
SED-01B-02	Acetone	47 µg/kg
SED-08-01	Acetone	27 µg/kg
SED-08-02	Acetone	300 µg/kg
Inorganics:		
	(See Table 23 of Appendix 15)	
Landfill Area	(SED-02, 09 through 012)	
Volatiles:		
SED-02-01	Acetone	190 µg/kg
	2-Butanone	58 µg/kg
	Toluene	96 µg/kg
SED-02-02	Vinyl Chloride	260 µg/kg
	Acetone	390 µg/kg
	1,2-DCE	47 µg/kg
	Toluene	190 µg/kg
	Ethyl Benzene	16 µg/kg
	Xylene	64 µg/kg
SED-09-01	Acetone	210 µg/kg
	2-Butanone	52 µg/kg
SED-09-02	Acetone	130 µg/kg
	Xylene	18 µg/kg
SED-10-01	Acetone	42 µg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SEDIMENTS

Location:	Constituents:	Concentrations:
SED-10-02	Vinyl Chloride	270 µg/kg
	Acetone	270 µg/kg
	1,2-DCE	860 µg/kg
	TCE	520 µg/kg
SED-11-01	Vinyl Chloride	430 µg/kg
	Acetone	280 µg/kg
	1,2-DCE	190 µg/kg
	2-Butanone	73 µg/kg
	TCE	27 µg/kg
	Toluene	180 µg/kg
	Ethyl Benzene	12 µg/kg
	Xylene	48 µg/kg
SED-11-02	1,2-DCE	1,700 µg/kg
SED-11-03	Acetone	340 µg/kg
	2-Butanone	59 µg/kg
	Methylchloride	4.2 µg/kg
	Toluene	21 µg/kg
SED-12-01	Acetone	52 µg/kg
	2-Butanone	16 µg/kg
	Toluene	11 µg/kg
SED-12-01 (BLDUP)	Acetone	87 µg/kg
	2-Butanone	26 µg/kg
SED-12-02	Acetone	400 µg/kg
	1,2-DCE	150 µg/kg
	TCE	180 µg/kg
	PCE	72 µg/kg

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REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SEDIMENTS

Location:	Constituents:	Concentrations:
SED-12-03	Acetone	59 µg/kg
	Carbon disulfide	1.9 µg/kg
	Ethylbenzene	2.9 µg/kg
	Toluene	4.6 µg/kg
	Vinyl chloride	86 µg/kg
	Xylene	2.5 µg/kg
PCBs/Pesticides:		
SED-02-02	PCB-1254	74 µg/kg
Exceeded NoAA ER-L 50 µg/kg, LEL 70 µg/kg		
Inorganics Exceeding NoAA ER-L:		
SED-09-01	Lead	39.7 mg/kg
	Mercury	0.18 mg/kg
SED-09-02	Zinc	130 mg/kg
SED-11-01	Lead	47.7 mg/kg
	Mercury	0.31 mg/kg
	Nickel	59.8 mg/kg
	Zinc	176 mg/kg
SED 11-02	Lead	60.2 mg/kg
	Mercury	0.37 mg/kg
	Nickel	57.6 mg/kg
SED-11-03	Lead	70.3 mg/kg
	Mercury	0.29 mg/kg
SED-11-03	Lead	52 mg/kg
BLDUP	Nickel	32.5 mg/kg
	Zinc	152 mg/kg
SED-12-02	Mercury	0.19 mg/kg

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WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SEDIMENTS

Location:	Constituents:	Concentrations:	
Downstream Samples (SED-03 through 07, 14, 15)			
Volatiles:			
SED-03-01	1,2-DCE	35 µg/kg	
	TCE	21 µg/kg	
SED-03-02	Acetone	79 µg/kg	
	TCE	12 µg/kg	
SED-04-02	1,2-DCE	10 µg/kg	
	TCE	56 µg/kg	
	PCE	130 µg/kg	
SED-04-02 (BLDUP)	TCE	8 µg/kg	
	PCE	18 µg/kg	
SED-07-02	TCE	8 µg/kg	
	PCE	9 µg/kg	
SED-14-02	Acetone	30 µg/kg	
	TCE	32 µg/kg	
	PCE	21 µg/kg	
SED-14-03	Acetone	26 µg/kg	
	Carbon disulfide	2.6 µg/kg	
	Methyl chloride	2.5 µg/kg	
SED-15-02	Acetone	150 µg/kg	
Semi Volatiles:			ER-L
SED-05-02	Phenanthrene	620 µg/kg	225
	Fluoranthene	780 µg/kg	600
	Pyrene	600 µg/kg	350
	Benzo(b)Fluoranthene	480 µg/kg	

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WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

SEDIMENTS

Location:	**Constituents:**	**Concentrations:**
PCBs/Pesticides:		
SED-05-02	4,4'-DDT	6.4 µg/kg
Inorganics Exceeding NoAA ER-L:		
SED-05-01	Mercury	0.16 mg/kg
SED-06-02	Mercury	0.27 mg/kg
SED-14-02	Mercury	0.31 mg/kg

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

LEACHATE SEEPS

Location:	Constituents:	Concentrations:
Volatiles:		
LS-1	1,2-DCE	32 µg/l
	TCE	570 µg/l
LS-2	Acetone	21 µg/l
	1,2-DCE	10 µg/l
LS-3	1,2-DCE	1,800 µg/l
	TCE	26,000 µg/l
	PCE	9,200 µg/l
LS-3 (BLDUP)	1,2-DCE	1,800 µg/l
	TCE	26,000 µg/l
	PCE	9,400 µg/l
Semi-Volatiles:		
LS-3	1,4-Dichlorobenzene	15 µg/l
LS-3	1,4-Dichlorobenzene	17 µg/l
Inorganics:		
(See Table 27 of Appendix 15)		

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REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
SHALLOW WELLS:				
Upgradient Well	(W-01 S1)			
Volatiles:				
W-01 S1-03	Acetone	4.5 µg/l	-	-
W-01 S1-04	Acetone	3.1 µg/l	-	-
Inorganics Exceeding State or Federal MCL's:				
W-01 S1-01	Chromium	97.0 µg/l	50 µg/l	25 µg/l
	Lead	48.2 µg/l	50 µg/l	10 µg/l
W-01 S1-02	Lead	18.2 µg/l	50 µg/l	10 µg/l
W-01 S1-03	Cadmium	7.7 µg/l	10 µg/l	2.5 µg/l
	Chromium	50.0 µg/l	50 µg/l	25 µg/l
	Lead	37.0 µg/l	50 µg/l	10 µg/l
W-01 S1-04	Lead	20.0 µg/l	50 µg/l	10 µg/l
Soil Staging Area Well:	(SBW-10 W-07S1)			
Volatiles:				
W-07 S1-01	Toluene	23 µg/l	1,000 µg/l	1,210 µg/l
	Ethyl Benzene	11 µg/l	700 µg/l	340 µg/l
	Xylene	120 µg/l	10,000µg/l	200 µg/l

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-07 S1-02	1,1,1-TCA	12 µg/l	200 µg/l	100 µg/l
	TCE	20 µg/l	-	0.5 µg/l
	Benzene	7 µg/l	5 µg/l	0.5 µg/l
	Toluene	55 µg/l	1,000 µg/l	1,210 µg/l
	Ethyl Benzene	16 µg/l	700 µg/l	340 µg/l
	Xylene	230 µg/l	10,000 µg/l	200 µg/l
W-07 S1-03	Ethylbenzene	1.1 µg/l	700 µg/l	340 µg/l
W-07 S1-04	Acetone	6.8 µg/l	-	-
	Ethylbenzene	4.8 µg/l	700 µg/l	340 µg/l
	Xylene (total)	20 µg/l	10,500 µg/l	200 µg/l
Semi-volatiles:				
SBW-10-03	Bis(2 ethylhexyl)phthalate	7.3 µg/l	-	-
W-07 S1-01	Naphthalene	11 µg/l	-	-
W-07 S1-02	Bis(2-ethylhexyl)phthalate	2.4 µg/l	-	-
W-07 SI-03	Bis(2 ethylhexyl)phthalate	2.4 µg/l	-	
W-07 DI-03	Benzyl Alcohol	4.9 µg/l	-	-
	Benzoic Acid	33 µg/l	-	-
	Bis(2-ethylhexyl)phthalate	4.8 µg/l	-	-
Inorganics Exceeding State or Federal MCL's:				
SBW-10-01	Barium	2350 µg/l	1,000 µg/l	.50 mg/l
	Chromium	290 µg/l	50 µg/l	25 µg/l
	Lead	163 µg/l	50 µg/l	10 µg/l
	Nickel	371 µg/l	150 µg/l	175 µg/l

All data are shown in µg/l unless otherwise noted. November 1, 1995

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WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
SBW-10-01	Chromium	84.6 µg/l	50 µg/l	25 µg/l
BLDUP 1-1	Lead	25.9 µg/l	50 µg/l	10 µg/l
SBW-10-02	Chromium	30.7 µg/l	50 µg/l	25 µg/l
	Lead	35.9 µg/l	50 µg/l	10 µg/l
SBW 10-03	Lead	42 µg/l	50 µg/l	10 µg/l
W-07 S1-01	Barium	816 µg/l	1000 µg/l	.50 mg/l
	Chromium	38.3 µg/l	50 µg/l	25 µg/l
	Lead	50.8 µg/l	50 µg/l	10 µg/l
W-07 S1-02	Lead	65.5 µg/l	50 µg/l	10 µg/l
W-07 S1-03	Barium	1400 µg/l	1000 µg/l	.50 mg/l
	Chromium	25 µg/l	50 µg/l	25 µg/l
	Lead	89 µg/l	50 µg/l	10 µg/l
	Mercury	1.3 µg/l	2 µg/l	1 µg/l
W-07 S1-04	Barium	800 µg/l	1000 µg/l	.50 µg/l
	Chromium	48 µg/l	50 µg/l	25 µg/l
	Lead	52 µg/l	50 µg/l	10 µg/l
Landfill Area Well:	(SBW-21, W-22T)			
Volatiles:				
SBW-21-01	1,2-DCE (Total)	8,700 µg/l	-	70 µg/l
	TCE	9,000 µg/l	-	0.5 µg/l
SBW-21-02	1,2-DCE (Total)	7,500 µg/l	-	70 µg/l
	TCE	14,000 µg/l	-	0.5 µg/l

All data are shown in µg/l unless otherwise noted.

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WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
SBW-21-03	vinyl chloride	300 µg/l	2 µg/l	0.2 µg/l
	chloromethane	140 µg/l	-	-
	1,1 DCE	61 µg/l	-	-
	1,2 DCE (total)	4,000 µg/l	-	70 µg/l
	1,2-DCA	25 µg/l	-	-
	TCE	8,400 µg/l	-	0.5 µg/l
SBW-21-04	vinyl chloride	280 µg/l	2 µg/l	0.2 µg/l
	1,2 DCE (total)	3,600 µg/l	-	70 µg/l
	TCE	5,700 µg/l	-	0.5 µg/l
W-22T-05	Methylene chloride	150 µg/l	-	-
	1,2 DCE (total)	310 µg/l	-	70 µg/l
	1,2 DCA	21 µg/l	-	0 µg/l
	TCE	6,400 µg/l	-	0.5 µg/l
Semi-Volatiles:				
SBW-21-02	2 - Methylnaphthalene	12 µg/l	-	-
SBW-21-03	2 - Methylnaphthalene	14 µg/l	-	-
	Acenaphthene	1.7 µg/l	-	-
Inorganics Exceeding State or Federal MCL's:				
SBW-21-01	Barium	669 µg/l	1000 µg/l	.50 mg/l
	Chromium	178 µg/l	50 µg/l	25 µg/l
	Nickel	166 µg/l	100 µg/l	25 µg/l
SBW-21-02	Chromium	54.2 µg/l	50 µg/l	25 µg/l
	Lead	21.5 µg/l	2 µg/l	1 µg/l
SBW -21-03	Chromium	85 µg/l	50 µg/l	25 µg/l
	Lead	22 µg/l		

All data are shown in µg/l unless otherwise noted. November 1, 1995

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WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
SBW-21-04	Barium	1100 µg/l	1000 µg/l	.50 mg/l
	Chromium	170 µg/l	50 µg/l	25 µg/l
	Lead	1120 µg/l	50 µg/l	10 µg/l
	Nickel	130 µg/l	100 µg/l	175 µg/l
W-22T	Barium	1180.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	229.0 µg/l	50 µg/l	25 µg/l
	Lead	186.0 µg/l	50 µg/l	10 µg/l
	Nickel	197.0 µg/l	100 µg/l	175 µg/l
Residential Wells:				
Inorganics Exceeding State or Federal MCL's:				
Dickinson-01	Lead	18.6 µg/l	50 µg/l	10 µg/l
Dickinson-03	Lead	18.0 µg/l	50 µg/l	10 µg/l
Hillside Wells:	(W-23, 24, T)			
Volatiles:				
W-24T-02	Toluene	12 µg/l	1,000 µg/l	1,210 µg/l
	Xylene	5 µg/l	10,000 µg/l	200 µg/l
W-24T-03	Toluene	5.2 µg/l	1,000 µg/l	1,210 µg/l
	Xylene	5 µg/l	10,000 µg/l	200 µg/l
Inorganics Exceeding State or Federal MCL's:				

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-23T-01	Antimony	108 ug/l	64 ug/l	-
	Barium	974 µg/l	1000 µg/l	.50 mg/l
	Beryllium	10 ug/l	4 ug/l	-
	Chromium	179 µg/l	50 µg/l	25 µg/l
	Lead	106 µg/l	50 µg/l	10 µg/l
	Nickel	212 µg/l	100 µg/l	175 µg/l
W-23T-02	Antimony	28.9 ug/l	6 ug/l	-
	Chromium	29.6 µg/l	50 µg/l	25 µg/l
	Lead	18.5 µg/l	50 µg/l	10 µg/l
W-23T-02-F	Lead	11.2 µg/l	50 µg/l	10 µg/l
W-23T-03	Barium	570 µg/l	1000 µg/l	.50 mg/l
	Chromium	73 µg/l	50 µg/l	25 µg/l
	Lead	65 µg/l	50 µg/l	10 µg/l
W-24T-01	Barium	532 µg/l	1000 µg/l	.50 mg/l
	Beryllium	6.5 ug/l	4 ug/l	-
	Chromium	139 µg/l	50 µg/l	25 µg/l
	Lead	52.3 µg/l	50 µg/l	10 µg/l
	Nickel	137 µg/l	100 µg/l	175 µg/l
W-24T-02	Antimony	20.6 ug/l	6 ug/l	-
W-24T-03	Antimony	21 ug/l	6 ug/l	-
Wells West of The Landfill: (08, 09, 25 S1, 26T, 27S1, 27T)				
W-08 S1-01	1,2-DCE (Total)	6 µg/l	-	70 µg/l
	TCE	150 µg/l	-	0.5 µg/l
	PCE	49 µg/l	-	0.07 µg/l

All data are shown in µg/l unless otherwise noted.

November 1, 1995

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REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-08 S1-02	1,2-DCE (Total)	14 µg/l	-	70 µg/l
	TCE	260 µg/l	-	0.5 µg/l
	PCE	73 µg/l	-	0.07 µg/l
W-08 S1-03	1,2 DCE (Total	14 µg/l	-	70 µg/l
	TCE	360 µg/l	-	.5 µg/l
	PCE	160 µg/l	-	.07 µg/l
W-08 S1-04	TCE	390 µg/l	-	.5 µg/l
	PCE	200 µg/l	-	.07 µg/l
W-09 S1-01	Acetone	34 µg/l	-	-
	1,2-DCE (Total)	11 µg/l	-	70 µg/l
	TCE	9 µg/l	-	0.5 µg/l
W-09 S1-02	1,2-DCE (Total)	9 µg/l	-	70 µg/l
	TCE	5 µg/l	-	0.5 µg/l
W-09 S1-03	Vinyl chloride	1.3 µg/l	2 µg/l	.2 µg/l
	1,2 DCE (total)	22 µg/l	-	.70 µg/l
	TCE	7.1 µg/l	-	.05 µg/l
W-09 S1-04	Vinyl chloride	2.9 µg/l	2 µg/l	.2 µg/l
	Acetone	9.1 µg/l	-	-
	1,2 DCE (total)	30 µg/l	-	70 µg/l
	TCE	2 µg/l	-	0.5µg/l
W-25 S1-01	Acetone	21 µg/l	-	-
	TCE	12 µg/l	-	0.5 µg/l
W-25 S1-02	TCE	6 µg/l	-	0.5 µg/l

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-25 S1-03	Acetone	88 µg/l	-	-
	2-Butanone	6.9 µg/l	-	-
	TCE	1.2 µg/l	-	0.5 µg/l
W-25 S1-04	Acetone	87 µg/l	-	-
	2-Butanone	29 µg/l	-	-
Semi-volatiles:				
W-08 S1-03	Benzoic Acid	9.9 µg/l	-	-
Inorganics Exceeding State or Federal MCL's:				
W-08 S1-01	Barium	1030 µg/l	1000 µg/l	.50 mg/l
	Chromium	168 µg/l	50 µg/l	25 µg/l
	Lead	78.5 µg/l	50 µg/l	25 µg/l
	Nickel	228 µg/l	100 µg/l	175 µg/l
W-08 S1-02	Lead	15.0 µg/l	50 µg/l	10 µg/l
W-08 S1-04	Barium	560 µg/l	1000 µg/l	.50 mg/l
	Chromium	48.0 µg/l	50 µg/l	25 µg/l
	Lead	48.0 µg/l	50 µg/l	10 µg/l
W-09 S1-01	Barium	1080 µg/l	1000 µg/l	.50 mg/l
	Chromium	186 µg/l	50 µg/l	25 µg/l
	Lead	116 µg/l	50 µg/l	10 µg/l
	Nickel	240 µg/l	1000 µg/l	175 µg/l
W-09 S1-02	Lead	11.8 µg/l	50 µg/l	10 µg/l
W-09 S1-03	Chromium	50 µg/l	50 µg/l	25 µg/l
	Lead	39 µg/l	50 µg/l	10 µg/l
W-09 S1-04	Lead	33 µg/l	50 µg/l	10 µg/l

All data are shown in µg/l unless otherwise noted. November 1, 1995

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-25 S1-01	Chromium	74.1 µg/l	50 µg/l	25 µg/l
	Lead	37.3 µg/l	50 µg/l	10 µg/l
W-25 S1-03	Chromium	32.0 µg/l	50 µg/l	25 µg/l
	Lead	29.0 µg/l	50 µg/l	10 µg/l
W-25 S1-04	Chromium	26.0 µg/l	50 µg/l	25 µg/l
	Lead	19.0 µg/l	50 µg/l	10 µg/l
W-26T-05	Chromium	79.4 µg/l	50 µg/l	25 µg/l
	Lead	53.2 µg/l	50 µg/l	10 µg/l
W-27S1-05	Chromium	48.5 µg/l	50 µg/l	25 µg/l
	Lead	21.3 µg/l	50 µg/l	10 µg/l
W-27T-05	Chromium	53.9 µg/l	50 µg/l	25 µg/l
	Lead	23.5 µg/l	50 µg/l	10 µg/l
Marshy Area Wells: Volatiles:	(W-02, 03, 03T, 04S, 04D, 05, 06S, 06D, 11S1, 12S1, 22S1)			
W-02-01	1,2-DCE (Total)	16,000 µg/l	-	70 µg/l
	TCE	4,600 µg/l	-	0.5 µg/l
	PCE	7,100 µg/l	-	0.07 µg/l
W-02-02	1,2-DCE (Total)	11,000 µg/l	-	70 µg/l
	TCE	1,800 µg/l	-	0.5 µg/l
	PCE	1,400 µg/l	-	0.07 µg/l
W-02-03	Vinyl chloride	630 µg/l	2 µg/l	.2 µg/l
	1,1 DCE	620 µg/l	-	-
	1,2 DCE (total)	1,400 µg/l	-	70 µg/l
	TCE	1,500 µg/l	-	.5 µg/l

All data are shown in µg/l unless otherwise noted.

November 1, 1995

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
	Benzene	550 µg/l	-	-
	PCE	400 µg/l	-	-
	Toluene	610 µg/l	-	.07 µg/l
	Chlorobenzene	580 µg/l	-	-
W-02-03	Vinyl Chloride	570 µg/l	2 µg/l	.2 µg/l
BLDUP	1,2 DEC (Total)	13,000 µg/l	-	70 µg/l
	TCE	1,900 µg/l	-	0.5 µg/l
	PCE	860 µg/l	-	.07 µg/l
W-03-01	1,2-DCE (Total)	22,000 µg/l	-	70 µg/l
	TCE	9,800 µg/l	-	0.5 µg/l
	PCE	10,000 µg/l	-	0.07 µg/l
W-03-02	Carbon Disulfide	510 µg/l	-	-
	1,2-DCE (Total)	16,000 µg/l	-	70 µg/l
	TCE	8,000 µg/l	-	0.5 µg/l
	PCE	5,800 µg/l	-	0.07 µg/l
	2-Butanone	1,000 µg/l	-	-
W-03-03	1,2 DCE (total)	11,000 µg/l	-	70 µg/l
	TCE	1,300 µg/l	-	.5 µg/l
	PCE	350 µg/l	-	.07 µg/l
W-03T-01	1,2-DCE (total)	76 µg/l	-	70 µg/l
	TCE	80 µg/l	-	0.5 µg/l
	PCE	150 µg/l	-	0.07 µg/l
W-03T-02	1,2-DCE (total)	56 µg/l	-	70 µg/l
	TCE	47 µg/l	-	0.5 µg/l
	PCE	81 µg/l	-	0.07 µg/l
W-03T-03	TCE	1.4 µg/l	-	

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-04S-01	Vinyl Chloride	620 µg/l	2 µg/l	0.2 µg/l
	1,2-DCE (Total)	2,000 µg/l	-	70 µg/l
	TCE	730 µg/l	-	0.5 µg/l
W-04S-02	Vinyl Chloride	1,000 µg/l	2 µg/l	0.2 µg/l
	1,2-DCE (Total)	3,900 µg/l	-	70 µg/l
	TCE	670 µg/l	-	0.5 µg/l
W-04S-03	Vinyl chloride	1,500 µg/l	2 µg/l	.2 µg/l
	1,1 DCE	120 µg/l	-	-
	1,2 DCE (total)	3,800 µg/l	-	70 µg/l
	TCE	2,000 µg/l	-	.5 µg/l
	Benzene	110 µg/l	-	-
	PCE	640 µg/l	-	.07 µg/l
	Toluene	110 µg/l	1,000 µg/l	1,210 µg/l
	Chlorobenzene	120 µg/l	-	-
W-04D-01	TCE	3,500 µg/l	-	0.5 µg/l
	PCE	1,000 µg/l	-	0.07 µg/l
	Vinyl chloride	620 µg/l	2 µg/l	0.2 µg/l
W-04D-02	TCE	1,900 µg/l	-	0.5 µg/l
	Vinyl chloride	620 µg/l	2 µg/l	0.2 µg/l
	PCE	560 µg/l	-	0.07 µg/l
W-04D-03	1,2 DCE (total)	150 µg/l	-	70 µg/l
W-05-01	1,2-DCE (Total)	140 µg/l	-	70 µg/l
	TCE	270 µg/l	-	0.5 µg/l
	PCE	100 µg/l	-	0.07 µg/l

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-05-02	1,2-DCE (Total)	1,100 µg/l	-	70 µg/l
	TCE	1,900 µg/l	-	0.5 µg/l
	PCE	980 µg/l	-	0.07 µg/l
W-05-03	1,2 DCE (total)	310 µg/l	-	70 µg/l
	TCE	870 µg/l	-	0.5 µg/l
	PCE	130 µg/l	-	.07 µg/l
W-06S-02	TCE	5 µg/l	-	0.5 µg/l
W-11 S1-01	Vinyl Chloride	1,600 µg/l	2 µg/l	0.2 µg/l
	1,2-DCE (Total)	3,300 µg/l	-	70 µg/l
W-11 S1-02	Vinyl Chloride	2,300 µg/l	2 µg/l	0.2 µg/l
	1,2-DCE (Total)	6,900 µg/l	-	70 µg/l
	TCE	810 µg/l	-	0.5 µg/l
W-11 S1-03	1,1 DCE	90 µg/l	-	-
	1,2 DCE (total)	7,600 µg/l	70 µg/l	
W-11 S1-04	Vinyl chloride	580 µg/l	2 µg/l	0.2 µg/l
	1,2 DCE (total)	2,000 µg/l	-	70 µg/l
	TCE	320 µg/l	-	.5 µg/l
	2-Hexanone	48 µg/l	-	-
W-12 S1-01	TCE	9 µg/l	-	0.5 µg/l
W-12 S1-04	TCE	11 µg/l	-	.5 µg/l
	1,2 DCE (total)	3.3 µg/l	-	70 µg/l
W-22 S1-01	1,2-DCE (Total)	3,300 µg/l	-	70 µg/l
	TCE	34,000 µg/l	-	0.5 µg/l

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-22 S1-02	1,2-DCE (Total)	4,400 µg/l	-	70 µg/l
	TCE	40,000 µg/l	-	0.5 µg/l
W-22 S1-02	Carbon Disulfide	1,600 µg/l	-	-
(BLDUP)	1,2-DCE (Total)	1,900 µg/l	-	70 µg/l
	TCE	14,000 µg/l	-	0.5 µg/l
W-22 S1-03	1,2 DCE (total)	1,500 µg/l	-	70 µg/l
	TCE	9,000 µg/l	-	0.5 µg/l
W-22 S1-04	1,2 DCE (total)	1,600 µg/l	-	70 µg/l
	TCE	13,000 µg/l	-	0.5 µg/l
W-04T-05	Vinyl chloride	20 µg/l	2 µg/l	0.2µg/l
	Methylene chloride	35 µg/l	-	-
	1,2 DCE (total)	320 µg/l	-	70 µg/l
	1,2 DCA	9 µg/l	-	-
	TCE	1,200 µg/l	-	0.5 µg/l
	PCE	41 µg/l	-	.07 µg/l
W-TP-12-05	Vinyl chloride	45 µg/l	2 µg/l	0.2 µg/l
	Methylene chloride	22 µg/l	-	-
	Carbon disulfide	10 µg/l	-	-
	1,2 DCE (total)	3,000 µg/l	-	20 µg/l
	1,2 DCE	10 µg/l	-	-
	1,1,1 TCA	17 µg/l	200 µg/l	100 µg/l
	TCE	27,000 µg/l	-	0.5 µg/l
	PCE	21,000 µg/l	-	0.07 µg/l
	Toluene	140 µg/l	-	1,210 µg/l
	Xylene	18 µg/l	-	200 µg/l
Semi-Volatiles:				
W-04S-02	Phenol	29 µg/l	3,500 µg/l	-

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-04S-03	1,3 Dichlorobenzene	1.3 µg/l	-	-
	1,4 Dichlorobenzene	2.4 µg/l	-	-
W-02-02	Pyrene	25 µg/l	-	-
W-02-03	1,4 Dichlorobenzene	1.6 µg/l	-	-
W-02-03 (BLDUP)	1,4 Dichlorobenzene	2.6 µg/l	-	-
W-05-02	4-Methylphenol	12 µg/l	-	-
W-11S1-03	Bis(2-ethylhexyl)phthalate	3.2 µg/l	-	-
W-TP-12-05	1,3 Dichlorobenzene	10 µg/l	-	-
W-TP-12-05	1,3 Dichlorobenzene	12 µg/l	-	-
(BLDUP)	1,4 Dichlorobenzene	37 µg/l	-	-
W-03-03	1,4 Dichlorobenzene	1.4 µg/l	-	-
Inorganics Exceeding State or Federal MCL's:				
W-02-01	Chromium	345 µg/l	50 µg/l	25 µg/l
	Lead	47.7 µg/l	50 µg/l	10 µg/l
	Nickel	469 µg/l	100 µg/l	175 µg/l
W-02-01 BLDUP #2-1	Chromium	38.3 µg/l	50 µg/l	25 µg/l
W-02-03	Lead	64.0 µg/l	50 µg/l	10 µg/l

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-02-03 BLDUP #4-3	Lead	72.0 µg/l	50 µg/l	10 µg/l
W-02-03-F BLDUP#4-3	Barium	980 µg/l	1000 µg/l	.50 mg/l
W-03-01	Chromium	56.3 µg/l	50 µg/l	25 µg/l
W-03-02	Chromium	139 µg/l	50 µg/l	25 µg/l
	Lead	13.2 µg/l	50 µg/l	10 µg/l
	Nickel	107 µg/l	100 µg/l	175 µg/l
W-03-03	Chromium	62.0 µg/l	50 µg/l	25 µg/l
	Lead	30.0 µg/l	50 µg/l	10 µg/l
	Nickel	330.0 µg/l	100 µg/l	175 µg/l
W-03T-01	Barium	2960 µg/l	1000 µg/l	.50 mg/l
	Chromium	401 µg/l	50 µg/l	25 µg/l
	Lead	188 µg/l	50 µg/l	10 µg/l
	Mercury	1.6 µg/l	2 µg/l	1 µg/l
	Nickel	1080 µg/l	100 µg/l	175 µg/l
W-03T-02	Barium	1430 µg/l	1000 µg/l	.50 mg/l
	Chromium	180 µg/l	50 µg/l	25 µg/l
	Lead	221 µg/l	50 µg/l	10 µg/l
	Nickel	495 µg/l	100 µg/l	175 µg/l
W-04S-01	Chromium	280.0 µg/l	50 µg/l	25 µg/l
	Lead	241.0 µg/l	50 µg/l	10 µg/l
	Nickel	154.0 µg/l	100 µg/l	175 µg/l

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-04S-02	Chromium	33.7 µg/l	50 µg/l	25 µg/l
	Lead	27.1 µg/l	50 µg/l	10 µg/l
	Nickel	154.0 µg/l	100 µg/l	175 µg/l
W-04S-03	Cadmium	4.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	85.0 µg/l	50 µg/l	25 µg/l
	Lead	250.0 µg/l	50 µg/l	10 µg/l
	Nickel	1400.0 µg/l	100 µg/l	175 µg/l
W-04D-03	Lead	21.0 µg/l	50 µg/l	10 µg/l
W-05-03	Chromium	43.0 µg/l	50 µg/l	25 µg/l
	Lead	27.0 µg/l	50 µg/l	10 µg/l
W-06S-01	Chromium	91.6 µg/l	50 µg/l	25 µg/l
	Lead	30.4 µg/l	50 µg/l	10 µg/l
W-06S-02	Chromium	28.6 µg/l	50 µg/l	25 µg/l
W-06S-03	Chromium	48.0 µg/l	50 µg/l	25 µg/l
	Lead	24.0 µg/l	50 µg/l	10 µg/l
W-06D-01	Barium	512.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	83.2 µg/l	50 µg/l	25 µg/l
	Lead	48.7 µg/l	50 µg/l	10 µg/l
W-06D-02	Chromium	49.5 µg/l	50 µg/l	25 µg/l
	Lead	34.6 µg/l	50 µg/l	10 µg/l
W-06D-02 BLDUP#1-2	Lead	18.5 µg/l	50 µg/l	10 µg/l

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-06D-03	Chromium	31.0 µg/l	50 µg/l	25 µg/l
	Lead	17.0 µg/l	50 µg/l	10 µg/l
W-11 S1-01	Barium	1830.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	221.0 µg/l	50 µg/l	25 µg/l
	Lead	194.0 µg/l	50 µg/l	10 µg/l
	Nickel	311.0 µg/l	100 µg/l	175 µg/l
W-11 S1-02	Lead	31.7 µg/l	50 µg/l	10 µg/l
W-11 S1-02-F	Lead	10.0 µg/l	50 µg/l	10 µg/l
W-11 S1-03	Barium	660.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	49.0 µg/l	50 µg/l	25 µg/l
	Lead	88.0 µg/l	50 µg/l	10 µg/l
W-11 S1-04	Lead	33.0 µg/l	50 µg/l	10 µg/l
W-12 S1-01	Barium	1140.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	581.0 µg/l	50 µg/l	25 µg/l
	Lead	120.0 µg/l	50 µg/l	10 µg/l
	Nickel	310.0 µg/l	1000 µg/l	175 µg/l
W-12 S1-02	Chromium	64.9 µg/l	50 µg/l	25 µg/l
	Lead	36.3 µg/l	50 µg/l	10 µg/l
W-12 S1-03	Chromium	100.0 µg/l	50 µg/l	25 µg/l
	Lead	30.0 µg/l	50 µg/l	10 µg/l
W-12 S1-04	Chromium	130.0 µg/l	50 µg/l	25 µg/l
	Lead	56.0 µg/l	50 µg/l	10 µg/l

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-22 S1-01	Chromium	109.0 µg/l	50 µg/l	25 µg/l
	Nickel	120.0 µg/l	100 µg/l	175 µg/l
W-22 S1-02	Chromium	81.2 µg/l	50 µg/l	25 µg/l
	Lead	66.3 µg/l	50 µg/l	10 µg/l
	Nickel	117.0 µg/l	100 µg/l	175 µg/l
W-22 S1-03	Cadmium	4.4 µg/l	10 µg/l	2.5 µg/l
	Chromium	35.0 µg/l	50 µg/l	25 µg/l
	Lead	16.0 µg/l	50 µg/l	10 µg/l
W-04T-05	Barium	722.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	157.0 µg/l	50 µg/l	25 µg/l
	Lead	69.2 µg/l	50 µg/l	10 µg/l
	Nickel	113.0 µg/l	100 µg/l	175 µg/l
W-TP-12-05	Chromium	104.0 µg/l	50 µg/l	25 µg/l
	Lead	3370.0 µg/l	50 µg/l	10 µg/l
	Mercury	1.1 µg/l	2 µg/l	1 µg/l
	Nickel	9370.0 µg/l	100 µg/l	175 µg/l
W-TP-12-05-F	Lead	232.0 µg/l	50 µg/l	10 µg/l
	Nickel	8220.0 µg/l	100 µg/l	175 µg/l
PCB/Pesticides:				
W-TP-12-05 (BLDUP 2-5)	Endrin	.085 µg/l	-	-

DEEP WELLS

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
Shallow Intermediate Weathered Bedrock Wells	(W-04, 07, 08, 09, 25 SI)			
Volatiles:				
W-08 SI-01	Acetone	21 µg/l	-	-
W-08 SI-03	Acetone	17 µg/l	-	-
	Carbon disulfide	5.4 µg/l	-	-
W-08 SI-04	Carbon disulfide	2.5 µg/l	-	-
W-09 SI-03	Acetone	2.3 µg/l	-	-
W-09 SI-04	Carbon disulfide	1.1 µg/l	-	-
W-25 SI-02	Chloroform	5 µg/l	-	-
W-25 SI-03	Chloroform	2.7 µg/l	-	-
W-25 SI-04	Chloroform	2.9 µg/l	-	-
W-25 SI-04 BLDUP 2-4	Chloroform	2.8 µg/l	-	-
Inorganics Exceeding State or Federal MCL's:				
W-04 SI-01	Chromium	26.5 µg/l	50 µg/l	25 µg/l
	Lead	38.1 µg/l	50 µg/l	10 µg/l
W-04 SI-01-F BLDUP #3-1-F	Lead	36.2 µg/l	50 µg/l	10 µg/l
W-04 SI-02	Lead	123.0 µg/l	50 µg/l	10 µg/l

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-04 SI-03	Chromium	26.0 µg/l	50 µg/l	25 µg/l
	Lead	48.0 µg/l	50 µg/l	10 µg/l
W-04 Si-04	Lead	14.0 µg/l	50 µg/l	10 µg/l
W-07 SI-01	Chromium	136.0 µg/l	50 µg/l	25 µg/l
	Lead	21.9 µg/l	50 µg/l	10 µg/l
	Nickel	126.0 µg/l	100 µg/l	175 µg/l
W-07 SI-02	Chromium	146.0 µg/l	50 µg/l	25 µg/l
	Lead	25.0 µg/l	50 µg/l	10 µg/l
	Nickel	114.0 µg/l	100 µg/l	175 µg/l
W-07 SI-04	Lead	11.0 µg/l	50 µg/l	10 µg/l
W-08 SI-01	Barium	3160.0 µg/l	1000 µg/l	.50 mg/l
W-08 SI-01-F	Barium	3220.0 µg/l	1000 µg/l	.50 mg/l
W-08 SI-02	Barium	2230.0 µg/l	1000 µg/l	.50 mg/l
W-08 SI-02-F	Barium	2490.0 µg/l	1000 µg/l	.50 mg/l
W-08 SI-03	Barium	2100.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	56.90 µg/l	50 µg/l	25 µg/l
W-08 SI-03-F	Barium	2000.0 µg/l	1000 µg/l	.50 mg/l
W-08 SI-04	Barium	1400.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	31.0 µg/l	50 µg/l	25 µg/l
W-08 SI-04-F	Barium	1200.0 µg/l	1000 µg/l	.50 mg/l

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-09 SI-01	Chromium	148.0 µg/l	50 µg/l	25 µg/l
W-09 SI-03	Chromium	40.0 µg/l	50 µg/l	25 µg/l
W-25 SI-01	Chromium	75.9 µg/l	50 µg/l	25 µg/l
	Lead	428.0 µg/l	50 µg/l	10 µg/l
W-25 SI-02	Chromium	45.0 µg/l	50 µg/l	25 µg/l
	Lead	1180.0 µg/l	50 µg/l	10 µg/l
W-25 SI-03	Lead	560.0 µg/l	50 µg/l	10 µg/l
W-25 Si-04	Lead	67.0 µg/l	50 µg/l	10 µg/l
W-25 SI-04 BLDUP#2-4	Lead	68.0 µg/l	50 µg/l	10 µg/l
Semivolatiles:				
W-04 SI-03	Benzoic acid	21 µg/l	-	-
	Bis(2-ethylhexyl)phthalate	5 µg/l	-	-
	Di-n-octylphthalate	1.6 µg/l	-	-
W-07 SI-03	Bis(2-ethylhexyl)phthalate	2.6 µg/l	-	-
W-08 SI-03	Bis(2-ethylhexyl)phthalate	6.9 µg/l	-	-
Deep Intermediate Weathered Bedrock Wells	(W-04, 07, 25, DI)			
Volatile organics:				
W-04 DI-03	Acetone	5.1 µg/l	-	-

All data are shown in µg/l unless otherwise noted.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
W-07 DI-03	Chloroform	1 µg/l	-	-
	TCE	1.1 µg/l	-	-
	PCE	1 µg/l	-	-
	Toluene	3.8 µg/l	-	-
	Xylene (total)	4.8 µg/l	-	-
Semivolatiles:				
W-04 DI-03	Bis(2-ethylhexyl)phthalate	5 µg/l	-	-
Inorganics Exceeding State or Federal MCL's:				
W-04 DI-03	Chromium	41.0 µg/l	50 µg/l	25 µg/l
	Lead	14.0 µg/l	50 µg/l	10 µg/l
	Nickel	150.0 µg/l	100 µg/l	175 µg/l
W-04 DI-04	Lead	26.0 µg/l	50 µg/l	10 µg/l
W-25 DI-01	Chromium	30.2 µg/l	50 µg/l	245 µg/l
W-25 DI-02	Lead	10.6 µg/l	50 µg/l	10 µg/l
W-25 DI-04	Chromium	140.0 µg/l	50 µg/l	25 µg/l
	Lead	26.0 µg/l	50 µg/l	10 µg/l
	Nickel	180.0 µg/l	1000 µg/l	175 µg/l
W-07 DI-03	Barium	4000.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	29.0 µg/l	50 µg/l	25 µg/l
	Lead	34.0 µg/l	50 µg/l	10 µg/l
W-07 DI-03-F	Barium	3800.0 µg/l	1000 µg/l	.50 mg/l
Competent Bedrock Wells	(W-01, 04, 08, 09, B)			

All data are shown in µg/l unless otherwise noted.

November 1, 1995

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WOODFORD AND BENNINGTON, VERMONT

Summary of Detected Parameters

GROUND WATER

Location:	Constituents:	Concentrations:	Fed. MCL's	Vermont Prev. Act. Limit
Volatiles:				
W-01 B-03	1,2 DCE (Total)	3.3 µg/l	-	-
W-09 B-03	Carbon disulfide	1.2 µg/l	-	-
Semivolatiles:				
W-01 B-03	Bis(2-ethylhexyl)phthalate	4.7 µg/l	-	-
W-04 B-02	Bis(2-ethylhexyl)phthalate	4.7 µg/l	-	-
W-08 B-03	Bis(2-ethylhexyl)phthalate	4.7 µg/l	-	-
Inorganics Exceeding State or Federal MCL's:				
W-01 B-03	Lead	11.0 µg/l	50 µg/l	10 µg/l
W-01 DI-05	Barium	6210.0 µg/l	1000 µg/l	.50 mg/l
	Chromium	165.0 µg/l	50 µg/l	25 µg/l
	Lead	114.0 µg/l	50 µg/l	10 µg/l
	Nickel	743.0 µg/l	100 µg/l	175 µg/l
W-01 DI-05	Barium	4890.0 µg/l	1000 µg/l	.50 mg/l
BLDUP-1-5	Chromium	139.0 µg/l	50 µg/l	25 µg/l
	Lead	104.0 µg/l	50 µg/l	10 µg/l
	Nickel	671.0 µg/l	100 µg/l	175 µg/l

All data are shown in µg/l unless otherwise noted.

Burgess Brothers Superfund Site
Summary of Soil Results

BEND IN THE ROAD

PARAMETERS	TEST PITS			
	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.
Volatile Organics			NA	-
Semi-volatile Organics			NA	-
PCBs / Pesticides			NA	-
Inorganics				
Chromium	412	11/11	3.0-5.7 mg/kg	BRP-8
Lead	9.5	11/11	4.8-39.2 mg/kg	BRP-1
Manganese	181	11/11	97.1-353 mg/kg	BRP-10
Nickel	5.58	11/11	4.0-8.7 mg/kg	BRP-10
Zinc	22	11/11	14.5-38.8 mg/kg	BRP-10

NA - Not Analyzed

Burgess Brothers Superfund Site
Summary of Soil and Ground Water Results

LANDFILL AREA

PARAMETERS	SURFACE SOILS Arithmetic Average	Freq. of Detections	Range	Location of Max. Conc.	SOIL BORINGS / TEST PITS Arithmetic Average	Freq. of Detections	Range	Location of Max. Conc.	GROUND WATER Arithmetic Average	Freq. of Detections	Range	Location of Max. Conc.	Regulatory Limit MCL or VT PGWS	No. Over Reg. Limit
Volatile Organics														
1,1,1-TCA	-	-	ND	-	-	-	ND	-	242	1/5	ND-17 ug/l	W-TP-12-05	100 ug/l	0
Vinyl Chloride	-	-	ND	-	-	-	ND-44 ug/kg	TP-10-05 2-4'	525	3/5	ND-300 ug/l	SBW-21-03	0.2 ug/l	3
Xylene	-	-	ND	-	-	-	ND	-	243	1/5	ND-18 ug/l	W-TP-12-05	200 ug/l	-
Methylene Chloride	-	-	ND	-	-	-	ND	-	243	1/5	ND-22 ug/l	W-TP-12-05	2.5 ug/l	1
1,2-DCA	-	-	ND	-	-	-	ND	-	241	2/5	ND-25 ug/l	SBW-21-03	0.5 ug/l	2
1,1-DCE	-	-	ND	-	-	-	ND	-	246	2/5	ND-61 ug/l	SBW-21-03	0.7 ug/l	2
Chloromethane	-	-	ND	-	-	-	ND	-	496	1/5	ND-140 ug/l	SBW-21-03	-	-
PCE	10	1/11	ND-26 ug/kg	SP-22	453849	10/34	ND-8,100,000 ug/kg	SBW-15 2-4'	4439	1/5	ND-21000 ug/l	W-TP-12-05	0.07 ug/l	1
TCE	7	2/11	ND-15 ug/kg	SP-22	278204	13/34	ND-6,900,000 ug/kg	SBW-15 4-6'	12820	5/5	ND-27000 ug/l	W-TP-12-05	0.5 ug/l	5
Acetone	-	-	ND-9 ug/kg	SP-22	32322	8/34	ND-150 ug/kg	SBW-18A BLDUP			ND	-	-	-
1,2-Dichloroethene (tot	-	-	ND		8613	5/34	ND-10000 ug/kg	TP-11-05 10-12'	5360	5/5	ND-8700 ug/l	SBW-21-01	70 ug/l	5
4-methyl-2-pentanone	-	-	ND		-	-	ND-19 ug/kg	SBW-17 12-14'			ND	-		
Toluene	-	-	ND		18215	3/34	ND-140 ug/kg	SBW-19 4-6',6-8'	257	1/5	ND-140 ug/l	W-TP-12-05	1000 ug/l	-
2-Butanone	-	-	ND		3463	2/34	ND-120 ug/kg	SBW-19 6-8'			ND	-		
cis-1,3-Dichloropropen	-	-	ND		-	-	ND-44 ug/kg	TP-12-05 20.5-22.5			ND	-		
2-Hexanone	-	-	ND		-	-	ND-1,2000,000 ug/l	TP-12-05 22.5-24.5			ND	-		
Semivolatile Organics														
1,2-Dichlorobenzene	-	-	NA		519.88	3/31	ND-2800 ug/kg	SBW-15 2-4'			ND	-		
1-3-Dichlorobenzene	-	-	NA		495.81	4/31	ND-1400 ug/kg	SBW-15 2-4'			ND	-		
1-4-Dichlorobenzene	-	-	NA		841.29	3/31	ND-5600 ug/kg	SBW-15 2-4'			ND	-		
Naphthalene	-	-	NA		1067.1	3/31	ND-18,000 ug/kg	SBW-15 2-4'			ND	-		
2-Methylnapthalene	-	-	NA		737.42	4/31	ND-6,900 ug/kg	SBW-15 2-4'	11.2	2/5	ND-14 ug/l	SBW-21-03		
Phenanthrene	-	-	NA		458.06	2/31	ND-1,800 ug/kg	SBW-15 2-4'			ND	-		
Fluorantene	-	-	NA		-	-	ND-1,400 ug/kg	SBW-15 2-4'			ND	-		
bis(2EH)phthalate	-	-	NA		1213.87	5/31	ND-19,000 ug/kg	SBW-15 2-4'			ND	-		
1,2,4 trichlorobenzene	-	-	NA		447.42	2/31	ND-820 ug/kg	SBW-15 2-4'			ND	-		
Di-n-butylphthalate	-	-	NA		530.32	1/31	ND-1400 ug/kg	SBW-15 8-10'			ND	-		
4-methylphenol	-	-	NA		783.23	5/31	ND-2900 ug/kg	SBW-17 6-8'			ND	-		
Pyrene	-	-	NA		577.74	1/31	ND-480 ug/kg	SBW-21 12-14'			ND	-		
Benzoic acid	-	-	NA		-	-	ND-630 ug/kg	TP-19-05 14-16'			ND	-		
4-Chloroaniline	-	-	NA		-	-	ND-540 ug/kg	TP-19-05 14-16'			ND	-		
Acenaphthylene	-	-	NA		-	-	ND	-	8.43	1/5	ND-1.7 ug/l	SBW-21-03		
PCB/Pesticides														
4,4'-DDE	27	1/5		SP-03	-	-	ND	-			ND	-		
Endrin	-	-			-	-	ND	-	0.04	1/2	ND-0.085 ug/l	W-TP-12-05	0.15 ug/l	0
PCB-1260	-	-			2048	5/32	ND-25,000 ug/kg	SBW-15 4-6'			ND	-	0.0008 ug/l	-
PCB-1254	-	-			1345	5/32	ND-680 ug/kg	SBW-19 4-6'			ND	-	0.0008 ug/l	-
PCB-1016/1242	-	-			1560	1/32	ND-1200 ug/kg	SBW-19 4-6'			ND	-	0.0008 ug/l	-
Inorganics									(ug/l)					
Aluminum - U	8154	11/11	010-7740 mg/kg	SP-04	4435	32/32	438-6830 mg/kg	TP-8-05 4-6'	48880	5/5	ND-88700 ug/l	SBW-21-04	50-200 ug/l	4
Aluminum - F									1203	2/5	ND-5720 ug/l	W-TP-12-05	50-200 ug/l	0
Antimony - U	2.84	5/11	ND-3.4 mg/kg	SBW-21	4.1	2/32	ND-38.9 mg/kg	SBW-18a 8-10'	38.1	1/5	ND-36.3 ug/l	SBW-21-01	6 ug/l	1
Antimony - F									35.4	1/5	ND-22.7 ug/l	SBW-21-01	6 ug/l	1
Arsenic - U	10	8/11	0.8-3.4 mg/kg	-03,SBW-21	1.6	30/32	ND-5.7 mg/kg	TP-8-05 4-6'	3.8	2/5	ND-3.9 ug/l	SBW-21-04	25 ug/l	0
Arsenic - F									2.8	3/5	ND-2.3 ug/l	SBW-21-04	25 ug/l	0
Barium - U	52.9	9/11	21.0-279 mg/kg	SP-03	44.4	32/32	11.1-2850 mg/kg	TP-14-05 10-12'	514.4	5/5	183-1100 ug/l	SBW-21-04	500 ug/l	2
Barium - F									130.1	5/5	84.7-182 ug/l	W-TP-12-05	500 ug/l	0
Beryllium - U	0.29	11/11	0.07-0.67 mg/kg	SP-04	0.4	30/32	ND-0.74 mg/kg	SBW-21 2-4'	3.6	5/5	2.1-6 ug/l	SBW-21-04	4 ug/l	1
Beryllium - F									1	1/5	ND-0.72 ug/l	W-TP-12-05	4 ug/l	0
Cadmium - U	0.45	4/11	ND-2.1 mg/kg	SP-03	0.31	7/32	ND-0.77 mg/kg	SBW-15 2-4'	1.4	2/5	ND-1.4 ug/l	SBW-21-04	2.5 ug/l	0
Cadmium - F									1.3	1/5	ND-1.3 ug/l	W-TP-12-05	2.5 ug/l	0
Calcium - U	6532	11/11	04-27100 mg/kg	SBW-21	4282	32/32	643-25800 mg/kg	SBW-21 12-14'	72880	5/5	61900-81800 ug/l	W-TP-12-05	-	0
Calcium - F									66160	5/5	40400-83400 ug/l	SBW-21-01	-	0
Chromium - U	8.5	10/11	4.5-12.1 mg/kg	SP-04	7.9	32/32	3.7-102 mg/kg	TP-11-05 10-12'	118.2	5/5	64.2-178 ug/l	SBW-21-01	25 ug/l	4
Chromium - F									5.4	2/5	ND-8.2 ug/l	SBW-21-03	25 ug/l	0
Cobalt - U	5.3	4/11	3.2-6.4 mg/kg	SP-03,SP-04	4.6	31/32	ND-10 mg/kg	SBW-16 10-12'	64.1	5/5	17.5-119 ug/l	SBW-21-04	-	0
Cobalt - F									15	4/5	ND-31.8 ug/l	W-TP-12-05	-	0
Copper - U	12	11/11	7.0-41.8 mg/kg	SP-03	14.8	32/32	2.3-107 mg/kg	SBW-15 2-4'	87.3	4/5	ND-183 ug/l	SBW-21-01	1000 ug/l	0
Copper - F									-	-	ND	-	1000 ug/l	0
Iron - U	11586	11/11	30-17100 mg/kg	SP-03	9327	32/32	482-33800 mg/kg	TP-14-05 10-12'	78880	5/5	28800-188000 ug/l	SBW-21-01	300 ug/l	4
Iron - F									827.8	5/5	488-1810 ug/l	SBW-21-02	300 ug/l	4
Lead - U	198	4/11	4.9-1580 mg/kg	SP-14	5887	32/32	2.5-488000 mg/kg	TP-11-05 10-12'	731.9	4/5	ND-337 ug/l	W-TP-12-05	10 ug/l	3
Lead - F									48	1/5	ND-232 ug/l	W-TP-12-05	10 ug/l	0
Magnesium - U	3323	11/11	90-11700 mg/kg	SBW-21	2378	30/32	ND-8880 mg/kg	SBW-21 12-14'	42140	5/5	24000-88100 ug/l	SBW-21-01	-	0
Magnesium - F									23008	5/5	20700-25000 ug/l	SBW-21-01	-	0
Manganese - U	238	11/11	84-488 mg/kg	SP-04	248.8	32/32	3.8-2380 mg/kg	SBW-15 4-6'	5188	5/5	1430-16400 ug/l	W-TP-12-05	50 ug/l	4
Manganese - F									3838	5/5	1200-13800 ug/l	W-TP-12-05	50 ug/l	4
Mercury - U	0.23	4/11	ND	-	1.36	9/32	ND-2130 mg/kg	TP-13-05 0-2'	0.4	3/5	ND-1.1 ug/l	W-TP-12-05	1 ug/l	0
Mercury - F									0.2	1/5	ND-0.2 ug/l	SBW-21-03	1 ug/l	0
Nickel - U	23.55	11/11	4.2-109 mg/kg	SP-14	341.8	31/32	ND-6310 mg/kg	TP-11-05 10-12'	1980.4	5/5	30.9-8370 ug/l	W-TP-12-05	100 ug/l	2
Nickel - F									1657.2	1/5	ND-8220 ug/l	W-TP-12-05	100 ug/l	0
Potassium - U	480	4/11	ND-888 mg/kg	SBW-18	854	21/32	ND-6770 mg/kg	SBW-18a 8-10'	24374	5/5	7870-67300 ug/l	W-TP-12-05	-	0
Potassium - F									17370	5/5	6400-50000 ug/l	W-TP-12-05	-	0
Selenium - U	-	-	ND	-	0.31	1/32	ND-0.29 mg/kg	TP-7-05 6-8'	-	-	ND	-	-	0
Selenium - F									3.7	2/5	ND-3.9 ug/l	SBW-21-01	-	0
Silver - U	0.022	1/11	ND-0.25 mg/kg	SBW-13	2.2	3/32	ND-41.8 mg/kg	TP-13-05 0-2'	-	-	ND	-	25 ug/l	0
Silver - F									4.8	1/5	ND-3.8 ug/l	SBW-21-03	25 ug/l	0
Sodium - U	161	11/11	121-216 mg/kg	SBW-16	1066	31/32	101-15300 mg/kg	SBW-17 8-10'	8842	3/5	ND-6380 ug/l	SBW-21-01	-	0
Sodium - F									8822	5/5	6300-16200 ug/l	W-TP-12-05	-	0
Thallium - U	-	-	ND-0.18 mg/kg	SP-03	0.15	16/32	ND-0.38 mg/kg	SBW-17 8-10'	2	1/5	ND-1.2 ug/l	SBW-21-04	2 ug/l	0
Thallium - F									-	-	ND	-	2 ug/l	0
Vanadium - U	8.4	11/11	6.6-14.0 mg/kg	SP-05	8.3	31/32	ND-85.9 mg/kg	TP-7-05 10-12'	73.4	5/5	29.9-134 ug/l	SBW-21-01	-	0
Vanadium - F									8.2	1/5	ND-7.8 ug/l	SBW-21-02	-	0
Zinc - U	114.7	11/11	22.1-885 mg/kg	SP-03	140.2	32/32	8.8-8880 mg/kg	TP-13-05 0-2'	898.4	5/5	69-1730 ug/l	W-TP-12-05	5000 ug/l	0
Zinc - F									236.8	3/5	ND-1150 ug/l	W-TP-12-05	5000 ug/l	0
Cyanide	0.36	1/11	ND-0.88 mg/kg	SP-02	0.82	8/29	ND-2 mg/kg	SBW-17 8-10'	-	-	NA	-	77 ug/l	
TOC	7881	5/5							-	-	NA	-		

NA - Not Analyzed ND - Not Detected R - Data Unusable U - Unfiltered F - Filtered

Burgess Brothers Superfund Site
Summary of Surface Water and Sediment Results

LANDFILL AREA

PARAMETERS	SURFACE WATER (8240)				SURFACE WATER (524.1)				SEDIMENTS			
	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.
Volatile Organics												
Vinyl chloride	84	4/10	ND–290 ug/l	SW–11–01	112.5	5/8	ND–460 ug/l	SW–02–01	279.64	4/13	ND–430 ug/kg	SED–11–01
Acetone	11.5	3/10	ND–12 ug/l	SW–02–01	3	1/8	ND–4 ug/l	SW–02–01	373.06	12/13	ND–400 ug/kg	SED–12–02
1,2–Dichloroethene (tot	377.2	9/10	ND–1300 ug/l	SW–02–01				SW–11–03	232.74	5/13	ND–1700 ug/kg	SED–11–02
Trichloroethene	137.8	9/10	ND–420 ug/l	SW–02–01	179	6/8	ND–920 ug/l	SW–02–01	155.05	3/13	ND–180 ug/kg	SED–12–02
PCE	17.6	4/10	ND–67 ug/l	SW–02–01	22.5	4/8	ND–67 ug/l	SW–02–01	106.12	1/13	ND–72 ug/kg	SED–12–02
Toluene	8.2	3/10	ND–18 ug/l	SW–02–01	4.72	3/8	ND–18 ug/l	SW–02–01	137.74	6/13	ND–190 ug/kg	SED–12–02
4–methyl–2–pentanone	11.5	2/10	ND–14 ug/l	SW–11–01				SW–02–01			ND	–
Bromodichloromethane	5.5	1/10	ND–10 ug/l	SW–11–02							ND	–
Dichlorodifluoromethane			ND–21 ug/l	–	5.46	1/8	ND–21 ug/l	SW–01–01			ND	–
Carbon Disulfide			ND	–	1.11	2/8	ND–2 ug/l	SW–02–01	103.8	1/13	ND–1.9 ug/kg	SED–12–03
cis–1,2–DCE			ND	–	524.1	6/8	ND–2600 ug/l	SW–02–01			NA	–
1,1,1 TCA			ND	–	0.5	1/8	ND–0.8 ug/l	SW–02–01			ND	–
Ethylbenzene			ND	–	0.73	1/8	ND–0.8 ug/l	SW–02–01			ND–18 ug/kg	SED–02–02
Oxylene			NA	–	0.77	1/8	ND–1.0 ug/l	SW–02–01			ND	–
1,2,4 trimethylbenzene			NA	–	1.39	2/8	ND–3.0 ug/l	SW–02–01			ND	–
1,1 DCE			ND	–	2.66	5/8	ND–8.0 ug/l	SW–03–01			ND	–
trans–1,2–DCE			ND	–	8.02	4/8	ND–23.0 ug/l	SW–02–01			NA	–
1,2 DCA			ND	–	0.71	1/8	ND–0.7 ug/l	SW–02–01			ND	–
m/p xylene			NA	–	0.77	1/8	ND–2 ug/l	SW–02–01			ND	–
Xylene (total)			ND	–	1.8	3/8	ND–3 ug/l	SW–12–03	111.36	4/13	ND–84 ug/kg	SED–02–02
1,3,5 trimethylbenzene			NA	–	0.91	1/8	ND–0.6 ug/l	SW–11–03			ND	–
2–Butanone									45.9	6/10	ND–69 ug/kg	SED–11–03
Methylene Chloride									103.06	1/13	ND–4.2 ug/kg	SED–11–03
Semi–volatile Organics			NA	–			NA	–			ND	–
PCBs/Pesticides												
PCB–1254			NA	–			NA	–	181	1/11	ND–74 ug/kg	SED–02–02
Inorganics												
Aluminum–U	278	7/13	ND–1290 ug/l	SW–10–01								
Aluminum–F	100	0/2							7283	7/14	3370–11600 mg/kg	SED–11–01
Antimony–U	31.2	0/13	ND–19 ug/l	SW–11–03–F							ND	–
Antimony–F	39.5	1/2										
Arsenic–U	2.8	2/13	ND–19 ug/l	SW–11–03					2.814	14/14	1.2–4.8 mg/kg	SED–11–01
Arsenic–F	8	0/2										
Barium–U	125.7	13/13	20–660 ug/l	SW–11–03					66.67	14/14	24.8–147 mg/kg	SED–11–03
Barium–F	41.5	2/2										
Beryllium–U			ND	–					0.62	14/14	ND–1.4 mg/kg	SED–02–02
Beryllium–F												
Cadmium–U	1.7	2/13	ND–0.47 ug/l	SW–11–03					0.822	6/14	ND–1.8 mg/kg	SED–11–03
Cadmium–F	0.31	1/2										
Calcium–U			3040–63300 ug/l	SW–11–03					2266	14/14	646–4660 mg/kg	SED–11–03
Calcium–F												
Chromium–U	5.8	2/13	ND–34 ug/l	SW–71–03					10.66	14/14	4–26.7 mg/kg	SED–11–01
Chromium–F	10	0/2										
Cobalt–U	5.3	1/13	ND–4.2 ug/l	SW–10–01					7.03	14/14	2.4–11.5 mg/kg	SED–11–01
Cobalt–F	10	0/2										
Copper–U	4.4	5/13	ND–4.9 ug/l	SW–09–02					10.25	13/14	4.9–21.3 mg/kg	SED–09–01
Copper–F	5	0/2										
Iron–U	46777	13/13	76–539000 ug/l	SW–11–03					24798	14/14	7370–63800 mg/kg	SED–11–03
Iron–F	100	2/2										
Lead–U	2.1	5/13	ND–6.6 ug/l	SW–10–01					31.37	14/14	7.3–70.3 mg/kg	SED–11–03
Lead–F	3	0/2										
Magnesium–U	7019	13/13	778–11800 ug/l	SW–11–03					1738	14/14	787–4080 mg/kg	SED–11–01
Magnesium–F	9050	2/2										
Manganese–U	2522	13/13	19.1–22800 ug/l	SW–11–03					674.5	13/14	184–1780 mg/kg	SED–11–03
Manganese–F	375	2/2										
Mercury–U			ND	–					0.22	5/14	ND–0.46 mg/kg	SED–11–03
Mercury–F												
Nickel–U			ND	–					26.2	6/14	4.1–69.8 mg/kg	SED–11–01
Nickel–F												
Potassium–U	3298	12/13	ND–6200 ug/l	SW–11–03–F					594	10/14	ND–1140 mg/kg	SED–11–01
Potassium–F	6250	2/2										
Selenium–U			ND	–					0.91	4/13	ND–1.9 mg/kg	SED–09–02
Selenium–F												
Silver–U	2.9	2/13	ND–6 ug/l	SW–12–03					0.74	2/14	ND–0.84 mg/kg	SED–09–01
Silver–F	10	0/2										
Sodium–U	4295	13/13	1500–7070 ug/l	SW–11–01					301	13/14	ND–466 mg/kg	SED–11–01
Sodium–F	3900	2/2										
Thallium–U			ND	–					0.37	6/14	ND–0.32 mg/kg	SED–02–02
Thallium–F												
Vanadium–U	6.6	5/13	ND–8.5 ug/l	SW–10–01					10.5	6/14	0.13–20.6 mg/kg	SED–11–01
Vanadium–F	10	0/2										
Zinc–U	25.4	2/13	ND–62.7 ug/l	SW–10–01					53.3	1/14	0.77–176 mg/kg	SED–11–01
Zinc–F	25.5	0/2										
Cyanide	5.1	1/11	ND–6 ug/l	SW–09–02							NA	

NA – Not Analyzed ND – Not Detected R – Data Unusable U – Unfiltered F – Filtered

Burgess Brothers Superfund Site
Summary of Surface Water and Sediment Results

UPSTREAM SAMPLES

PARAMETERS	SURFACE WATER				SEDIMENTS			
	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.
Volatile Organics								
Acetone	-	-	ND	-	71.67	3/6	ND-300 ug/kg	SED-08-02
Carbon Disulfide	0.5	1/3	ND-10 ug/l	SW-01B-01				
Semi-volatile Organics			ND	-	-	-	ND	-
PCBs / Pesticides			ND	-	-	-	ND	-
Inorganics								
Aluminum-U	761	4/4	ND-2140 ug/l	SW-08-02	15649	6/6	3060-7220 mg/kg	SED-01A-01
Aluminum-F								
Antimony-U	-	-	R	-			ND	-
Antimony-F								
Arsenic-U	3	1/4	ND-6 ug/l	SW-08-02	2.95	6/6	3.9-98.2 mg/kg	SED-08-02
Arsenic-F								
Barium-U	87.9	4/4	12.6-278 ug/l	SW-08-02	68.3	6/6	39-98.2 mg/kg	SED-08-02
Barium-F								
Beryllium-U	-	-	ND	-	2.62	6/6	0.39-0.73 mg/kg	SED-01A-02
Beryllium-F								
Cadmium-U	-	-	ND	-			ND	-
Cadmium-F								
Calcium-U	10155	4/4	5950-21000 ug/l	SW-08-02	1660	6/6	745-2490 mg/kg	SED-01A-02
Calcium-F								
Chromium-U	3.4	1/4	ND-5.6 ug/l	SW-08-02	5.28	6/6	3.6-6.5 mg/kg	SED-01B-01
Chromium-F								
Cobalt-U	9.9	1/4	ND-25.6 ug/l	SW-08-02	5.3	6/6	4-9 mg/kg	SED-08-02
Cobalt-F								
Copper-U	6.87	3/4	ND-12.2 ug/l	SW-08-02	5.5	6/6	4.3-6.6 mg/kg	SED-01A-02
Copper-F								
Iron-U	77527.75	4/4	44-309000 ug/l	SW-08-02	23218	6/6	6590-78900 mg/kg	SED-08-02
Iron-F								
Lead-U	3.075	3/4	ND-7.5 ug/l	SW-08-02	13.5	6/6	5.1-21.5 mg/kg	SED-01A-02
Lead-F								
Magnesium-U	2874	4/4	706-4390 ug/l	SW-01B-01	911.5	6/6	585-1280 mg/kg	SED-01A-02
Magnesium-F								
Manganese-U	725.5	4/4	12-2680 ug/l	SW-08-02	319.3	6/6	1.4-577 mg/kg	SED-08-02
Manganese-F								
Nickel-U	-	-	ND	-	3.6	6/6	1.7-6.2 mg/kg	SED-01B-02
Nickel-F								
Potassium-U	682	2/4	ND-1050 ug/l	SW-01B-02	205	1/6	ND-246 mg/kg	SED-01B-02
Potassium-F								
Selenium-U	-	-	ND	-	0.66	2/6	ND-1.1 mg/kg	SED-08-02
Selenium-F								
Silver-U	3	1/4	ND-6.6 ug/l	SW-01-03	0.37	1/6	ND-0.38 mg/kg	SED-08-01
Silver-F								
Sodium-U	2175	4/4	1830-3900 ug/l	SW-01-03	220	6/6	168-304 mg/kg	SED-01A-01
Sodium-F								
Thallium-U	-	-	ND	-	0.21	2/6	ND-0.35 mg/kg	SED-01A-02
Thallium-F								
Vanadium-U	6.8	1/4	ND-11.2 ug/l	SW-08-02	8.55	6/6	5.9-9.6 mg/kg	SED-01A-01
Vanadium-F								
Zinc-U	49.7	1/4	170 ug/l	SW-08-02	41	6/6	ND-0.35 mg/kg	SED-01A-02
Zinc-F								

NA - Not Analyzed ND - Not Detected R - Data Unusable U - Unfiltered F - Filtered

Feb. 16, 1995

Burgess Brothers Superfund Site
Summary of Soil and Ground Water Results

WEST OF THE LANDFILL AREA

	SURFACE SOILS				GROUND WATER					
PARAMETERS	Arithmetic Average	Freq.of Detection	Range	Location of Max. Conc.	Arithmetic Average	Freq.of Detection	Range	Location of Max. Conc.	Regulatory Limit MCL or VT PGWS	No. Over Reg.Limit
Volatile Organics	(ug/kg)				(ug/l)					
Vinyl Chloride	-	-	ND	-	12	2/15	ND-29 ug/l	W-09S1-04	0.2 ug/l	2
Acetone	11	2/3	ND-11 ug/kg	W-08S2	28.7	4/15	ND-88 ug/l	W-25S1-03	-	-
1,2-Dichloroethene (total)	-	-	ND	-	10.8	7/15	ND-30 ug/l	W-09S1-04	70 ug/l	-
Trichloroethene	-	-	ND	-	87	9/15	ND-390 ug/l	W-08S1-04	0.5 ug/l	9
Tetrachloroethene	-	-	ND	-	38	4/15	ND-200 ug/l	W-08S1-04	0.07 ug/l	4
Semivolatile Organics			NA	-			NA	-		
PCB/Pesticides			NA	-			NA	-		
Inorganics	(mg/kg)				(ug/l)		(ug/l)			
Aluminum-U	5800	3/3	3880-6410 mg/kg	W-08S2	44283	15/15	ND-154000	W-08S1-01	50-200 ug/l	15
Aluminum-F					104.88	6/15	ND-590	W-09S1-04		1
Antimony-U	-	-	R	-	47.64	4/15	ND-132	W-08S1-01	6 ug/l	3
Antimony-F					29.38	1/15	ND-14	W-09S1-04		1
Arsenic-U	1.55	3/3	0.87-1.8 mg/kg	W-08S2	4.75	9/12	ND-12	W-09S1-01	25 ug/l	1
Arsenic-F					3.5	4/12	ND-8.4	W-25S1-03		0
Barium-U	20.9	3/3	18.8-23.3 mg/kg	W-07S2	411.66	15/15	ND-1080	W-09S1-01	500 ug/l	4
Barium-F					38.59	14/15	ND-88.4	W-27T-05		0
Beryllium-U	0.22	3/3	0.08-0.28 mg/kg	W-08S2	3.34	13/15	ND-12.5	W-09S1-01	4 ug/l	2
Beryllium-F					0.833	0/15	ND	-		0
Cadmium-U	0.24	1/3	ND-0.25 mg/kg	W-07S2	1.28	2/15	ND-0.68	W-25S1-04	2.5 ug/l	0
Cadmium-F					1.19	0/15	ND	-		0
Calcium-U	360	3/3	298-608 mg/kg	W-07S2	168319	15/15	1220-512000	W-08S1-01	-	0
Calcium-F					29526	15/15	11700-113000	W-27T-05		0
Chromium-U	5.4	3/3	4.7-5.8 mg/kg	W-08S2	58.61	14/15	ND-186	W-09S1-01	25 ug/l	10
Chromium-F					4.99	2/15	ND-5.2	W-27T-05		0
Cobalt-U	9.2	3/3	3.3-3.8 mg/kg	W-08S2	78.49	15/15	ND-320	W-09S1-03-F	-	0
Cobalt-F					50.53	8/15	ND-320	W-09S1-04		0
Copper-U	5.1	3/3	5.0-6.3 mg/kg	W-08S2	73.17	9/15	ND-255	W-09S1-01	1000 ug/l	0
Copper-F					4.01	4/15	ND-9.6	W-08S1-04		0
Iron-U	8793	3/3	6550-9030 mg/kg	W-08S2	92613.33	15/15	ND-303000	W-09S1-01	300 ug/l	15
Iron-F					5432.97	11/15	ND-30600	W-25S1-04		7
Lead-U	25.4	3/3	3.2-11.3 mg/kg	W-08S2	36.72	13/15	ND-116	W-09S1-01	10 ug/l	
Lead-F					1.85	1/15	ND-1.8	W-27S1-05		13
Magnesium-U	1014	3/3	998-1500 mg/kg	W-07S2	86413.33	15/15	2800-253000	W-08S1-01	-	0
Magnesium-F					9865.99	15/15	2760-56000	W-27T-05		0
Manganese-U	101	3/3	76.5-292 mg/kg	W-07S2	10963	15/15	ND-80000	W-25S1-04	50 ug/l	0
Manganese-F					9262.47	14/15	ND-85100	W-25S1-04		15
Mercury-U	-	-	ND	-	0.278	5/14	ND-0.22	W-09S1-03	1 ug/l	10
Mercury-F					0.214	0/15	ND	-		0
Nickel-U	4.8	3/3	4.6-5.8 mg/kg	W-08S2	76.51	15/15	ND-240	W-09S1-01	100 ug/l	3
Nickel-F					15.199	9/15	ND-20.1	W-25S1-04		0
Potassium-U	303	2/3	133-718 mg/kg	W-07S2	7559	15/15	ND-19400	W-08S1-01	-	0
Potassium-F					1452.67	12/15	ND-6020	W-27T-05		0
Selenium-U	-	-	ND	-	10.91	0/12	ND	-	-	0
Selenium-F					4.66	0/15	ND	-		0
Silver-U	-	-	ND	-	5.92	1/15	ND-12	W-08S1-04	25 ug/l	0
Silver-F					5.01	2/15	ND-5.2	W-09S1-04		0
Sodium-U	155	3/3	135-172 mg/kg	W-08S2	5068.67	5/15	ND-8100	W-25S1-03	-	0
Sodium-F					3553.99	15/15	1320-9300	W-25S1-04		0
Thallium-U	0.2	3/3	0.18-0.21 mg/kg	W-08S2	2.65	2/15	ND-1.4	W-09S1-01& W-25S1-01	2 ug/l	0
Thallium-F					2.59	0/15	ND	-		0
Vanadium-U	9.8	3/3	8.4-8.9 mg/kg	W-08S2	66.28	15/15	ND-270	W-09S1-01	-	0
Vanadium-F					6.64	0/15	ND	-		0
Zinc-U	19	3/3	16.1-23.0 mg/kg	W-08S2	234.28	13/15	ND-721	W-08S1-01	5000 ug/l	0
Zinc-F					14.48	5/15	ND-18.4	W-26T-05		0

NA - Not Analyzed ND - Not Detected R - Data Unusable U - Unfiltered F - Filtered

Feb. 16, 1995

Burgess Brothers Superfund Site
SUMMARY OF SOIL AND GROUND WATER RESU LTS

HILLSIDE AREA

PARAMETERS	SURFACE SOILS				SOIL BORINGS				GROUND WATER					
	Arithmetic Average	Freq.of Detect.	Range	Location of Max. Conc.	Arithmetic Average	Freq.of Detect.	Range	Location of Max. Conc.	Arithmetic Average	Freq.of Detect.	Range	Location of Max. Conc.	Regulatory Limit MCL or VT PGWs	No. Over Reg. Limit
Volatile Organics														
Acetone			ND–18 ug/kg	SP–21			ND–72 ug/kg	W–24T 10–12'			ND		–	
1,2–Dichloroethene (total)			ND–16 ug/kg	SP–21			ND	–			ND		70 ug/l	
Toluene			ND	–			ND	–			ND–12 ug/l	W–24T–02	1000 ug/l	
Xylene (total)			ND	–			ND	–			ND–5 ug/l	W–24T–02	200 ug/l	
Semi–volatiles			NA	–			NA	–			ND	–		
PCB/pesticides			NA	–			NA	–			NA	–		
Inorganics														
Aluminum–U			4,470–14,600 mg/kg	SP–20			NA	–	56963	7/7	ND–149,000 ug/l	W–23T–01	50–200 ug/l	7
Aluminum–F							NA	–	78	2/7	ND–109 ug/l	W–23T–02F	50–200 ug/l	0
Antimony–U			ND				NA	–	59	3/7	ND–108 ug/l	W–23T–01	6 ug/l	3
Antimony–F							NA	–	38	1/7	ND–21 ug/l	W–24T–03F	6 ug/l	0
Arsenic–U			2.1–2.3 mg/kg	SP–20			NA	–	6	3/5	ND–12 ug/l	W–23T–03	25 ug/l	0
Arsenic–F							NA	–	4	0/7	ND	–	25 ug/l	0
Barium–U			20.7–63.6 mg/kg	SP–20			NA	–	391	7/7	ND–974 ug/l	W–23T–01	500 ug/l	3
Barium–F							NA	–	5	6/7	ND–7.8 ug/l	W–24T–03F	500 ug/l	0
Beryllium–U			.08–0.54 mg/kg	SP–20			NA	–	4	4/7	ND–10 ug/l	W–23T–01	4 ug/l	2
Beryllium–F							NA	–	0.7	0/7	ND	–	4 ug/l	0
Cadmium–U			ND–0.47 mg/kg	SP–20			NA	–	1.5	0/7	ND	–	2.5 ug/l	0
Cadmium–F							NA	–	2.2	0/7	ND	–	2.5 ug/l	0
Calcium–U			229–2010 mg/kg	SP–20			NA	–	120650	7/7	17,100–241,000 ug/l	W–24T–01	–	0
Calcium–F							NA	–	20983	6/7	17100–23300 ug/l	W–24T–03F	–	0
Chromium–U			4.6–12.3 mg/kg	SP–20			NA	–	76	7/7	ND–179 ug/l	W–23T–01	25 ug/l	4
Chromium–F							NA	–	3.6	1/7	ND–4.1 ug/l	W–23T–02F	25 ug/l	0
Cobalt–U			2.0–8.7 mg/kg	SP–20			NA	–	63	7/7	ND–152 ug/l	W–23T–01	–	0
Cobalt–F							NA	–	5.3	1/7	ND–4.2 ug/l	W–24T–03F	–	0
Copper–U			2.5–3.7 mg/kg	SP–20			NA	–	84	3/7	ND–221 ug/l	W–23T–01	1000 ug/l	0
Copper–F							NA	–	4.6	1/7	ND–8.4 ug/l	W–23T–01F	1000 ug/l	0
Iron–U			10,500–13,800 mg/kg	SP–20			NA	–	107050	7/7	ND–286,000 ug/l	W–23T–01	300 ug/l	7
Iron–F							NA	–	26.8	3/7	ND–46.2 ug/l	W–23T–02F	300 ug/l	0
Lead–U			13.2–15.3 mg/kg	SP–20			NA	–	42.4	4/7	ND–106 ug/l	W–23T–01	10 ug/l	4
Lead–F							NA	–	3.4	1/7	ND–11.2 ug/l	W–23T–02F	10 ug/l	1
Magnesium–U			670–1,400 mg/kg	SP–20			NA	–	71580	7/7	7,870–136,000 ug/l	W–23T–01	–	0
Magnesium–F							NA	–	9305	7/7	7870–10700 ug/l	W–24T–02F	–	0
Manganese–U			90.2–340 mg/kg	SP–20			NA	–	3400	7/7	ND–6,130 ug/l	W–23T–01	50 ug/l	7
Manganese–F							NA	–	118	6/7	ND–288 ug/l	W–24T–01F	50 ug/l	4
Mercury–U			ND	–			NA	–	0.23	1/7	ND–0.36 ug/l	W–23T–03	1 ug/l	2
Mercury–F							NA	–	0.2	0/7	ND	–	1 ug/l	0
Nickel–U			2.8–8.7 mg/kg	SP–20			NA	–	84	7/7	ND–212 ug/l	W–23T–01	100 ug/l	0
Nickel–F							NA	–	19	0/7	ND	–	100 ug/l	0
Potassium–U			173–230 mg/kg	SP–20			NA	–	7400	7/7	ND–16,800 ug/l	W–23T–01	–	0
Potassium–F							NA	–	1380	5/7	ND–1520 ug/l	W–23T–02F	–	0
Selenium–U			ND	–			NA	–	7.8	0/5	ND	–	–	0
Selenium–F							NA	–	4.5	0/5	ND	–	–	0
Silver–U			ND	–			NA	–	6	2/7	ND–9.2 ug/l	W–23T–01	25 ug/l	0
Silver–F							NA	–	5	2/7	ND–3.8 ug/l	W–24T–03F	25 ug/l	0
Sodium–U			156–179 mg/kg	SP–20			NA	–	3270	1/7	ND–1,900 ug/l	W–24T–03	–	0
Sodium–F							NA	–	1280	4/7	ND–1420 ug/l	W–23T–01F	–	0
Thallium–U			ND	–			NA	–	2.3	0/7	ND	–	2 ug/l	0
Thallium–F							NA	–	2.3	0/7	ND	–	2 ug/l	0
Vanadium–U			12.1–15.0 mg/kg	SP–20			NA	–	80	7/7	ND–219 ug/l	W–23T–01	–	0
Vanadium–F							NA	–	8	1/7	ND–6.5 ug/l	W–23T–02F	–	0
Zinc–U			15.5–50.0 mg/kg	SP–20			NA	–	250	5/7	ND–612 ug/l	W–23T–01	5000 ug/l	0
Zinc–F							NA	–	7.3	1/7	ND–2.6 ug/l	W–23T–02F	5000 ug/l	0
Cyanide–U										0/7	ND	–	–	0
Cyanide–F										0/7	ND	–	–	0

NA – Not Analyzed ND – Not Detected U – Unfiltered F – Filtered

Feb. 16, 1995

Burgess Brothers Superfund Site
Summary of Background Soil Results

BACKGROUND AREA

PARAMETERS	SURFACE SOILS				SOIL BORINGS			
	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.
Volatile Organics								
Acetone	23	1/3	ND–15 ug/kg	SP–19	28	1/3	ND–84 ug/kg	W–01B
Trichloroethene	–	–	ND	–	6	1/3	ND–7 ug/kg	W–01B
Semi–volatile Organics	–	–	NA	–	–	–	ND	–
PCBs/ Pesticides	–	–	NA	–	–	–	NA	–
Inorganics								
Aluminum	9953	3/3	8760–11500 mg/kg	SP–18	4610	5/5	2980–6240 mg/kg	W–01S1 10–12'
Antimony	–	–	ND	–	–	–	ND	–
Arsenic	2.15	2/3	0.46–3.0 mg/kg	SP–18	1.5	5/5	0.88–2.6 mg/kg	W–01B 32–34'
Barium	39.8	3/3	30–54.9 mg/kg	SP–18	80.7	5/5	29.5–281 mg/kg	W–01DI 210–212'
Beryllium	–	–	0.30–0.65 mg/kg	SP–18	0.76	5/5	0.4–2.3 mg/kg	W–01DI 210–212'
Cadmium	–	–	ND	–	–	–	ND	–
Calcium	–	–	202–470 mg/kg	SP–17	5148	5/5	452–13200 mg/kg	W–01B 32–34'
Chromium	7.8	3/3	7.3–9.3 mg/kg	SP–18	3.8	5/5	1.8–4.5 mg/kg	W–01S1 10–12'
Cobalt	6.3	1/3	3.6–9.9 mg/kg	SP–18	7.5	5/5	3.5–22.1 mg/kg	W–01DI 210–212'
Copper	5.4	3/3	4.0–6.4 mg/kg	SP–18	12.6	5/5	5.8–40.2 mg/kg	W–01DI 210–212'
Iron	16333	3/3	12600–20100 mg/kg	SP–17	20748	5/5	6810–69800 mg/kg	W–01DI 210–212'
Lead	–	–	5.3–19.6 mg/kg	SP–18	8.5	5/5	3.3–19.4 mg/kg	W–01DI 210–212'
Magnesium	972	3/3	846–1050 mg/kg	SP–19	3024	5/5	508–6690 mg/kg	W–01B 32–34'
Manganese	345	2/2	77–708 mg/kg	SP–18	575	5/5	132–2140 mg/kg	W–01DI 210–212'
Mercury	–	–	ND	–	0.12	1/5	ND–0.15 mg/kg	W–01B 32–34'
Nickel	–	–	5.4–7.0 mg/kg	SP–18	22	5/5	4.4–58.7 mg/kg	W–01DI 210–212'
Potassium	–	–	63.4–423 mg/kg	SP–18	618	5/5	32–831 mg/kg	W–01S1 10–12'
Selenium	–	–	ND	–	–	–	ND	–
Silver	–	–	ND	–	0.26	1/5	ND–0.36 mg/kg	W–01S1 10–12'
Sodium	–	–	2.2–146 mg/kg	SP–18	164	5/5	130–235 mg/kg	W–01DI 4–6'
Thallium	–	–	0.17–0.23 mg/kg	SP–18	0.41	4/5	0.13–1.2 mg/kg	W–01DI 210–212'
Vanadium	10.4	3/3	0.23–17.9 mg/kg	SP–18	9	5/5	6.1–16.1 mg/kg	W–01DI 210–212'
Zinc	28.4	3/3	0.34–42.9 mg/kg	SP–19	49	5/5	20.2–175 mg/kg	W–01DI 210–212'

NA – Not Analyzed ND – Not Detected R – Data Unusable

Burgess Brothers Superfund Site
Summary of Ground Water Results

RESIDENTIAL WELLS

PARAMETERS	GROUND WATER					
	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.	Regulatory Limit MCL or VT PGWS	No. Over Reg. Limit
Volatile Organics			ND	-		
Semi-volatile Organics			NA	-		
PCBs / Pesticides			NA	-		
Inorganics						
Aluminum-U	129	1/14	ND-33 ug/l	Dickinson-02	50-200 ug/l	-
Aluminum-F	70	0/14	ND	-	-	-
Antimony-U	37	0/14	nd	-	6 ug/l	-
Antimony-F	39	2/14	ND-13 ug/l	Ryspg-04	6 ug/l	2
Arsenic-U	4	0/14	ND	-	25 ug/l	-
Arsenic-F	5	0/14	ND	-	-	-
Barium-U	44	14/14	8.4-150 ug/l	Dickinson-04	500 ug/l	-
Barium-F	51	14/14	10.1-141 ug/l	Dickinson-01	-	-
Beryllium-U	1	0/14	ND	-	4 ug/l	-
Beryllium-F	1	0/14	ND	-	-	-
Cadmium-U	1	4/14	ND-0.33 ug/l	Dickinson-03	2.5 ug/l	-
Cadmium-F	1	0/14	ND	-	-	-
Calcium-U	34379	14/14	8900-126000 ug/l	Dickinson-04	-	-
Calcium-F	40500	14/14	9500-11000 ug/l	Dickinson-04	-	-
Chromium-U	5	4/14	ND-5.3 ug/l	Dickinson-03	25 ug/l	-
Chromium-F	6	3/14	ND-6.7 ug/l	Ryspg-03	-	-
Cobalt-U	6	1/14	ND-4.2 ug/l	Olin-03	-	-
Cobalt-F	7	1/14	ND-4.9 ug/l	Ryspg-03	-	-
Copper-U	15	8/14	ND-40 ug/l	Dickinson-04	1000 ug/l	-
Copper-F	10	7/14	ND-32 ug/l	Dickinson-04	-	-
Iron-U	45	8/14	ND-130 ug/l	Dickinson-03	300 ug/l	-
Iron-F	35	5/14	ND-76 ug/l	Dickinson-03	-	-
Lead-U	5	9/14	ND-18.6 ug/l	Dickinson-01	10 ug/l	2
Lead-F	2	5/15	ND-4.6 ug/l	Dickinson-03	-	-
Magnesium-U	9957	14/14	3600-30300 ug/l	Dickinson-04	-	-
Magnesium-F	11948	14/14	3900-27500 ug/l	Dickinson-04	-	-
Manganese-U	5	3/14	ND-1.4 ug/l	Dickinson-02	50 ug/l	-
Manganese-F	6	0/14	ND	-	-	-
Mercury-U	0.2	0/14	ND	-	1 ug/l	-
Mercury-F	0.2	1/14	ND-0.21 ug/l	Ryspg-02	-	-
Nickel-U	23	0/14	ND	-	100 ug/l	-
Nickel-F	26	0/14	ND	-	-	-
Potassium-U	890	6/14	ND-2700 ug/l	Dickinson-04	-	-
Potassium-F	1471	11/14	ND-2300 ug/l	Dickinson-03	-	-
Selenium-U	4	0/14	ND	-	-	-
Selenium-F	4	0/14	ND	-	-	-
Silver-U	6	1/14	ND-3.3 ug/l	Dickinson-03	25 ug/l	-
Silver-F	7	3/14	ND-3.8 ug/l	Dickinson-03	-	-
Sodium-U	104895	11/16	ND-363000 ug/l	Dickinson-05	-	-
Sodium-F	105405	15/16	ND-326000 ug/l	Dickinson-05	-	-
Thallium-U	5	2/14	ND-1.5 ug/l	Olin-04	2 ug/l	-
Thallium-F	3	0/14	ND	-	-	-
Vanadium-U	7	0/14	ND	-	-	-
Vanadium-F	8	4/14	ND-9.6 ug/l	Olin-01	-	-
Zinc-U	15	4/14	ND-59 ug/l	Dickinson-03	5000 ug/l	-
Zinc-F	11	5/14	ND-24 ug/l	Ryspg-03	-	-

NA - Not Analyzed ND - Not Detected U - Unfiltered F - Filtered

Burgess Brothers Superfund Site
Summary of Soil and Ground Water Results

MARSHY AREA

PARAMETERS	SURFACE SOILS				SOIL BORINGS				GROUND WATER					
	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.	Regulatory Limit MCL or VT PGWS	No. Over Reg. Limit
Volatile Organics	(ug/kg)				(ug/kg)				(ug/l)					
Vinyl Chloride	251	2/21	ND–4900 ug/kg	SP–07	19	4/25	ND–110 ug/kg	W–11S1 2–4', 6–8'	285.9	2/58	ND–2300 ug/l	W–11S1–02	0.2 ug/l	2
Methylene Chloride			ND	–	6	1/25	ND–8 ug/kg	W–04B 0–3'			ND	–	–	–
Acetone	106	3/21	ND–1100 ug/kg	SP–07	66	22/25	ND–320 ug/kg	W–11S1 0–2'			ND	–	–	–
Carbon Disulfide	12	3/21	ND–27 ug/kg	SP–07	6.1	1/25	ND–6 ug/kg	W–04B 3–6'	283.5	1/58	ND–1600 ug/l	W–22S1–02	–	–
1,1–Dichloroethene	11	1/21	ND–48 ug/kg	SP–07			ND	–	275	3/56	ND–620 ug/l	W–02–03	0.7 ug/l	3
1,1–Dichloroethene	10	1/21	ND–20 ug/kg	SP–07			ND	–			ND	–	–	–
1,2–Dichloroethene (total)	3233	2/21	ND–66,000 ug/kg	SP–07	54	10/25	ND–620 ug/kg	W–11S1 8–10'	3815	2/58	ND–32,000 ug/l	W–03–01	70 ug/l	2
1,2–Dichloroethane			ND	–			ND	–	275	2/56	ND–9 ug/l	W–04T–05	0.5 ug/l	2
2–Butanone	44	5/21	ND–380 ug/kg	SP–07			ND	–			ND	–	–	–
1,1,1–Trichloroethane	10	1/21	ND–21 ug/kg	SP–07			ND	–			ND	–	100 ug/l	–
Trichloroethene	103	3/21	ND–1500 ug/kg	SP–11	57	14/25	ND–320 ug/kg	W–11S1 8–10'	3911	21/59	ND–40,000 ug/l	W–22S1–02	0.5 ug/l	31
Benzene	10	1/21	ND–20 ug/kg	SP–07			ND	–	285	2/58	ND–550 ug/l	W–02–03	0.5 ug/l	2
4–methyl–2–pentanone	21	1/21	ND–68 ug/kg	SP–07	20	2/25	ND–29 ug/kg	W–11S1 2–4', 4–6'			ND	–	–	–
2–Hexanone			ND	–			ND	–	289	1/58	ND–48 ug/l	W–11S1–04	–	–
Tetrachloroethene	307	3/21	ND–5300 ug/kg	SP–11	47	6/25	ND–340 ug/kg	W–03T 10–12'	984.6	16/58	ND–21 000 ug/l	W–TP–12–05	0.07 ug/l	16
Toluene	806	6/21	ND–15,000 ug/kg	SP–07			ND	–	285	1/58	ND–810 ug/l	W–02–03	1000 ug/l	–
Chlorobenzene			ND	–			ND	–	275	1/56	ND–580 ug/l	W–02–03	50 ug/l	1
Ethylbenzene	20	2/21	ND–230 ug/kg	SP–07			ND	–			ND	–	–	–
Xylene (total)	53	2/21	ND–840 ug/kg	SP–07			ND	–			ND	–	–	–
Semivolatile Organics	(ug/kg)													
Phenol			ND	–			NA	–	11.2	1/51	ND–29 ug/l	W–04B–02	–	
1,3–Dichlorobenzene			ND	–			NA	–	19	1/51	ND–12 ug/l	W–TP–12–05	–	
1,4–Dichlorobenzene			ND	–			NA	–	9.2	1/51	ND–37 ug/l	W–TP–12–05	–	
4–Methylphenol			ND	–			NA	–			ND–12 ug/l	W–05–02	–	
Acenaphthylene	649	1/5	ND–810 ug/kg	SP–07			NA	–			ND	–	–	
Phenanthrene	3648	1/5	ND–14,000 ug/kg	SP–07			NA	–			ND	–	–	
Anthracene	1273	1/5	ND–1500 ug/kg	SP–07			NA	–			ND	–	–	
Benzo(a)anthracene	1444	1/5	ND–4900 ug/kg	SP–07			NA	–			ND	–	–	
Chrysene	1684	1/5	ND–6100 ug/kg	SP–07			NA	–			ND	–	–	
Benzo(b)fluoranthene	1804	1/5	ND–5700 ug/kg	SP–07			NA	–			ND	–	–	
Benzo(k)fluoranthene	1444	1/5	ND–4900 ug/kg	SP–07			NA	–			ND	–	–	
Benzo(a)pyrene	1384	1/5	ND–4600 ug/kg	SP–07			NA	–			ND	–	–	
Indeno(1,2,3–cd)pyrene	1124	1/5	ND–3300 ug/kg	SP–07			NA	–			ND	–	–	
Pyrene	2984	1/5	ND–12,000 ug/kg	SP–07			NA	–			ND	–	–	
bis–(2 Et)phthalate			ND	–			NA	–	16.7	1/51	ND–26 ug/l	W–02–02	–	
Fluoranthene	2864	1/5	ND–12,000 ug/kg	SP–07			NA	–	9.7	1/51	ND–3.2 ug/l	W–11S1–03	–	
PCB/Pesticides											ND	–	–	
			ND	–			NA	–						
Inorganics	(mg/kg)										ND	–	–	
Aluminum–U	9660	21/21	660–24900 mg/kg	SP–30–05			NA	–	(ug/l)		(ug/l)			
Aluminum–F									46152.28	42/42	ND–234000	W–11S1–01	50–200 ug/l	42
Antimony–U	1.58	7/21	ND–6.5mg/kg	SP–07			NA	–	275.03	29/41	ND–6910	W–03T–05		7
Antimony–F									49.86	21/42	ND–102	W–12S1–01	6 ug/l	21
Arsenic–U	1.5	21/21	0.27–4.2 mg/kg	SP–07			NA	–	25.75	14/41	ND–32	W–06S–03		14
Arsenic–F									4.82	16/42	ND–13	W–11S1–03	25 ug/l	6
Barium–U	80.7	21/21	21.6–280 mg/kg	SP–07			NA	–	3.73	11/41	ND–4.8	W–11S1–01		0
Barium–F									416.75	42/42	4.8–1630	W–11S1–01	600 ug/l	3
Beryllium–U	0.4	21/21	0.05–1.3 mg/kg	SP–20–05			NA	–	61.25	41/41	4.8–660	W–02–03		1
Beryllium–F									3.87	21/42	ND–13.4	W–11S1–01	4 ug/l	0
Cadmium–U	0.66	6/21	ND–4.5 mg/kg	SP–26–05			NA	–	0.79	0/41	ND	–		0
Cadmium–F									1.86	13/42	ND–4.4	W–22S1–03	2.5 ug/l	2
Calcium–U	1514	21/21	286–3120 mg/kg	SP–26–05			NA	–	1.49	3/41	ND–6.36	W–12S1–03		0
Calcium–F									167276.1	42/42	ND–779000	W–11S1–01	–	0
Chromium–U	8.4	21/21	5.0–19.8 mg/kg	SP–30–05			NA	–	37634.14	41/41	19300–97100	W–02–03		0
Chromium–F									94.86	41/42	ND–681	W–12S1–01	25 ug/l	29
Cobalt–U	4.8	21/21	1.5–17 mg/kg	SP–30–05			NA	–	0.12	3/41	ND–0.2	W–22S1–01		0
Cobalt–F									69.21	38/42	ND–329	W–12S1–01	–	0
Copper–U	11.9	21/21	2.7–51.0 mg/kg	SP–07			NA	–	5.84	4/41	ND–6.3	W–11S1–01		0
Copper–F									82.57	30/42	ND–364	W–12S1–01	1000 ug/l	0
Iron–U	13554	21/21	350–29400 mg/kg	SP–07			NA	–	4.39	0/41	ND–10.9	W–12S1–02		0
Iron–F									66065.8	42/42	ND–478000	W–11S1–01	300 ug/l	42
Lead–U	165.5	21/21	9.7–1040 mg/kg	SP–07			NA	–	4642.19	29/41	ND–51800	W–11S1–03		12
Lead–F									57.25	26/42	ND–250	W–04B–03	15 ug/l	30
Magnesium–U	1181	21/21	404–1980 mg/kg	SP–26–05			NA	–	2.69	7/41	ND–3.8	W–03T–02		0
Magnesium–F									68069.04	42/42	ND–330000	W–11S1–01	–	0
Manganese–U	371	21/21	31.1–3060 mg/kg	SP–06			NA	–	15798.04	39/41	ND–30300	W–02–03		0
Manganese–F									3491.02	42/42	ND–15800	W–11S1–01	50 ug/l	42
Mercury–U	0.15	1/21	ND–0.36 mg/kg	SP–07			NA	–	668.67	6/41	ND–47400	W–11S1–02		29
Mercury–F									0.31	17/40	ND–.56	W–12S1–01	1 ug/l	0
Nickel–U	80	21/21	3.9–666 mg/kg	SP–10			NA	–	0.19	0/41	ND	–		0
Nickel–F									180.13	42/42	ND–1400	W–04S1–01	100 ug/l	14
Potassium–U	481	21/21	100–1530 mg/kg	SP–07			NA	–	18.7	21/41	ND–62	W–04S–03		0
Potassium–F									5225.21	41/42	ND–34100	W–11S1–01	–	0
Selenium–U	0.43	6/21	ND–0.62 mg/kg	SP–30–05			NA	–	3499.66	18/41	ND–12000	W–11S1–02		0
Selenium–F									2.29	9/20	ND–10	W–02–03–F	–	0
Silver–U			ND	–			NA	–	4.34	3/41	ND–19	W–02–03		0
Silver–F									5.02	12/42	ND–11	W–11S1–03F	25 ug/l	0
Sodium–U	383	21/21	162–1150 mg/kg	SP–07			NA	–	5.86	13/41	ND–12	W–06D–03		0
Sodium–F									6897.62	21/42	ND–46300	W–22S1–02	–	0
Thallium–U	0.21	6/21	ND–0.24 mg/kg	SP–12			NA	–	9893.41	39/41	ND–46100	W–22S1–02		0
Thallium–F									3.89	3/42	ND–1.4	W–12S1–04F	2 ug/l	1
Vanadium–U	13.7	21/21	7.7–25.2 mg/kg	SP–23–05			NA	–	2.5	1/41	ND–1.4	W–12S1–04		0
Vanadium–F									66.85	34/42	ND–305	W–11S1–01	–	0
Zinc–U	194	21/21	22.6–715 mg/kg	SP–06			NA	–	7.42	3/41	ND–10	W–11S1–03		0
Zinc–F									283.41	39/42	ND–1240	W–12S1–01	5000 ug/l	0
Cyanide–U									5	13/41	ND–16	W–03T–02		0
Cyanide–F									13.92	8/19	–	–		0
									0	NA	–	–		0

NA – Not Analyzed ND – Not Detected R –Data Unusable

Burgess Brothers Superfund Site
Summary of Soil and Ground Wat er Results

SOIL STAGING AREA

	SURFACE SOILS				GROUND WATER					
PARAMETERS	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc	No. Over Reg. Limit	Reg. Limit MCL or VT PGWS
Volatile Organics	(ug/kg)				(ug/l)					
Acetone	10	1/2	8 ug/kg	SP-01	5.2	1/9	ND-6.8 ug/l	W-07S-04	-	
1,1,1-Trichloroethane			ND	-	5.8	1/9	ND-12 ug/l	W-07S1-02	100 ug/l	
Trichloroethene			ND	-	6.7	1/9	ND-20 ug/l	W-07S1-02	0.5 ug/l	
Benzene			ND	-	5.2	1/9	ND-7 ug/l	W-07S1-02	0.5 ug/l	
Toluene			ND	-	12.6	2/9	ND-55 ug/l	W-07S1-02	1000 ug/l	
Ethylbenzene			ND	-	6.4	4/9	1.1-16 ug/l	W-08S1-02	340 ug/l	
Xylene (total)	10	1/2	14 ug/kg	SP-01	444.4	3/9	ND-230 ug/l	W-07S1-02	200 ug/l	
Semivolatile Organics										
Bis (2 ethylhexyl) phthalate			ND	-	7.16	4/9	ND-7.3 ug/l	SBW-10-03	-	
Benzyl Alcohol			ND	-			ND			
Naphthalene			ND	-	6.1	1/9	ND-4.9 ug/l	W-07DI-03	-	
Benzoic Acid			ND	-	14.8	1/9	ND-11 ug/l	W-07S1-01	-	
			ND	-	17.1	1/9	U-33 ug/l	W-07DI-03	-	
PCBs/Pesticides										
Inorganics	(mg/kg)				(ug/l)					
Aluminum-U	4840	2/2	4170-5510 mg/kg	SP-01	58425	8/8	ND-295000 ug/l	SBW-10-01	50-200 ug/l	8
Aluminu-F					97.29	3/8	ND-350 ug/l	SBW-10-03		1
Antimony-U	-	-	R	-	52.79	3/8	ND-29.1 ug/l	W-07S1-01	6 ug/l	3
Antimony-F					26	2/8	ND-16 ug/l	W-07S1-04		2
Arsenic-U	2.4	2/2	1.8-2.9 mg/kg	SP-01	3.75	3/8	ND-4.6 ug/l	W-07S1-03	25 ug/l	-
Arsenic-F							ND	-		-
Barium-U	77	2/2	32.0-122 mg/kg	SBW-10	821.75	8/8	11.3-2350 ug/l	SBW-10-01	5000 ug/l	4
Barium-F					53.7	8/8	8-1-200 ug/l	SBW-10-03		-
Beryllium-U	0.18	2/2	0.08-0.29 mg/kg	SP-01	4.76	8/8	ND-16.6 ug/l	SBW-10-01	4 ug/l	1
Beryllium-F							ND	-		-
Cadmium-U	0.26	1/2	ND-.30 mg/kg	SBW-10	1.675	2/8	ND-1 ug/l	W-07S1-04	2.5 ug/l	-
Cadmium-F							ND	-		-
Calcium-U	1165	2/2	1140-1190 mg/kg	SBW-10	208800	8/8	31800-491000 ug/l	SBW-10-01	-	-
Calcium-F					49075	8/8	31800-90300 ug/l	W-07S1-03		-
Chromium-U	5.2	2/2	4.5-5.9 mg/kg	SP-01	68.06	8/8	ND-290 ug/l	SBW-10-01	2.5 ug/l	5
Chromium-F							ND	-		-
Cobalt-U	8.4	2/2	5.2-11.5 mg/kg	SBW-10	95.71	8/8	ND-277 ug/l	SBW-10-01	-	-
Cobalt-F							ND	-		-
Copper-U	6.1	2/2	5.6-6.5 mg/kg	SP-01	100.61	5/8	ND-423 ug/l	SBW-10-01	1000 ug/l	-
Copper-F							ND	-		-
Iron-U	9130	2/2	6460-11800 mg/kg	SP-01	110325	8/8	ND-613000 ug/l	SBW-10-01	300 ug/l	8
Iron-F					58.93	2/8	ND-300 ug/l	SBW-10-03		1
Lead-U	9.55	2/2	9.2-9.9 mg/kg	SP-01	65.51	8/8	ND-163 ug/l	SBW-10-01	10 ug/l	8
Lead-F					1.55	2/8	ND-1 ug/l	SBW-10-01		-
Magnesium-U	1480	2/2	1430-1530 mg/kg	SP-01	119662.5	8/8	11300-316000 ug/l	SBW-10-01	-	-
Magnesium-F					18912.5	8/8	9900-33800 ug/l	W-07S1-03		-
Manganese-U	1375	2/2	279-2470 mg/kg	SBW-10	5605	8/8	ND-14600 ug/l	SBW-10-01	50 ug/l	8
Manganese-F					582.76	6/8	ND-2030 ug/l	W-07S1-01		4
Mercury-U	-	-	ND	-			ND	-	1 ug/l	-
Mercury-F							ND	-		-
Nickel-U	7.55	2/2	8.3-6.8 mg/kg	SP-01	80.36	8/8	ND-371 ug/l	SBW-10-01	100 ug/l	1
Nickel-F							ND	-		-
Potassium-U	405	2/2	250-560 mg/kg	SBW-10	9558.75	7/8	ND-38200 ug/l	SBW-10-01	-	-
Potassium-F					2151.25	4/8	ND-3800 ug/l	W-07S1-04		-
Selenium-U	-	-	ND	-			ND	-	-	-
Selenium-F							ND	-		-
Silver-U	-	-	ND	-			ND	-	25 ug/l	-
Silver-F					6.27	1/8	ND-9.6 ug/l	W-07S1-03		-
Sodium-U	165	2/2	150-181 mg/kg	SBW-10	10590	2/8	ND-56100 ug/l	W-07S1-04	-	-
Sodium-F					9640	7/8	ND-56100 ug/l	W-07S1-04		-
Thallium-U	-	-	ND	-	3.64	1/8	ND-1.1 ug/l	SBW-10-01	2 ug/l	-
Thallium-F							ND	-		-
Vanadium-U	7.4	2/2	6.8-7.9 mg/kg	SP-01	80.3	8/8	ND-382 ug/l	SBW-10-01	-	-
Vanadium-F					8.98	2/8	ND-7.3 ug/l	W-07S1-02		-
Zinc-U	27.2	2/2	24.7-29.7 mg/kg	SP-01	278	8/8	ND-1280 ug/l	SBW-10-01	0	-
Zinc-F					6.83	1/8	ND-8.6 ug/l	SBW-10-03		-

NA - Not Analyzed ND - Not Detected R - Data Unusable U - Unfiltered F - Filtered

DOWNSTREAM SAMPLES

	SURFACE WATER (6240)				SURFACE WATER (524.2)				SEDIMENTS			
PARAMETERS	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.	Arithmetic Average	Freq. of Detection	Range	Location of Max. Conc.
Volatile Organics												
1,2 DCE	82.6	5/10	ND–560 ug/l	SW–03–01	–	–	ND	–	9.25	2/18	ND–35 ug/kg	SED–03–01
Trichloroethene	23.3	3/10	ND–140 ug/l	SW–03–01	32.72	8/17	ND–270 ug/l	SW–03–01	13.4	6/18	ND–56 ug/kg	SED–04–01
Acetone	9	2/10	ND–5 ug/l	SW–03–01 & SW–14–01	1.81	1/17	ND–3 ug/l	SW–06–02	30.56	3/18	ND–150 ug/kg	SED–15–02
PCE	6.4	2/10	ND–17 ug/l	SW–03–01	4.49	7/17	ND–22 ug/l	SW–03–03	18.03	4/18	ND–130 ug/kg	SED–04–02
Carbon Disulfide	31.6	4/10	ND–230 ug/l	SW–03–01	0.98	1/17	ND–1.0 ug/l	SW–15–01	7.5	1/18	ND–2.6 ug/kg	SED–14–03
Vinyl Chloride	14.1	1/10	ND–49 ug/l	SW–03–01	10.97	6/17	ND–120 ug/l	SW–03–01	–	–	ND	–
1,1–Dichloroethene	4.7	1/10	ND–2 ug/l	SW–03–01	0.97	2/17	ND–2 ug/l	SW–03–01	–	–	ND	–
Toluene	4.7	1/10	ND–2 ug/l	SW–03–01	1.15	1/17	ND–3 ug/l	SW–03–01	–	–	ND	–
Dichlorodifluoromethane			ND	–	1.17	1/17	ND–4 ug/l	SW–03–01	–	–	ND	–
cis–1,2–Dichloroethene			NA	–	92.44	8/17	ND–780 ug/l	SW–03–01	–	–	ND	–
trans1,2–DCE			NA	–	1.24	4/17	ND–5 ug/l	SW–03–01			ND	–
Methylene Chloride			ND	–					7.5	1/18	ND–2.5 ug/kg	SED–14–03
Semi–volatile Organics												
Phenanthrene			ND	–					519	1/13	ND–620 ug/kg	SED–05–02
Fluouranthene			ND	–					531	1/13	ND–780 ug/kg	SED–05–02
Pyrene			ND	–					517	1/13	ND–600 ug/kg	SED–05–02
benzo(b)fluoranthene			ND	–					508	1/13	ND–480 ug/kg	SED–05–02
PCBs / Pesticides												
4,4' DDT			ND	–					14.3	1/13	ND–6.4 ug/kg	SED–05–02
Inorganics												
Aluminum–U	194.23	20/26	ND–884 ug/l	SW–03–01					5151	18/18	2380–10200 mg/kg	SED–03–02
Aluminum–F			ND									
Antimony–U	36.48	5/62	ND–60 ug/l	SW–16–03–F					–	–	ND	–
Antimony–F	50.38	3/11										
Arsenic–U			ND	–					1.54	18/18	0.89–2.1 mg/kg	SED–07–02
Arsenic–F			ND									
Barium–U	32.91	26/25	ND–66.4 ug/l	SW–03–01					61	18/18	24.0–108 mg/kg	SED–03–02
Barium–F	18.45	10/11										
Beryllium–U			ND						0.52	18/18	0.33–0.81 mg/kg	SED–03–02
Beryllium–F	3.64	1/11	ND–20 ug/l	SW–03–03–F								
Cadmium–U	1.278	8/23	ND–0.43 ug/l	SW–07–03–F					0.39	6/18	ND–0.73 mg/kg	SED–03–02
Cadmium–F	0.439	8/11										
Calcium–U	11559	26/26	3370–26900 ug/l	SW–06–01					1908	17/18	ND–3630 mg/kg	SED–05–02
Calcium–F	10527.27	11/11										
Chromium–U	5.92	4/25	ND–9.9 ug/l	SW–05–03–F					5.68	18/18	3.1–9.2 mg/kg	SED–03–02
Chromium–F	9.65	3/11										
Cobalt–U	6.87	1/25	ND–5.8 ug/l	SW–03–02					6.07	18/18	2.6–23.3 mg/kg	SED–06–02
Cobalt–F			ND									
Copper–U	5.41	8/26	ND–6 ug/l	SW–06–02					5.38	18/18	2.7–9.9 mg/kg	SED–06–02
Copper–F	4.88	1/11										
Iron–U	483.92	26/26	ND–3150 ug/l	SW–03–01					10169	17/18	6440–17500 mg/kg	SED–03–02
Iron–F	62.36	9/11										
Lead–U	1.72	16/26	ND–3.5 ug/l	SW–03–01					11.96	18/18	6.4–22.5 mg/kg	SED–03–02
Lead–F			ND									
Magnesium–U	4075.54	26/26	806–9970 ug/l	SW–06–01					1269	18/18	512–2560 mg/kg	SED–05–02
Magnesium–F	3690	11/11										
Manganese–U	112.61	26/26	ND–681 ug/l	SW–03–01					576.7	18/18	117–1170 mg/kg	SED–13–02
Manganese–F	38.16	9/11										
Mercury–U			ND	–					0.16	5/18	ND–0.31 mg/kg	SED–14–02
Mercury–F			ND									
Nickel–U	21.06	2/26	ND–7.5 ug/l	SW–03–01					13.63	17/18	2.7–24.2 mg/kg	SED–07–02
Nickel–F			ND									
Potassium–U	1932.73	15/26	ND–4310 ug/l	SW–15–01					346	11/18	ND–603 mg/kg	SED–05–02
Potassium–F	2930	7/11										
Selenium–U	3.66	2/26	ND–2.4 ug/l	SW–17–03					0.89	6/15	ND–3 mg/kg	SED–13–02
Selenium–F			ND									
Silver–U	3.85	11/26	ND–7.9 ug/l	SW–03–03					–		ND	–
Silver–F	7.15	6/11										
Sodium–U	3540.77	25/26	ND–6090 ug/l	SW–14–01					196	18/18	136–314 mg/kg	SED–03–02
Sodium–F	3609	7/11										
Thallium–U			ND	–					0.18	2/18	ND–0.19 mg/kg	SED–14–01
Thallium–F												
Vanadium–U			ND	–					7.97	18/18	4.5–12.7 mg/kg	SED–03–02
Vanadium–F												
Zinc–U			ND	–					48.7	18/18	24.1–79.9 mg/kg	SED–03–02
Zinc–F												
Cyanide–U			ND	–								
Cyanide–F												

Table 34

BURGESS BROTHERS SITE
BENNINGTON, VERMONT
RI SOIL VAPOR SURVEY RESULTS

Sample	Vinyl Chloride	t-1,2-DCE	1,1-DCA	1,2-DCA	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethyl-benzene	Xylene	Other VOCs	Total VOCs
SG-1-1'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	<0.002	<0.005	<0.005	3.869	3.869
SG-1-4' HS	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	<0.002	<0.005	<0.005	<0.001	<0.001
SG-2-2'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	0.028	<0.002	<0.005	<0.005	0.050	0.078
SG-3-1'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	0.009	<0.004	0.180	<0.005	<0.005	0.060	0.249
SG-3-4' HS	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	<0.002	<0.005	<0.005	<0.001	<0.001
SG-4-2' HS	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	0.010	<0.002	<0.005	<0.005	0.060	0.070
SG-5-2'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	<0.002	<0.005	<0.005	<0.001	<0.001
SG-6-2'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	0.050	<0.005	<0.005	0.030	0.080
SG-7-1'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	<0.002	<0.005	<0.005	<0.001	<0.001
SG-7-4'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	0.060	<0.002	<0.005	<0.005	<0.001	0.060
SG-7-4' DUP	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	<0.002	<0.005	<0.005	<0.001	<0.001
SG-7-7'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	0.020	<0.005	<0.005	<0.001	0.020
SG-8-1'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	<0.002	<0.005	<0.005	<0.001	<0.001
SG-8-4'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	<0.002	<0.005	<0.005	<0.001	<0.001
SG-9-1'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	0.070	<0.005	<0.005	<0.001	0.070
SG-9-4'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	0.030	<0.005	<0.005	<0.001	0.030
SG-10-3'	<0.014	0.080	<0.060	<0.060	<0.041	<0.003	1.100	<0.004	0.010	<0.005	<0.005	<0.001	1.190
SG-11-3'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	164.800	<0.002	<0.005	54.900	617.800	837.500
SG-12-3'	<0.014	<0.011	<0.060	20.800	9.800	0.289	1.130	<0.004	0.028	<0.005	<0.005	6.600	38.647
SG-13-3'	<0.014	<0.011	<0.060	14.500	7.500	0.490	0.589	<0.004	<0.002	<0.005	<0.005	7.800	30.879
SG-14-3'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	<0.002	<0.005	<0.005	<0.001	<0.001
SG-15-3' HS	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	0.050	<0.002	0.040	<0.005	<0.001	0.090
SG-17-3'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	0.090	<0.002	0.080	<0.005	0.060	0.230
SG-18-3'	<0.014	<0.011	<0.060	<0.060	<0.041	0.270	<0.001	0.090	<0.002	0.02	1.000	2.500	3.880
SG-19-3'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	0.120	<0.002	0.090	<0.005	0.100	0.310
SG-20-3'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	<0.004	<0.002	0.050	<0.005	<0.001	0.050
SG-21-3'	<0.014	<0.011	<0.060	<0.060	<0.041	<0.003	<0.001	0.050	<0.002	0.030	<0.005	0.050	0.130

NOTE: All values expressed in parts per million by volume.
HS - Denotes samples on which headspace analysis was performed.
DUP - Denotes a duplicate sample.

H:\USERS\CRAIG\BURGTABL.ALL

Table 35
Summary of Samples and Analyses
Burgess Brothers Superfund Site

ıple ID	Depth(Ft.)	Site Area	Type	Parameters
W-01B-01	–	Background	Deep Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness
W-01B-02	–	Background	Deep Ground Water	TOC, 8240, Metals, BOD_5, Hardness
W-01B-03	–	Background	Deep Ground Water	TOC, 8240, Metals, BOD_5, Hardness
W-01B-04	–	Background	Deep Ground Water	TOC, 8240, Metals, BOD_5, Hardness
W-04B-01	–	Marshy Area	Deep Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-04B-02	–	Marshy Area	Deep Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-04B-03	–	Marshy Area	Deep Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-[illegible]4B-04	–	Marshy Area	Deep Ground Water	TOC, 8240, Metals, BOD_5, Hex.Chromium
W-04B-04D	–	Marshy Area	Deep Ground Water	TOC, 8240, Metals, BOD_5, Hardness
W-04DI-01	–	Marshy Area	Deep Ground Water	8240, 8270, Metals BOD_5, Hardness, Hex Chromium
W-04DI-02	–	Marshy Area	Deep Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-04DI-03	–	Marshy Area	Deep Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-04DI-04	–	Marshy Area	Deep Ground Water	TOC, 8240, Metals, BOD_5, Hardness
W-04SI-01	–	Marshy Area	Deep Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-04SI-01D	–	Marshy Area	Deep Ground Water	8240, 8270, Metals
W-04SI-02	–	Marshy Area	Deep Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness
W-04SI-03	–	Marshy Area	Deep Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-04SI-04	–	Marshy Area	Deep Ground Water	TOC, 8240, Metals, BOD_5, Hardness
W-07DI-03	–	Soil Staging Area	Deep Ground Water	8240, 8270, Metals
W-07SI-01	–	Soil Staging Area	Deep Ground Water	8240, 8270, Metals
W-07SI-02	–	Soil Staging Area	Deep Ground Water	8240, 8270, Metals
W-07SI-03	–	Soil Staging Area	Deep Ground Water	8270, Metals
W-07SI-04	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-08B-01	–	Soil Staging Area	Deep Ground Water	8240, 8270, Metals, Hex Chromium
W-08B-02	–	Soil Staging Area	Deep Ground Water	8240, 8270, Metals
W-08B-03	–	Soil Staging Area	Deep Ground Water	8240, 8270, Metals
W-08SI-01	–	Soil Staging Area	Deep Ground Water	8240, 8270, Metals
[illegible]-08SI-02	–	Soil Staging Area	Deep Ground Water	8240, 8270, Metals
8SI-03	–	Soil Staging Area	Deep Ground Water	8240, 8270, Metals
-08SI-04	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-09B-01	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-09B-02	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-09B-03	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-09B-04	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-09SI-01	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-09SI-02	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-09SI-03	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-09SI-04	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-25DI-01	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-25DI-02	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-25DI-03	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-25DI-04	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-25SI-01	–	Soil Staging Area	Deep Ground Water	8240, Metals, Hex Chromium
W-25SI-02	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-25SI-03	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-25SI-04	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-25SI-04D	–	Soil Staging Area	Deep Ground Water	8240, Metals
W-01B-01-F	–	Background	Deep Ground Water Filtered	Metals
W-01B-02-F	–	Background	Deep Ground Water Filtered	Metals
W-01B-03-F	–	Background	Deep Ground Water Filtered	Metals, Hardness
W-01B-04-F	–	Background	Deep Ground Water Filtered	Metals, Hardness
W-04B-01-F	–	Marshy Area	Deep Ground Water Filtered	Metals, Hex Chromium
W-04B-02-F	–	Marshy Area	Deep Ground Water Filtered	Metals
W-04B-03-F	–	Marshy Area	Deep Ground Water Filtered	Metals, Hardness
W-04B-04-F	–	Marshy Area	Deep Ground Water Filtered	Metals, Hardness
W-04DI-01-F	–	Marshy Area	Deep Ground Water Filtered	Metals
W-04DI-02-F	–	Marshy Area	Deep Ground Water Filtered	Metals
[illegible]04DI-03-F	–	Marshy Area	Deep Ground Water Filtered	Metals, Hardness
4DI-04-F	–	Marshy Area	Deep Ground Water Filtered	Metals, Hardness
[illegible]04SI-01-F	–	Marshy Area	Deep Ground Water Filtered	Metals, Hex Chromium
W-04SI-01-FD	–	Marshy Area	Deep Ground Water Filtered	Metals, BOD_5
W-04SI-02-F	–	Marshy Area	Deep Ground Water Filtered	

Table 35
Summary of Samples and Analyses
Burgess Brothers Superfund Site

S ID	Depth(Ft.)	Site Area	Type	Parameters
W-04SI-03-F	--	Marshy Area	Deep Ground Water Filtered	Metals, Hardness
W-04SI-04-F	--	Marshy Area	Deep Ground Water Filtered	Metals, BOD_5, Hardness
W-07DI-03-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-07SI-01-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-07SI-02-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-07SI-03-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-07SI-04-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-08B-01-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals, Hex.Chromium
W-08B-02-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-08B-03-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-08SI-01-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-08SI-02-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-08SI-03-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-08SI-04-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-09B-01-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-09B-02-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-09B-03-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-09B-04-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-09SI-01-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-09SI-02-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-09SI-03-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-09SI-04-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-25DI-01-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-25DI-02-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-25DI-03-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-25DI-04-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-25SI-01-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W [illegible]SI-02-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
[illegible]-03-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W[illegible]-04-F	--	Soil Staging Area	Deep Ground Water Filtered	Metals
W-25SI-04-FD	--	Soil Staging Area	Deep Ground Water Filtered	Metals
SBW-10-01	--	Soil Staging Area	Shallow Ground Water	8240, 8270, Metals, Hex Chromium
SBW-10-01D	--	Soil Staging Area	Shallow Ground Water	8240, 8270, Metals, Hex Chromium
SBW-10-02	--	Soil Staging Area	Shallow Ground Water	8240, 8270, Metals, Hex Chromium
SBW-10-03	--	Soil Staging Area	Shallow Ground Water	8240, 8270, Metals, Hex Chromium
SBW-11-03	--	Soil Staging Area	Shallow Ground Water	8270
SBW-21-01	--	Landfill Area	Shallow Ground Water	8240, 8270, Metals, Hex Chromium
SBW-21-02	--	Landfill Area	Shallow Ground Water	8240, 8270, Metals, Hex Chromium
SBW-21-03	--	Landfill Area	Shallow Ground Water	8240, 8270, Metals, Hex Chromium
SBW-21-04	--	Landfill Area	Shallow Ground Water	8240, Metals, Hex Chromium
W-01-04	--	Background	Shallow Ground Water	8240
W-01-4	--	Background	Shallow Ground Water	TOC, Metals, Cyanide
W-011SI-01	--	Marshy Area	Shallow Ground Water	8080, Metals, Hex Chromium, Cyanide
W-011SI-02	--	Marshy Area	Shallow Ground Water	8080, Metals, Hex Chromium, Cyanide
W-011SI-02D	--	Marshy Area	Shallow Ground Water	8080
W-011SI-03	--	Marshy Area	Shallow Ground Water	8080, Metals, Cyanide
W-01S-01	--	Background	Shallow Ground Water	8240
W-01S-02	--	Background	Shallow Ground Water	8240
W-01S-03	--	Background	Shallow Ground Water	8240
W-01SI-01	--	Background	Shallow Ground Water	TOC, 8270, Metals, BOD_5, Hardness
W-01SI-02	--	Background	Shallow Ground Water	TOC, 8270, Metals, BOD_5, Hardness
W-01SI-03	--	Background	Shallow Ground Water	TOC, 8270, Metals, BOD_5, Hardness
W-01SI-04	--	Background	Shallow Ground Water	TOC, 8270, Metals, BOD_5, Hardness
W-02-01	--	Marshy Area	Shallow Ground Water	TOC, 8080, 8240, 8270, Metals, Cyanide
W-02-01D	--	Marshy Area	Shallow Ground Water	TOC, 8080, Metals, Cyanide
W-02-02	--	Marshy Area	Shallow Ground Water	TOC, 8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyan
W-02-03	--	Marshy Area	Shallow Ground Water	TOC, 8080, 8240, 8270, Metals, Hardness, Cyanide
W[illegible]03D	--	Marshy Area	Shallow Ground Water	TOC, 8080, 8240, 8270, Metals, Hardness, Cyanide
[illegible]	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-[illegible]02	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-03-03	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals, Hex Chromium
W-03S2-01	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals, Hex Chromium

Table 35
Summary of Samples and Analyses
Burgess Brothers Superfund Site

ple ID	Depth(Ft.)	Site Area	Type	Parameters
W-03S2-02	--	Marshy Area	Shallow Ground Water	8240, 8270, Metals, Hex Chromium
W-03S2-03	--	Marshy Area	Shallow Ground Water	8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-04D-01	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium
W-04D-02	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium
W-04D-03	--	Marshy Area	Shallow Ground Water	8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-04S-01	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-04S-02	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-04S-03	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals, Hex Chromium
W-05-01	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-05-02	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals
W-05-02D	--	Marshy Area	Shallow Ground Water	8270, Metals, BOD_5, Hardness, Hex Chromium
W-05-03	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals
W-06D-01	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium
W-06D-02	--	Marshy Area	Shallow Ground Water	8240, Metals
W-06D-02D	--	Marshy Area	Shallow Ground Water	TOC, 8240, Metals, Hardness
W-06D-03	--	Marshy Area	Shallow Ground Water	8240, Metals
W-06S-01	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-06S-02	--	Marshy Area	Shallow Ground Water	TOC, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium
W-06S-03	--	Marshy Area	Shallow Ground Water	TOC, 8270, Metals, Hex Chromium
W-07S1-01	--	Soil Staging Area	Shallow Ground Water	8240, 8270, Metals
W-07S1-02	--	Soil Staging Area	Shallow Ground Water	8240, 8270, Metals
W-07S1-03	--	Soil Staging Area	Shallow Ground Water	8240, 8270, Metals
W-07S1-04	--	Soil Staging Area	Shallow Ground Water	8240, Metals
W-08S1-1	--	West of Landfill	Shallow Ground Water	8240, 8270, Metals
W-08S1-02	--	West of Landfill	Shallow Ground Water	8240, 8270, Metals
W-08S1-03	--	West of Landfill	Shallow Ground Water	8240, 8270, Metals
W-08S1-04	--	West of Landfill	Shallow Ground Water	8240, Metals
W-09S1-01	--	West of Landfill	Shallow Ground Water	8240, Metals
S1-02	--	West of Landfill	Shallow Ground Water	8240, Metals
9S1-03	--	West of Landfill	Shallow Ground Water	8240, Metals
W-09S1-04	--	West of Landfill	Shallow Ground Water	8240, Metals
W-11S1-01	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium, Cyanide
W-11S1-02	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium, Cyanide
W-11S1-03	--	Marshy Area	Shallow Ground Water	8240, 8270, Metals, Cyanide
W-11S1-04	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium, Cyanide
W-12S1-01	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium
W-12S1-02	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium
W-12S1-03	--	Marshy Area	Shallow Ground Water	8240, Metals
W-12S1-04	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium
W-22S1-01	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium
W-22S1-02	--	Marshy Area	Shallow Ground Water	8240, Metals, Hex Chromium
W-22S1-02D	--	Marshy Area	Shallow Ground Water	8240, Metals
W-22S1-03	--	Marshy Area	Shallow Ground Water	8240, Metals
W-22S1-04	--	Marshy Area	Shallow Ground Water	8240, Metals, BOD_5
W-23T-01	--	Hillside Area	Shallow Ground Water	8240, 8270, Metals
W-23T-02	--	Hillside Area	Shallow Ground Water	8240, 8270, Metals
W-23T-03	--	Hillside Area	Shallow Ground Water	8240, 8270, Metals
W-24T-01	--	Hillside Area	Shallow Ground Water	8240, 8270, Metals
W-24T-02	--	Hillside Area	Shallow Ground Water	8240, 8270, Metals
W-24T-03	--	Hillside Area	Shallow Ground Water	8240, 8270, Metals
W-24T-03D	--	Hillside Area	Shallow Ground Water	8240, 8270, Metals
W-25S1-01	--	West of Landfill	Shallow Ground Water	8240, Metals
W-25S1-02	--	West of Landfill	Shallow Ground Water	8240, Metals
W-25S1-03	--	West of Landfill	Shallow Ground Water	8240, Metals
W-25S1-04	--	West of Landfill	Shallow Ground Water	8240, Metals
SBW-10-01-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
SBW-10-01-FD	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-10-02-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
10-03-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
-21-01-F	--	Landfill Area	Shallow Ground Water Filtered	Metals
SBW-21-02-F	--	Landfill Area	Shallow Ground Water Filtered	Metals
SBW-21-03-F	--	Landfill Area	Shallow Ground Water Filtered	Metals

Table 35
Summary of Samples and Analyses
Burgess Brothers Superfund Site

Sample ID	Depth(Ft.)	Site Area	Type	Parameters
SBW-21-04-F	--	Landfill Area	Shallow Ground Water Filtered	Metals
W-01-4-F	--	Background Area	Shallow Ground Water Filtered	Metals
W-01S1-01-F	--	Background Area	Shallow Ground Water Filtered	Metals
W-01S1-02-F	--	Background Area	Shallow Ground Water Filtered	Metals
W-01S1-03-F	--	Background Area	Shallow Ground Water Filtered	Metals, Hardness
W-01S1-04-F	--	Background Area	Shallow Ground Water Filtered	Metals, Hardness
W-02-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-02-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals, BOD_5, Hardness, Hex Chromium
W-02-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-03-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-03-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals, Hardness
W-03-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-03S2-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-03S2-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-03S2-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-04D-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-04D-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-04D-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-04S-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-04S-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals, Hardness
W-04S-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-05-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals, Hex Chromium
W-05-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals, Hardness
W-05-02-FD	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-05-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals, BOD_5, Hardness, Hex Chromium
W-06D-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals, BOD_5, Hardness
W-06D-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-06D-02-FD	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-06D-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals, Hex Chromium
W-06S-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-06S-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals, Hardness
W-06S-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-07S1-01-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-07S1-02-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-07S1-03-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-07S1-04-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-08S1-01-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-08S1-02-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-08S1-03-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-08S1-04-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-09S1-01-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-09S1-02-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-09S1-03-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-09S1-04-F	--	Soil Staging Area	Shallow Ground Water Filtered	Metals
W-11S1-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-11S1-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-11S1-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-11S1-04-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-12S1-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-12S1-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-12S1-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-12S1-04-F	--	Marsby Area	Shallow Ground Water Filtered	Metals
W-22S1-01-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-22S1-02-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-22S1-03-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-22S1-04-F	--	Marshy Area	Shallow Ground Water Filtered	Metals
W-23T-01-F	--	Hillside Area	Shallow Ground Water Filtered	Metals
W-23T-02-F	--	Hillside Area	Shallow Ground Water Filtered	Metals
W-23T-03-F	--	Hillside Area	Shallow Ground Water Filtered	Metals
W-24T-01-F	--	Hillside Area	Shallow Ground Water Filtered	Metals
W-24T-02-F	--	Hillside Area	Shallow Ground Water Filtered	Metals
W-24T-03-F	--	Hillside Area	Shallow Ground Water Filtered	Metals

Table 35
Summary of Samples and Analyses
Burgess Brothers Superfund Site

Sample ID	Depth(Ft.)	Site Area	Type	Parameters
W-24T-03-FD	--	Hillside Area	Shallow Ground Water Filtered	Metals
W-25S1-01-F	--	West of Landfill	Shallow Ground Water Filtered	Metals
W-25S1-02-F	--	West of Landfill	Shallow Ground Water Filtered	Metals
W-25S1-03-F	--	West of Landfill	Shallow Ground Water Filtered	Metals
W-25S1-04-F	--	West of Landfill	Shallow Ground Water Filtered	Metals
SBW-20	20-22'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-21	20-22'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
W-01B	32-34'	Background	Subsurface Soil	8240, 8270, Metals
SBW-10	10-12'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-10	14-16'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-10	8-10'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-10D	14-16'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-14	12-14'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-14	6-8'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-14	8-10'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-15	2-4'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-15	4-6'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-15	8-10'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-16	2-4'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-16	4-6'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-16	8-10'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-17	12-14'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-17	6-8'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-17	8-10'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-18A	12-14'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-18A	4-6'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-18A	8-10'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-18AD	12-14'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-19	10-12'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-19	4-6'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-19	6-8'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-20	12-14'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-20	6-8'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-21	12-14'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
SBW-21	2-4'	Landfill Area	Subsurface Soil	8240, 8270, 8080, Metals, Cyanide
W-01S1	10-12'	Background	Subsurface Soil	8240, 8270
W-01S1	6-8'	Background	Subsurface Soil	8240, 8270
W-01S1	6-8'	Background	Subsurface Soil	Metals
W-01S1	10-12'	Background	Subsurface Soil	Metals
W-03S2	10-12'	Marshy Area	Subsurface Soil	8240
W-03S2	12-14'	Marshy Area	Subsurface Soil	8240
W-03S2	2-4'	Marshy Area	Subsurface Soil	8240
W-03S2	6-8'	Marshy Area	Subsurface Soil	8240
W-03S2	8-10'	Marshy Area	Subsurface Soil	8240
W-04S1	0-3'	Marshy Area	Subsurface Soil	8240
W-04S1	11-13'	Marshy Area	Subsurface Soil	8240
W-04S1	15-17'	Marshy Area	Subsurface Soil	8240
W-04S1	3-5'	Marshy Area	Subsurface Soil	8240
W-04S1	5-7'	Marshy Area	Subsurface Soil	8240
W-04S1	7-9'	Marshy Area	Subsurface Soil	8240
W-04S1	9-11'	Marshy Area	Subsurface Soil	8240
W-04S1	9-11'	Marshy Area	Subsurface Soil	8240
W-11S1	0-2'	Marshy Area	Subsurface Soil	8240
W-11S1	2-4'	Marshy Area	Subsurface Soil	8240
W-11S1	4-6'	Marshy Area	Subsurface Soil	8240
W-11S1	6-8'	Marshy Area	Subsurface Soil	8240
W-11S1	8-10'	Marshy Area	Subsurface Soil	8240
W-22S1	10-12'	Marshy Area	Subsurface Soil	8240
W-22S1	4-6'	Marshy Area	Subsurface Soil	8240
W-22S1	6-8'	Marshy Area	Subsurface Soil	8240
W-22S1	8-10'	Marshy Area	Subsurface Soil	8240
W-22S1	6-8'	Marshy Area	Subsurface Soil	8240

Table 35
Summary of Samples and Analyses
Burgess Brothers Superfund Site

Sample ID	Depth(Ft.)	Site Area	Type	Parameters
W-23T	4-6'	Hillside Area	Subsurface Soil	8240
W-23T	4-6'	Hillside Area	Subsurface Soil	8240
W-24T	10-12'	Hillside Area	Subsurface Soil	8240
SBW-10	0-10'	Landfill Area	Surface Soil	TOC, Metals
SBW-10	6'	Landfill Area	Surface Soil	8240
SBW-13	0-12'	Background Area	Surface Soil	Metals
SBW-13	5-7'	Background Area	Surface Soil	8240, TOC
SBW-13D	0-12'	Background Area	Surface Soil	Metals
SBW-13D	5-7'	Background Area	Surface Soil	8240
SBW-18	0-12'	Landfill Area	Surface Soil	Metals
SBW-18	5-7'	Landfill Area	Surface Soil	TOC, 8240
SBW-21	0-12'	Landfill Area	Surface Soil	Metals
SBW-21	5-7'	Landfill Area	Surface Soil	8240, TOC
SP-01	0-10'	Soil Staging Area	Surface Soil	8080, 8270, Metals, cyanide
SP-01	5-7'	Soil Staging Area	Surface Soil	8240
SP-02	0-10'	Landfill Area	Surface Soil	Metals, Cyanide
SP-02	0-12'	Landfill Area	Surface Soil	8080, 8270
SP-02	5-7'	Landfill Area	Surface Soil	TOC, 8240
SP-03	0-12'	Landfill Area	Surface Soil	8080, 8270, Metals, Cyanide
SP-03	5-7'	Landfill Area	Surface Soil	TOC, 8240
SP-04	0-12'	Landfill Area	Surface Soil	8080, 8270, Metals, Cyanide
SP-04	5-7'	Landfill Area	Surface Soil	8240
SP-05	0-12'	Landfill Area	Surface Soil	Metals
SP-05	5-7'	Landfill Area	Surface Soil	8240
SP-06	0-12'	Marshy Area	Surface Soil	8080, 8270, Metals, Cyanide
SP-06	5-7'	Marshy Area	Surface Soil	TOC, 8240
SP-07	0-12'	Marshy Area	Surface Soil	8080, 8270, Metals, Cyanide
SP-07	5-7'	Marshy Area	Surface Soil	TOC, 8240
SP-08	0-12'	Marshy Area	Surface Soil	Metals
SP-08	5-7'	Marshy Area	Surface Soil	8240
SP-09	0-12'	Marshy Area	Surface Soil	8080, 8270, Metals, Cyanide
SP-09	4-7'	Marshy Area	Surface Soil	TOC, 8240
SP-10	0-12'	Marshy Area	Surface Soil	8080, 8270, Metals, Cyanide
SP-10	5-7'	Marshy Area	Surface Soil	TOC, 8240
SP-11	0-12'	Marshy Area	Surface Soil	Metals
SP-11	5-7'	Marshy Area	Surface Soil	TOC, 8240
SP-12	0-12'	Marshy Area	Surface Soil	Metals
SP-12	5-7'	Marshy Area	Surface Soil	TOC, 8240
SP-13	0-12'	Marshy Area	Surface Soil	8080, 8270, Metals, Cyanide
SP-13	5-7'	Marshy Area	Surface Soil	TOC, 8240
SP-14	0-12'	Landfill Area	Surface Soil	Metals
SP-14	5-7'	Landfill Area	Surface Soil	8240
SP-15	0-12'	Marshy Area	Surface Soil	Metals
SP-15	5-7'	Marshy Area	Surface Soil	8240
SP-16	0-12'	Marshy Area	Surface Soil	Metals
SP-16	5-7'	Marshy Area	Surface Soil	8240
SP-17	0-12'	Background	Surface Soil	Metals
SP-17	5-7'	Background	Surface Soil	8240
SP-18	0-12'	Background	Surface Soil	Metals
SP-18	5-7'	Background	Surface Soil	8240
SP-19	0-12'	Background	Surface Soil	Metals
SP-19	4-7'	Background	Surface Soil	8240
SP-20	0-12'	Hillside Area	Surface Soil	Metals
SP-20	1-7'	Hillside Area	Surface Soil	8240
SP-21	0-12'	Hillside Area	Surface Soil	Metals
SP-21	5-7'	Hillside Area	Surface Soil	TOC, 8240
SP-22	0-12'	Landfill Area	Surface Soil	8080, 8270, Metals, Cyanide
SP-22	4-7'	Landfill Area	Surface Soil	8240
SP-22D	0-12'	Landfill Area	Surface Soil	8080, 8270, Metals, Cyanide
SP-22D	4-7'	Landfill Area	Surface Soil	8240
W-04S2	0-12'	Marshy Area	Surface Soil	Metals
W-04S2	5-7'	Marshy Area	Surface Soil	8240

Table 35
Summary of Samples and Analyses
Burgess Brothers Superfund Site

Sample ID	Depth(Ft.)	Site Area	Type	Parameters
)7S2	0-12'	West of Landfill	Surface Soil	Metals
W-07S2	4-7'	West of Landfill	Surface Soil	8240
W-08S2	0-12'	West of Landfill	Surface Soil	Metals
W-08S2	5-7'	West of Landfill	Surface Soil	8240
W-12S2	0-12'	Marshy Area	Surface Soil	Metals
W-12S2	5-7'	Marshy Area	Surface Soil	8240
W-25S2	0-12'	West of Landfill	Surface Soil	Metals
W-25S2	5-7'	West of Landfill	Surface Soil	8240
SW-01-03FD	--	Upstream	Surface Water	Metals
SW-01-3D	--	Upstream	Surface Water	Metals
SW-01B-01	--	Upstream	Surface Water	524.2, 8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-01B-02	--	Upstream	Surface Water	524.2, 8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-01B-02D	--	Upstream	Surface Water	524.2
SW-06-01	--	Landfill Area	Surface Water	524.2, Metals, BOD_5, Hardness, Hex Chromium
SW-06-02	--	Landfill Area	Surface Water	524.2, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-06-03	--	Landfill Area	Surface Water	524.2, Metals, Hex Chromium
SW-13-02	--	Upstream	Surface Water	8080, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-06-03-F	--	Downstream	Surface Water Filtered	Metals
SW-02-01	--	Landfill Area	Surface Water	524.4, 8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-02-02	--	Landfill Area	Surface Water	524.4, 8080, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-03-01	--	Downstream	Surface Water	524.4, 8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-03-02	--	Downstream	Surface Water	524.4, 8080, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-03-03	--	Downstream	Surface Water	524.2, Metals, Hex Chromium
SW-04-1	--	Downstream	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-04-02	--	Downstream	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-04-02D	--	Downstream	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-04-03	--	Downstream	Surface Water	524.2, Metals, Hex Chromium
SW-05-01	--	Downstream	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-05-02	--	Downstream	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
W-05-03	--	Downstream	Surface Water	524.2, Metals, Hex Chromium
/-07-01	--	Downstream	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-07-02	--	Downstream	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-07-03	--	Downstream	Surface Water	524.2, Metals, Hex Chromium
SW-08-02	--	Upstream	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-09-01	--	Landfill Area	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-09-02	--	Landfill Area	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-10-01	--	Landfill Area	Surface Water	524.2, 8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-10-01D	--	Landfill Area	Surface Water	524.2
SW-10-02	--	Landfill Area	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-11-01	--	Landfill Area	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-11-02	--	Landfill Area	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-11-03	--	Landfill Area	Surface Water	524.2, Metals, Hex Chromium
SW-12-01	--	Landfill Area	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-12-01D	--	Landfill Area	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-12-02	--	Landfill Area	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-12-03	--	Downstream	Surface Water	524.2, Metals, Hex Chromium
SW-14-01	--	Downstream	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-14-02	--	Downstream	Surface Water	8080, 8240, 8270, Metals, BOD_5, Hardness, Hex Chromium, Cyanide
SW-14-03	--	Downstream	Surface Water	524.2, Metals, Hex Chromium
SW-15-01	--	Downstream	Surface Water	524.2, Metals, BOD_5, Hardness, Hex Chromium
SW-15-02	--	Downstream	Surface Water	524.2, Metals, BOD_5, Hardness, Hex Chromium
SW-15-03	--	Downstream	Surface Water	524.2, Metals, Hex Chromium
SW-16-03	--	Downstream	Surface Water	524.2, Metals, Hex Chromium
SW-17-03	--	Downstream	Surface Water	524.2, Metals, Hex Chromium
SW-17-03D	--	Downstream	Surface Water	524.2, Metals, Hex Chromium
SW-17-04	--	Downstream	Surface Water	524.2, Metals
SW-03-03-F	--	Downstream	Surface Water Filtered	Metals
SW-04-03-F	--	Downstream	Surface Water Filtered	Metals
SW-05-03-F	--	Downstream	Surface Water Filtered	Metals
W-07-03-F	--	Downstream	Surface Water Filtered	Metals
/-11-03-F	--	Landfill Area	Surface Water Filtered	Metals
SW-12-03-F	--	Landfill Area	Surface Water Filtered	Metals

Table 35
Summary of Samples and Analyses
Burgess Brothers Superfund Site

Sample ID	Depth(Ft.)	Site Area	Type	Parameters
SW-14-03-F	--	Downstream	Surface Water Filtered	Metals
SW-15-03-F	--	Downstream	Surface Water Filtered	Metals
SW-16-03-F	--	Downstream	Surface Water Filtered	Metals
SW-17-03-F	--	Downstream	Surface Water Filtered	Metals
SED-01A-01	--	Upstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-01A-02	--	Upstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-01B-01	--	Upstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-01B-02	--	Upstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-06-01	--	Downstream	Sediment	TOC, 8240, Metals
SED-06-02	--	Downstream	Sediment	TOC, 8240, Metals
SED-13-01	--	Upstream	Sediment	8080, 8240, 8270, Metals, Cyanide
SED-13-02	--	Upstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-10-01	--	Downstream	Sediment	8080, 8270, Cyanide
SED-02-01	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-02-02	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-03-01	--	Downstream	Sediment	8080, 8240, 8270, Metals, Cyanide
SED-03-02	--	Downstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-04-01	--	Downstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-04-02	--	Downstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-04-02D	--	Downstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-05-01	--	Downstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-05-02	--	Downstream	Sediment	8080, 8240, 8270, Metals, Cyanide
SED-07-01	--	Downstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-07-02	--	Downstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-08-01	--	Upstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-08-02	--	Upstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-09-01	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-09-02	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-10-01	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-10-02	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-11-01	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-11-02	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-11-03	--	Landfill Area	Sediment	TOC, 8240, Metals, Cyanide
SED-11-03D	--	Landfill Area	Sediment	TOC, Metals, Cyanide
SED-12-01	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-12-01D	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-12-02	--	Landfill Area	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-12-03	--	Landfill Area	Sediment	TOC, 8240, Metals
SED-14-01	--	Downstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-14-02	--	Downstream	Sediment	TOC, 8080, 8240, 8270, Metals, Cyanide
SED-14-03	--	Downstream	Sediment	TOC, 8240, Metals, Cyanide
SED-15-01	--	Downstream	Sediment	TOC, 8240, 8270, Metals, Cyanide
SED15-02	--	Downstream	Sediment	TOC, 8240, Metals
LS-1	--	--	Leachate Seeps	8240, 8270, Metals, BOD_5, Hardness, Cyanide
LS-1-02	--	--	Leachate Seeps	8080
LS-2	--	--	Leachate Seeps	TOC, 8240, 8270, Metals, BOD_5, Hardness, Cyanide
LS-3	--	--	Leachate Seeps	TOC, 8240, 8270, Metals, BOD_5, Hardness, Cyanide
LS-3D	--	--	Leachate Seeps	TOC, 8240, 8270, Metals, BOD_5, Hardness, Cyanide
DICKINSON-05	--	--	Residential	Metals
DICKINSON-05-BD	--	--	Residential	Metals
DICKINSON-05-F	--	--	Residential	Metals
DICKINSON-05-F-BD	--	--	Residential	Metals
DICKINSON -01	--	--	Residential	524.2, Metals
DICKINSON -02	--	--	Residential	524.2, Metals
DICKINSON -03	--	--	Residential	524.2, Metals
DICKINSON -04	--	--	Residential	524.2, Metals
DICKINSON -04 BLDUP	--	--	Residential	524.2, Metals
OLIN -01	--	--	Residential	524.2, Metals
OLIN -02	--	--	Residential	524.2, Metals
OLIN -03	--	--	Residential	524.2, Metals
OLIN -04	--	--	Residential	524.2, Metals
RySPG -01	--	--	Residential	524.2, Metals

Table 35
Summary of Samples and Analyses
Burgess Brothers Superfund Site

Sample ID	Depth(Ft.)	Site Area	Type	Parameters
RySPG -01-BLDUP	--	--	Residential	524.2
RySPG -02	--	--	Residential	524.2, Metals, Hex Chromium
RySPG -02-BLDUP1	--	--	Residential	524.2
RySPG -03	--	--	Residential	524.2, Metals
RySPG -03-BLDUP	--	--	Residential	524.2, Metals
RySPG -04	--	--	Residential	524.2, Metals
DICKINSON -01F	--	--	Residential	Metals
DICKINSON -02F	--	--	Residential	Metals
DICKINSON -03F	--	--	Residential	Metals
DICKINSON -04F	--	--	Residential	Metals
OLIN -01F	--	--	Residential	Metals
OLIN -02F	--	--	Residential	Metals
OLIN -03F	--	--	Residential	Metals
OLIN -04F	--	--	Residential	Metals
RySPG -01F	--	--	Residential	Metals
RySPG -02F	--	--	Residential	Metals
RySPG -03F	--	--	Residential	Metals
RySPG -03F-BLDUP-2-3	--	--	Residential	Metals
RySPG -04F	--	--	Residential	Metals
SB-22-05	0-2	Soil Staging Area	Soil Boring	8240
SB-22-05	4-6	Soil Staging Area	Soil Boring	8240
SB-23-05	0-2	Soil Staging Area	Soil Boring	8240
SB-23-05	6-7	Soil Staging Area	Soil Boring	8240
SB-23-05-BD	6-7	Soil Staging Area	Soil Boring	8240
SB-24-05	0-2	Soil Staging Area	Soil Boring	8240
SB-24-05	2-4	Soil Staging Area	Soil Boring	8240
SB-25-05	0-2	Soil Staging Area	Soil Boring	8240
SB-25-05	2-4	Soil Staging Area	Soil Boring	8240
SP-23-05	--	Soil Staging Area	Surface Soil	Metals
SP-23-05	--	Soil Staging Area	Surface Soil	8240
SP-24-05	--	Soil Staging Area	Surface Soil	8240
SP-24-05	--	Soil Staging Area	Surface Soil	Metals
SP-25-05	--	Soil Staging Area	Surface Soil	8240
SP-25-05	--	Soil Staging Area	Surface Soil	Metals
SP-26-05	--	Soil Staging Area	Surface Soil	8240
SP-26-05	--	Soil Staging Area	Surface Soil	Metals
SP-26-05-BD	--	Soil Staging Area	Surface Soil	8240
SP-26-05-BD	--	Soil Staging Area	Surface Soil	Metals
SP-27-05	--	Soil Staging Area	Surface Soil	Metals
SP-27-05	--	Soil Staging Area	Surface Soil	8240
SP-28-05	--	Soil Staging Area	Surface Soil	Metals
SP-28-05	--	Soil Staging Area	Surface Soil	8240
SP-29-05	--	Soil Staging Area	Surface Soil	Metals
SP-29-05	--	Soil Staging Area	Surface Soil	8240
SP-30-05	--	Soil Staging Area	Surface Soil	Metals
SP-30-05	--	Soil Staging Area	Surface Soil	8240
SP-EB-05	--		Equipment Blank	Metals
SS-EQT/FLV-05	--		Equipment Blank	8240
TP-10-05	2-4	Lagoon Area	Test Pit	8240, Metals
TP-10-05	8-10	Lagoon Area	Test Pit	8240, Metals
TP-10-05-BD	2-4	Lagoon Area	Test Pit	8240, Metals
TP-10-DRUM-05	--	Lagoon Area	Test Pit	8240
TP-11-05	10-12	Lagoon Area	Test Pit	8240, Metals
TP-11-05	17-19	Lagoon Area	Test Pit	8080, 8270, Metals
TP-11-05	17-19	Lagoon Area	Test Pit	8240
TP-12-05	10-12	Lagoon Area	Test Pit	8240, Metals
TP-12-05	14-16	Lagoon Area	Test Pit	8240, Metals
TP-12-05	14-16	Lagoon Area	Test Pit	8080, 8270, Metals
TP-12-05	20.6-22.6	Lagoon Area	Test Pit	8240
TP-12-05	22.6-24.6	Lagoon Area	Test Pit	8080
TP-12-05	22.6-24.6	Lagoon Area	Test Pit	8240
TP-12-05	24.6-26.6	Lagoon Area	Test Pit	8240

Table 35
Summary of Samples and Analyses
Burgess Brothers Superfund Site

Sample ID	Depth(Ft.)	Site Area	Type	Parameters
TP-12-05	24.6-26.6	Lagoon Area	Test Pit	8080
TP-12-05	26.6-28.6	Lagoon Area	Test Pit	8240
TP-12-05-BD	20.6-22.6	Lagoon Area	Test Pit	8240
TP-12-05-BD	24.6-26.6	Lagoon Area	Test Pit	8080
TP-13-05	0-2	Landfill Area	Test Pit	8240, Metals
TP-13-05	2-4	Landfill Area	Test Pit	8240, Metals
TP-14-05	12-14	Landfill Area	Test Pit	8240, Metals
TP-19-05	14-16	Landfill Area	Test Pit	8270, Metals
TP-19-05	14-16	Landfill Area	Test Pit	8240
TP-19-05	20-22	Landfill Area	Test Pit	8270, Metals
TP-19-05	20-22	Landfill Area	Test Pit	8240
TP-8-05	10-12	Landfill Area	Test Pit	8240, Metals
TP-9-05	10-12	Lagoon Area	Test Pit	8240, Metals
TP-9-05	6-8	Lagoon Area	Test Pit	8240, Metals
TP10-05	2-4	Lagoon Area	Test Pit	8270, Metals
TP10-05	8-10	Lagoon Area	Test Pit	Metals
TP10-05-BD	2-4	Lagoon Area	Test Pit	8270, Metals
TP11-05	10-12	Lagoon Area	Test Pit	Metals
TP12-05	10-12	Lagoon Area	Test Pit	Metals
TP13-05	0-2	Landfill Area	Test Pit	Metals
TP13-05	2-4	Landfill Area	Test Pit	Metals
TP14-05	10-12	Landfill Area	Test Pit	Metals
TP14-05	12-14	Landfill Area	Test Pit	Metals
TP19-05	22-22	Landfill Area	Test Pit	Metals
TP7-05	10-12	Landfill Area	Test Pit	Metals
TP7-05	6-8	Landfill Area	Test Pit	Metals
TP8-05	10-12	Landfill Area	Test Pit	Metals
TP8-05	4-6	Landfill Area	Test Pit	Metals
TP9-05	10-12	Lagoon Area	Test Pit	Metals
TP9-05	6-8	Lagoon Area	Test Pit	8270, Metals
W-01-05	–	Background	Monitoring Well	8240, Metals
W-01-5-F	–	Background	Monitoring Well	Metals
W-01-SI-05	210-212	Background	Monitoring Well	Metals
W-01-SI-05	4-6	Background	Monitoring Well	Metals
W-01DI-05	–	Background	Monitoring Well	8240, Metals
W-01DI-05-BD	–	Background	Monitoring Well	8240, Metals
W-01DI-05-F	–	Background	Monitoring Well	Metals
W-01DI-05-F-BD	–	Background	Monitoring Well	Metals
W-04T-05	–	Marshy Area	Monitoring Well	8240, Metals
W-04T-05	19-21	Marshy Area	Monitoring Well	8240, Metals
W-04T-05-BD	19-21	Marshy Area	Monitoring Well	8240, Metals
W-04T-05-F	–	Marshy Area	Monitoring Well	Metals
W-22T-05	–	Marshy Area	Monitoring Well	8240, Metals
W-22T-05	17-19	Marshy Area	Monitoring Well	8240, Metals
W-22T-05-F	–	Marshy Area	Monitoring Well	Metals
W-26T-05	–	West of Landfill	Monitoring Well	8240, Metals
W-26T-05-F	–	West of Landfill	Monitoring Well	Metals
W-27SI-05	–	West of Landfill	Monitoring Well	8240
W-27SI-05	–	West of Landfill	Monitoring Well	Metals
W-27SI-05-F	–	West of Landfill	Monitoring Well	Metals
W-27T-05	–	West of Landfill	Monitoring Well	8240, Metals
W-27T-05-F	–	West of Landfill	Monitoring Well	Metals
W-TP-12-05	–	Lagoon Area	Monitoring Well Test Pit	8080, 8240, 8270, Metals
W-TP-12-05-BD	–	Lagoon Area	Monitoring Well Test Pit	8080, 8270
W-TP-12-05-F	–	Lagoon Area	Monitoring Well Test Pit	Metals
WTP-12-05	22.6-24.6	Lagoon Area	Test Pit	8270, Metals
WTP-12-05-BD	22.6-24.6	Lagoon Area	Test Pit	8270
WTP12-05	24.6-26.6	Lagoon Area	Test Pit	Metals
VTP12-05-BD	24.6-26.6	Lagoon Area	Test Pit	Metals

Key: F - Filtered Water Sample
BD - Blind Duplicate

Table 36

PID HEADSPACE SOIL SCREENING
RESULTS-SOIL STAGING AREA
BURGESS BROTHERS SUPERFUND SITE
WOODFORD AND BENNINGTON, VERMONT

SAMPLE ID	PID READING
SS-1	54 ppmv*
SS-2	110 ppmv
SS-3	38 ppmv
SS-4	11.4 ppmv
SS-5	10.1 ppmv
SS-6	10.2 ppmv
SS-7	9.4 ppmv

*-ppmv, parts per million by volume

SAMPLE ID	HEADSPACE READINGS AT DEPTH			
	0'-2'	2'-4'	4'-6'	6'-7'
SB-22	11.3*	10.6	9.0/9.4*	-
SB-23	90/280*	24	0.8/14.4	19.2*
SB-24	11.5/12.0*	9.8/10.4*	-	-
SB-25	9.2/10.4*	8.8/8.2*	-	-

NOTE: *-SAMPLE SUBMITTED TO LAB FOR EPA METHOD 8240 ANALYSIS.

Table 37

COMPARISON OF INORGANICS RESULTS FROM W-01 (ROUNDS 4 AND 5) WITH RESIDENTIAL WELLS

	W-01		RESIDENTIAL WELLS	
	Filtered	Unfiltered	Filtered	Unfiltered
Aluminum	ND to 33.8	20,200 to 64,000	ND	ND to 33
Antimony	ND	ND	ND to 18	ND
Arsenic	ND	ND to 1.8	ND	ND
Barium	8.6 to 12	360 to 830	10.1 to 141	8.4 to 150
Beryllium	ND	1.3 to 3.8	ND	ND
Cadmium	ND	ND to 1.5	ND	ND to 0.33
Calcium	19,800 to 23,700	100,000 to 258,000	9,500 to 110,000	8,900 to 126,000
Chromium	ND to 2.1	57.5 to 110	ND	ND to 5.3
Cobalt	ND	27.6 to 100	ND to 4.9	ND to 4.2
Copper	ND	37.6 to 93	ND to 32	ND to 40
Iron	ND to 39.2	43,600 to 97,500	ND to 76	ND to 130
Lead	ND	17.6 to 43	ND to 4.6	ND to 18.6
Magnesium	7,890 to 9,900	47,600 to 137,000	3,920 to 27,500	3,600 to 30,300
Manganese	ND to 1.5	1,480 to 4,200	ND	ND to 4.1
Mercury	ND	ND to 0.65	ND to 0.21	ND
Nickel	ND to 1.1	47.5 to 91	ND	ND
Potassium	301 to 350	5,220 to 12,500	ND to 2,300	ND to 2,700
Selenium	ND to 1.1	R	ND	ND
Silver	ND	ND	ND to 3.8	ND to 3.3
Sodium	ND to 2,070	ND to 3,010	1,600 to 326,000	ND to 363,000
Thallium	ND	ND	ND	ND to 1.5
Vanadium	ND	28.7 to 78	ND to 9.6	ND
Zinc	ND to 13.3	131 to 230	ND to 24	ND to 59

Notes: ND = Not Detected R = Not Available
All units in ug/l
Residential Wells represent the range of values
from Dickinson, Olin, and Ryder Spring water analyses.

Table 38 (page 1 of 2)

Volatile Organics
Burgess Brothers Superfund Site
Federal and State of Vermont Regulations

	State Water Laws* Primary Ground Water Standards		Federal Regulations* Maximum Contaminant Levels
	Enforcement Standard (micrograms per liter)	Preventive Action Limit (micrograms per liter)	(micrograms per liter)
Compound			
Chloromethane			
Bromomethane			
Vinyl chloride	2.0	0.2	2.0
Chloroethane			
Methylene chloride	5.0	2.5	
Acetone			
Carbon disulfide			
1,1-Dichloroethene	7.0	0.7	
1,1-Dichloroethane			
1,2-Dichloroethene (total)	140	70	
Chloroform			
1,2-Dichloroethane	5.0	0.5	5.0
2-Butanone			
1,1,1-Trichloroethane	200	100	200
Carbon tetrachloride	5	0.5	5.0
Vinyl acetate			
Bromodichloroethane			
1,2-Dichloropropane	0.58	.058	5.0
Cis-1.3-Dichloropropene			
Trichloroethene	5.0	0.5	
Dibromochloromethane			
1,1,2-Trichloroethane			
Benzene	5.0	0.5	5.0
Trans-1,3-Dichloropropene			
Bromoform			
4-Methyl-2-pentanone			
2-Hexanone			
Tetrachloroethene	.70	.07	
1,1,2,2-Tetrachloroethane			
Toluene	2.42 mg/l	1.21 mg/l	1000
Chlorobenzene	100	50	
Ethylbenzene	680	340	700
Styrene	5.0	0.5	100
Xylene (total)	400	200	10,000
TOC (mg/L)			

*Regulations published by the Bureau of National Affairs, Inc.

Table 38 (page 2 of 2)

Inorganics
Burgess Brothers Superfund Site
Federal and State of Vermont Regulations

	State Water Laws* Primary Ground Water Standards		Federal Regulations* Maximum Contaminant Levels	
	Enforcement Standard (micrograms per liter)	Preventive Action Limit (micrograms per liter)	Primary (micrograms per liter)	Secondary (micrograms per liter)
Compound				
Aluminum				50 to 200
Antimony			6	
Arsenic	50.0	25.0	50	
Barium	1.0 mg/l	0.50 mg/l	1000	
Berylium			4	
Cadmium	5.0	2.5	10	
Calcium				
Chromium	50.0	25.0	50	
Cobalt				
Copper				1000
Iron				300
Lead	20.0	10.	50	
Magnesium				
Manganese				50
Mercury	2.0	1.0	2	
Nickel	350.0	175.0	100	
Potassium				
Selenium				
Silver	50.0	25.0		100
Sodium				
Thalium			2	
Vanadium				
Zinc				5000
Cyanide	154.0	77.0	200	
BOD5 (mg/L)				
Hardness (mg/L)				

*Regulations published by the Bureau of National Affairs, Inc.

Table 39 (page 1 of 2)

Surface Water Qualty Standards

Compound	USEPA Ambient Water Quality Standards (µg/l unless indicated otherwise)	State of Vermont Class A or Class B Waters (µg/l unless indicated otherwise)
Acrolein		320
Acrylonitrile		.058
Aldrin		.074 ng
Antimony		146
Arsenic	360	2.2 ng
Asbestos		30 x 10^3 f/l
Barium		1 mg
Benzene		.66
Benzidine		.12 ng
Beryllium		6.8 ng
Cadmium	1.79	10
Carbon tetrachloride		.4
Chlordane	2.4	.46 ng
Chloroethyl ether (Bis-2)		.03
Chloromethyl ether (Bis-2)		0.00376 ng
Chloroisopropyl ether (Bis-2)		34.7
Chloroform		.19
Chlorophenoxy herbicides (2,4,5-TP)		10
Chlorophenoxy herbicides (2,4-D)		100
Chromium (hex)	16	50
Chromium (Tri)	984	170 mg
Cyanide	22	200
DDT	1.1	.024 ng
Dibutyl phthalate		34 mg
Dichlorobenzene		400
Dichlorobenzidine		.01
1,2-Dichloroethane		.94
1,1-Dichloroethylene		.033
2,4-Dichlorophenol		3.09
Dichloropropenes		87
Dieldrin	2.5	.071 ng
Diethyl phthalate		350 mg
Di-2-ethylhexyl phthalate		15 mg
Dimethyl phthalate		313 mg
2.4-Dinitrophenol		70
2,4-Dinitro-o-cresol		13.4
2,4-Dinitrotoluene		.11
Dioxin (2,3,7,8-TCDD)		.000013 ng
Diphenylhydrazine		.042
Endosulfan	0.22	74
Endrin	0.18	1
Ethylbenzene		1.4 mg
Fluoranthene		42
Halomethanes		.19
Heptachlor	0.52	.28 ng
Hexachlorobenzene		.72 ng
Hexachlorobutadiene		.45

Table 39 (page 2 of 2)

Surface Water Quality Standards

Compound	USEPA Ambient Water Quality Standard (µg/l unless indicated otherwise)	State of Vermont Class A or Class B Waters (µg/l unless indicated otherwise)
Hexachlorocyclohexane-Alpha		9.2 ng
Hexachlorocyclohexane-Beta		16.3 ng
Hexachlorocyclohexane-Gamma (Lindance)		18.6 ng
Hexachlorocyclohexane-Technical		12.3 ng
Hexachlorocyclopentadiene		206
Hexachloroethane		1.9
Isophorone		5.2 mg
Lead	33.78	50
Mercury	2.4	144 ng
Monochlorobenzene		488
Nickel	789	13.4
Nitrobenzene		19.8
N-Nitrosodibutylamine		6.4 ng
N-Nitrosodiethylamine		.8 ng
N-Nitrosodimethylamine		1.4 ng
N-Nitrosodiphenylamine		4.9
N-Nitrosopyrrolidine		16 ng
Pentachlorobenzene		74
Pentachlorophenol	20	101 mg
Phenol		3.5 mg
Polychlorinated Biphenyls		.079 ng
Polynuclear Aromatic Hydrocarbons		2.8 ng
Selenium	20	10
Silver	1.23	50
1, 2, 4, 5-Tetrachlorobenzene		38
1, 2, 2, 2-Tetrachloroethane		.17
Tetrachloroethylene		.8
Thallium		13
Toluene		14.3 mg
Toxaphene	0.73	.71 ng
1, 1, 1-Trichloroethane		18.4 mg
1, 1, 2-Trichloroethane		.6
Trichloroethylene		2.7
2, 4, 5-Trichlorophenol		2.6 mg
2, 4, 6-Trichlorophenol		1.2
Vinyl Chloride		2

Published by the Bureau of National Affairs, Inc.

Criteria are in micrograms/liter (parts per billion) unless otherwise noted,
ng = nanograms/liter (parts per trillion), mg = milligrams/liter (parts per million),
g = grams/liter, f = fibers/liter

Carcinogenic - for those toxic substances which are identified as carcinogens the criteria have been established at a risk level of 10^{-6} assuming a lifetime exposure to a 70 Kg male consuming 6.5 grams per day of fish and shell-fish products and ingesting 2.0 liters of water per day.

\- for those toxic substances which are identified as noncarcinogens the criteria are best estimated of concentrations which are not expected to produce adverse effects in human health assuming a lifetime exposure of a 70 Kg male consuming 6.5 grams per day of fish and shell-fish products and ingesting 2.0 liters of water per day.

Table 40

Burgess Brothers Superfund Site
Interim Sediment Quality Criteria

SCREENING GUIDELINES

Compound	NOAA EFFECTS RANGE SEDIMENT QUALITY GUIDELINES		ONTARIO MINISTRY OF THE ENVIRONMENT AQUATIC SEDIMENT GUIDELINES	
	ER-L	ER-M	Lowest Effect Level	Severe Effect Level
Antimony	2 mg/kg	75 mg/kg	-	-
Arsenic	33 mg/kg	85 mg/kg	6 mg/kg	33 mg/kg
Cadmium	5 mg/kg	9 mg/kg	1.6 mg/kg	10 mg/kg
Chromium	80 mg/kg	145 mg/kg	26 mg/kg	110 mg/kg
Copper	70 mg/kg	390 mg/kg	16 mg/kg	250 mg/kg
Iron	-	-	4 mg/kg	2 mg/kg
Lead	35 mg/kg	110 mg/kg	31 mg/kg	250 mg/kg
Manganese	-	-	460 mg/kg	1,100 mg/kg
Mercury	.150 mg/kg	1.3 mg/kg	.02 mg/kg	2.0 mg/kg
Nickel	30 mg/kg	50 mg/kg	16 mg/kg	75 mg/kg
Silver	1 mg/kg	2.2 mg/kg	-	-
Zinc	120 mg/kg	270 mg/kg	120 mg/kg	820 mg/kg
PCBs	50 ug/kg	400 ug/kg	70 ug/kg	*530 mg/kg
p,p-DDT	1 ug/kg	7 ug/kg	8 ug/kg	*71 mg/kg
p,p-DDE	2 ug/kg	15 ug/kg	5 ug/kg	*19 mg/kg
p,p-DDD	2 ug/kg	20 ug/kg	8 ug/kg	*6 mg/kg
total DDT	3 ug/kg	350 ug/kg	7 ug/kg	*12 mg/kg
Chlordane	0.5 ug/kg	6 ug/kg	7 ug/kg	*6 mg/kg
Dieldrin	0.02 ug/kg	8 ug/kg	2 ug/kg	*91 mg/kg
Endrin	0.02 ug/kg	45 ug/kg	3 ug/kg	*130 mg/kg
Acemaphthene	150 ug/kg	650 ug/kg	-	-
Anthracene	85 ug/kg	960 ug/kg	-	-
Benzo(a)anthracene	230 ug/kg	1,600 ug/kg	-	-
Benzo(a)pyrene	400 ug/kg	2,500 ug/kg	-	-
Chrysene	400 ug/kg	2,800 ug/kg	-	-
Dibenz(a,h)anthracene	60 ug/kg	260 ug/kg	-	-
Fluoranthene	600 ug/kg	3,600 ug/kg	-	-
Fluorene	35 ug/kg	640 ug/kg	-	-
2-Methylnaphthalene	65 ug/kg	670 ug/kg	-	-
Naphthalene	340 ug/kg	2,100 ug/kg	-	-
Phenanthrene	225 ug/kg	1,380 ug/kg	-	-
Pyrene	350 ug/kg	2,200 ug/kg	-	-
total PAH	4,000 ug/kg	35,000 ug/kg	2,000 ug/kg	11 mg/kg

* Numbers are to be converted to bulk sediment values by multiplying the actual TOC concentration of the sediments to a maximum of 10% (e.g., analysis of a sediment sample gave a PCB value of 30 ppm and a TOC of 5%). The value for PCB in the Sever Effects column is first converted to a bulk sediment value for a sediment with 5% TOC by multiplying 530 x 0.05 = 26.5 ppm as the Severe Effect Level guidelines for that sediment. The measured value of 30 ppm is then compared with this bulk sediment value and is found to exceed the guideline.

Table 41

BURGESS BROTHERS SUPERFUND SITE
Sampling Pump Pre-and Post-Calibration Data

Pump Identification	Pre-Calibration Flowrate (cc/min)	Post-Calibration Flowrate (cc/min)	Average Flowrate (cc/min)
501125	41.5	40.9	41.2
500969	41.6	41.6	41.6
500827	41.3	40.3	40.8
500955	41.4	41.3	41.35
501312	40.1	42.9	41.5
L5	40.1	41.9	41
513951	40.5	41.1	40.8
21927	41.1	42.5	41.8
89-082-05	41.8	40.1	40.95
89-082-10	44.8	45.9	45.35
89-082-16	40.4	40.9	40.65
513432	41.3	43.8	42.55
21932	40.8	42.4	41.6
21924	40.8	44.1	42.25
21925	40.2	41.5	40.85

Table 42

BURGESS BROTHERS SUPERFUND SITE

Volatile Compound Results

USEPA Modified Method TO-2

Sampled October 14, 1992

Compounds	CAS Number	OSHA PEL (ug/m^3)	ACGIH TLV (ug/m^3)	Vermont Hazard Limiting Value Annual Average (ug/m^3)	Blank (ug)	AS-01-V (ug/m^3) (Exclusion) (Zone)	AS-02-V (ug/m^3) (Upwind)	AS-03-V (ug/m^3) (Landfill) (Downwind)	AS-04-V (ug/m^3) (Upwind)	AS-05-V (ug/m^3) (Downwind)	AS-06-V (ug/m^3) (Downwind)	AS-07-V (ug/m^3) (AS-03-V) (Duplicate) (Landfill)
1,1,1-Trichloroethane	71-55-6	1900000	1910000	190000	0.02	1.8U	2U	1.4U	2U	1.4U	3.4U	2.2U
1,1,2,2-Tetrachloroethane	79-34-5	7000(skin)	6900(skin)	0.017	0.05U	2.5U	2.5U	2.5U	2.5U	2.5U	2.5U	2.5U
1,1,2-Trichloroethane	79-00-5	45000(skin)	55000(skin)	0.061	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.69U
1,1-Dichloroethane	75-34-3	400000	405000	19300	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,1-Dichloroethene	75-35-4	4000	20000	---	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,2-Dichloroethane	107-06-2	4000	40000	0.038	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,2-Dichloroethene	540-59-0	790000	793000	79000	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,2-Dichloropropane	78-87-5	350000	347000	0.01	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
2-Butanone	78-93-3	590000	590000	5900	0.025U	2.1	1.3U	1.3U	1.3U	1.3U	1.3UJ	1.3UJ
2-Hexanone	591-78-6	20000	20000(skin)	---	0.025U	1.3U	1.3U	1.3U	1.3U	1.3U	1.3U	0.5U
4-Methyl-2-Pentanone	108-10-1	205000	205000	---	0.025U	1.3U	1.3U	1.3U	1.3U	1.3U	1.3U	1.3U
Acetone	67-64-1	1800000	1780000	178000	0.12U	6.3UJ	6.1UJ	6.3UJ	6.1UJ	6.1UJ	27UJ	65UJ
Benzene	71-43-2	3000	32000	0.12	0.011	0.99U	0.81U	1.3U	1.1U	0.56U	1.8UJ	1.8UJ
Bromodichloromethane	75-57-4	---	---	---	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Bromoform	75-25-2	5000(skin)	5200(skin)	0.01	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Bromomethane	74-83-9	20000(skin)	19000(skin)	0.1	0.025U	1.3U	1.3U	1.3U	1.3U	1.3U	1.3U	1.3U
Carbon Disulfide	75-15-0	12000(skin)	31000(skin)	714	0.01U	4.5	0.5U	4.2J	0.5U	0.5U	10	0.5UJ
Carbon Tetrachloride	56-23-5	12600	31000(skin)	0.067	0.01U	0.52	0.65	0.63J	0.85	0.5U	0.85	1.1J
Chlorobenzene	108-90-7	350000	46000	833	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Chloroform	67-66-3	9780	49000	0.043	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
cis-1,3-Dichloropropene	10061-01-5	---	---	---	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Dibromochloromethane	124-48-1	---	---	---	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethylbenzene	100-41-4	435000	434000	43500	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.8	1.4U
m,p-Xylene	1330-20-7	435000	434000	86.3	0.01U	0.57	1.1	1.1J	0.7	1.1	2.6	0.5J
Methylene Chloride	75-09-2	62500	174000	0.25	0.055B	9.5U	6.1U	2.5U	1U	3.7U	18U	11U
o-Xylene	1330-20-7	435000	434000	86.3	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.95	0.5U

Table 22

BURGESS BROTHERS SUPERFUND SITE

Volatile Compound Results

USEPA Modified Method TO-2

Sampled October 14, 1992

Table 42 (Continued)

Compounds	CAS Number	OSHA PEL (ug/m^3)	ACGIH TLV (ug/m^3)	Vermont Hazard Limiting Value Annual Average (ug/m^3)	Blank (ug)	AS-01-V (ug/m^3) (Exclusion) (Zone)	AS-02-V (ug/m^3) (Upwind)	AS-03-V (ug/m^3) (Landfill) (Downwind)	AS-04-V (ug/m^3) (Upwind)	AS-05-V (ug/m^3) (Downwind)	AS-06-V (ug/m^3) (Downwind)	AS-07-V (ug/m^3) (AS-03-V) (Duplicate) (Landfill)
Styrene	100-42-5	215000	213000(skin)	512	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Tetrachloroethene	127-18-4	170000	339000	0.41	0.01U	32	0.5U	0.5UJ	0.5U	0.5U	0.75	1.3J
Toluene	108-88-3	375000	377000	8930	0.01U	1.4	4.5	2.1	1.8	4	6	3.2
trans-1,3-Dichloropropene	10061-02-6	---	---	---	0.01U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Trichloroethene	79-01-6	270000	269000	0.42	0.01U	37	0.5U	0.5UJ	0.5U	0.5U	0.9	0.85J
Trichlorofluoromethane	75-69-4	5600000(ceiling)	5620000(ceiling)	---	0.6	40U	30U	20U	30U	40U	40U	20U
Vinyl Acetate	108-05-4	30000	35000	---	0.025U	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ	0.5UJ
Vinyl Chloride	75-01-4	2600	13000	0.2	0.025U	1.3U	1.3U	1.3U	1.3U	1.3U	1.3U	1.3U
TIC's												
2-ethyl-Hexanal	123-05-7	---	---	---	ND	ND	ND	ND	ND	ND	6	ND
Aliphatic Hydrocarbon	---	---	---	---	0.04	ND	R	ND	R	R	R	R
Aliphatic Hydrocarbon	---	---	---	---	ND	ND	ND	ND	ND	ND	3	ND
Aliphatic Hydrocarbon	---	---	---	---	ND	ND	ND	ND	ND	2	4	ND
Aliphatic Hydrocarbon	---	---	---	---	ND	ND	3	ND	4	2	2	ND
Limonene	138-86-3	---	---	---	ND	ND	ND	ND	ND	ND	3	ND
Nonanal	124196	---	---	---	ND	ND	4	1	10	4	ND	ND
Unknown Hyrdocarbon	---	---	---	---	ND	ND	ND	3B	2B	ND	ND	3
Unknown Hyrdocarbon	---	---	---	---	ND	ND	ND	3	1	10B	ND	2
Unknown Silane	---	---	---	---	0.3	R	R	R	R	R	R	R

BURGESS BROTHERS SUPERFUND SITE

Semi-Volatile Compound Results

USEPA Modified Method TO-13

Sampled October 14, 1992

Compounds	CAS Number	OSHA PEL (ug/m^3)	ACGIH TLV (ug/m^3)	Vermont Hazard Limiting Value Annual Average (ug/m^3)	Blank (ug)	AS-01-SV (ug/m^3) (Exclusion) (Zone)	AS-02-SV (ug/m^3) (Upwind)	AS-03-SV (ug/m^3) (Landfill) (Downwind)	AS-04-SV (ug/m^3) (Upwind)	AS-05-SV (ug/m^3) (Downwind)	AS-06-SV (ug/m^3) (Downwind)	AS-07-SV (ug/m^3) (AS-03-SV) (Duplicate) (Landfill)
1,2,4-Trichlorobenzene	120-82-1	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
1,2-Dichlorobenzene	95-48-1	300000(ceiling)	150000	3000	10U	520U	560U	520U	510U	460U	500U	530U
1,3-Dichlorobenzene	541-73-1	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
1,4-Dichlorobenzene	106-46-7	450000	451000	---	10U	520U	560U	520U	510U	460U	500U	530U
2,2'-oxybis(1-Chloropropane)	39638-32-9	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
2,4,5-Trichlorophenol	95-95-4	---	---	---	50U	2600U	2800U	2600U	2600U	2300U	2500U	2600U
2,4,6-Trichlorophenol	88-06-2	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
2,4-Dichlorophenol	120-83-2	---	---	---	10U	520U	560U	520U	[illegible]0U	460U	500U	530U
2,4-Dimethylphenol	105-67-9	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
2,4-Dinitrophenol	51-28-5	---	---	---	50U	2600U	2800U	2600U	2600U	2300U	2500U	2600U
2,4-Dinitrotoluene	121-14-2	---	---	---	10U	520UJ	560UJ	520UJ	510UJ	460UJ	500UJ	530UJ
2,6-Dinitrotoluene	606-20-2	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
2-Chloronaphthalene	91-58-7	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
2-Chlorophenol	95-57-8	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
2-Methylnaphthalene	91-57-6	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
2-Methylphenol	95-48-7	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
2-Nitroaniline	88-74-4	---	---	---	50U	2600U	2800U	2600U	2600U	2300U	2500U	2600U
2-Nitrophenol	88-75-1	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
3,3'-Dichlorobenzidine	91-94-1	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
3-Nitroaniline	99-09-2	---	---	---	50U	2600U	2800U	2600U	2600U	2300U	2500U	2600U
4,6-Dinitro-2-methylphenol	534-52-1	200(skin)	200(skin)	---	50U	2600U	2800U	2600U	2600U	2300U	2500U	2600U
4-Bromophenyl-phenylether	101-55-3	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
4-Chloroaniline	106-47-8	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
4-Chlorophenyl-phenylether	7005-72-3	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
4-Chloro-3-methylphenol	59-50-7	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
4-Methylphenol	95-48-7	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
4-Nitroaniline	100-01-6	3000(skin)	3000(skin)	---	50U	2600U	2800U	2600U	2600U	2300U	2500U	2600U

Table 4B (Continued)

BURGESS BROTHERS SUPERFUND SITE

Semi-Volatile Compound Results

USEPA Modified Method TO-13

Sampled October 14, 1992

Compounds	CAS Number	OSHA PEL (ug/m^3)	ACGIH TLV (ug/m^3)	Vermont Hazard Limiting Value Annual Average (ug/m^3)	Blank (ug)	AS-01-SV (ug/m^3) (Exclusion) (Zone)	AS-02-SV (ug/m^3) (Upwind)	AS-03-SV (ug/m^3) (Landfill) (Downwind)	AS-04-SV (ug/m^3) (Upwind)	AS-05-SV (ug/m^3) (Downwind)	AS-06-SV (ug/m^3) (Downwind)	AS-07-SV (ug/m^3) (AS-03-SV) (Duplicate) (Landfill)
4-Nitrophenol	100-02-7	---	---	---	50U	2600U	2800U	2600U	2600U	2300U	2500U	2600U
Acenaphthene	83-32-9	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Acenaphthylene	208-96-8	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Anthrecene	120-12-7	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Benzo(a)anthracene	56-55-3	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Benzo(a)pyrene	50-32-8	---	---	0.0003	10U	520U	560U	520U	510U	460U	500U	530U
Benzo(b)fluoranthene	205-99-2	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Benzo(g,h,i)perylene	191-24-2	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Benzo(k)fluoranthene	207-08-9	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
bis(2-Chloroethoxy)methane	111-91-1	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
bis(2-Chloroethyl)ether	111-44-4	30000(skin)	29000(skin)	0.0031	10U	520U	560U	520U	510U	460U	500U	530U
Bis(2-ethylhexyl)phthalate	117-81-7	5000	5000	---	10U	520U	560U	520U	510U	460U	500U	530U
Butylbenzylphthalate	85-68-7	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Carbazol	86-74-8	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Chrysene	218-01-9	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Dibenzofuran	132-64-9	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Dibenz(a,h)anthracene	53-70-3	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Diethylphthalate	84-66-2	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Dimethylphthalate	131-11-3	5000	5000	120	10U	520U	560U	520U	510U	460U	500U	530U
Di-n-butylphthalate	84-74-2	5000	5000	500	73B	3500U	10000U	5100U	7700U	7900U	2900U	7400U
Di-n-octylphthalate	117-84-0	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Fluoranthene	206-44-0	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Fluorene	86-73-7	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Hexachlorobenzene	118-74-1	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Hexachlorobutadiene	87-68-3	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Hexachlorocyclopentadiene	77-47-4	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U

Table 43 (Continued)

BURGESS BROTHERS SUPERFUND SITE
Semi-Volatile Compound Results
USEPA Modified Method TO-13
Sampled October 14, 1992

Compounds	CAS Number	OSHA PEL (ug/m^3)	ACGIH TLV (ug/m^3)	Vermont Hazard Limiting Value Annual Average (ug/m^3)	Blank (ug)	AS-01-SV (ug/m^3) (Exclusion) (Zone)	AS-02-SV (ug/m^3) (Upwind)	AS-03-SV (ug/m^3) (Landfill) (Downwind)	AS-04-SV (ug/m^3) (Upwind)	AS-05-SV (ug/m^3) (Downwind)	AS-06-SV (ug/m^3) (Downwind)	AS-07-SV (ug/m^3) (AS-03-SV) (Duplicate) (Landfill)
Hexachloroethane	67-72-1	10000(skin)	9700(skin)	0.25	10U	520U	560U	520U	510U	460U	500U	530U
Indeno(1,2,3-cd)pyrene	193-39-5	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Isophorone	78-59-1	23000	28000(skin)	---	10U	520U	560U	520U	510U	460U	500U	530U
Naphthalene	91-20-3	---	---	120	10U	520U	560U	520U	510U	460U	500U	530U
Nitrobenzene	98-95-3	5000(skin)	5000(skin)	119	10U	520U	560U	520U	510U	460U	500U	530U
N-Nitrosodiphenylamine	86-30-6	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
N-Nitroso-di-n-propylamine	621-64-7	---	---	---	10U	520U	560U	520U	510U	460U	500U	530U
Pentachlorophenol	87-86-5	500(skin)	500(skin)	1.19	50U	2600U	2800U	2600U	2600U	2300U	2500U	2600U
Phenanthrene	85-01-8	---	---	1.3	10U	520U	560U	520U	510U	460U	500U	530U
Phenol	108-95-2	19000(skin)	19000(skin)	1900	10U	520UJ	560UJ	520UJ	510UJ	460UJ	500UJ	530UJ
Pyrene	129-00-0	---	---	3.4	10U	520U	560U	520U	510U	460U	500U	530U
TIC's												
Acetic acid ester	---	---	---	---	50J	ND	ND	ND	R	ND	R	R
Phthalate	---	---	---	---	13J	ND	ND	ND	ND	ND	ND	ND

TABLE 44

COMPARISON OF SITE BACKGROUND INORGANICS TO VERMONT AND NORTHEAST U.S. SOILS

Analyte	Site Background Concentration (W-01 DI) Range (mg/kg)	Vermont Avg. Surface Soils (mg/kg)	Average Concentrations in Northeast US Surface Soils (mg/kg)
Aluminum	3,530 to 4,320	NA	33,000
Antimony	ND	NA	NA
Arsenic	1.2 to 1.2	2.4 to 5.9	5
Barium	22.9 to 32.9	200 to 500	290
Beryllium	0.26 to 0.42	1.5 to 2.0	0.6
Cadmium	ND	NA	0.2
Calcium	716 to 1070	150	3,400
Chromium	4.1 to 4.2	30 to 100	33
Cobalt	2.9 to 4.8	10 to 15	5.9
Copper	4.4 to 6.6	15 to 20	13
Iron	6,810 to 9,680	NA	14,000
Lead	3.3 to 4.2	20	14
Magnesium	1,030 to 1,220	NA	2,200
Manganese	132 to 235	700 to 1,000	272
Mercury	ND	0.05 to 0.43	0.081
Nickel	4.4 to 6	15 to 30	12
Potassium	651 to 751	NA	7,400 to 12,000
Selenium	ND	0.3 to 0.5	0.3
Silver	ND	NA	NA
Sodium	130 to 235	NA	2,500
Thallium	0.13 to 0.25	NA	NA
Vanadium	6.1 to 6.9	70	43
Zinc	18.8 to 20.2	30 to 50	40

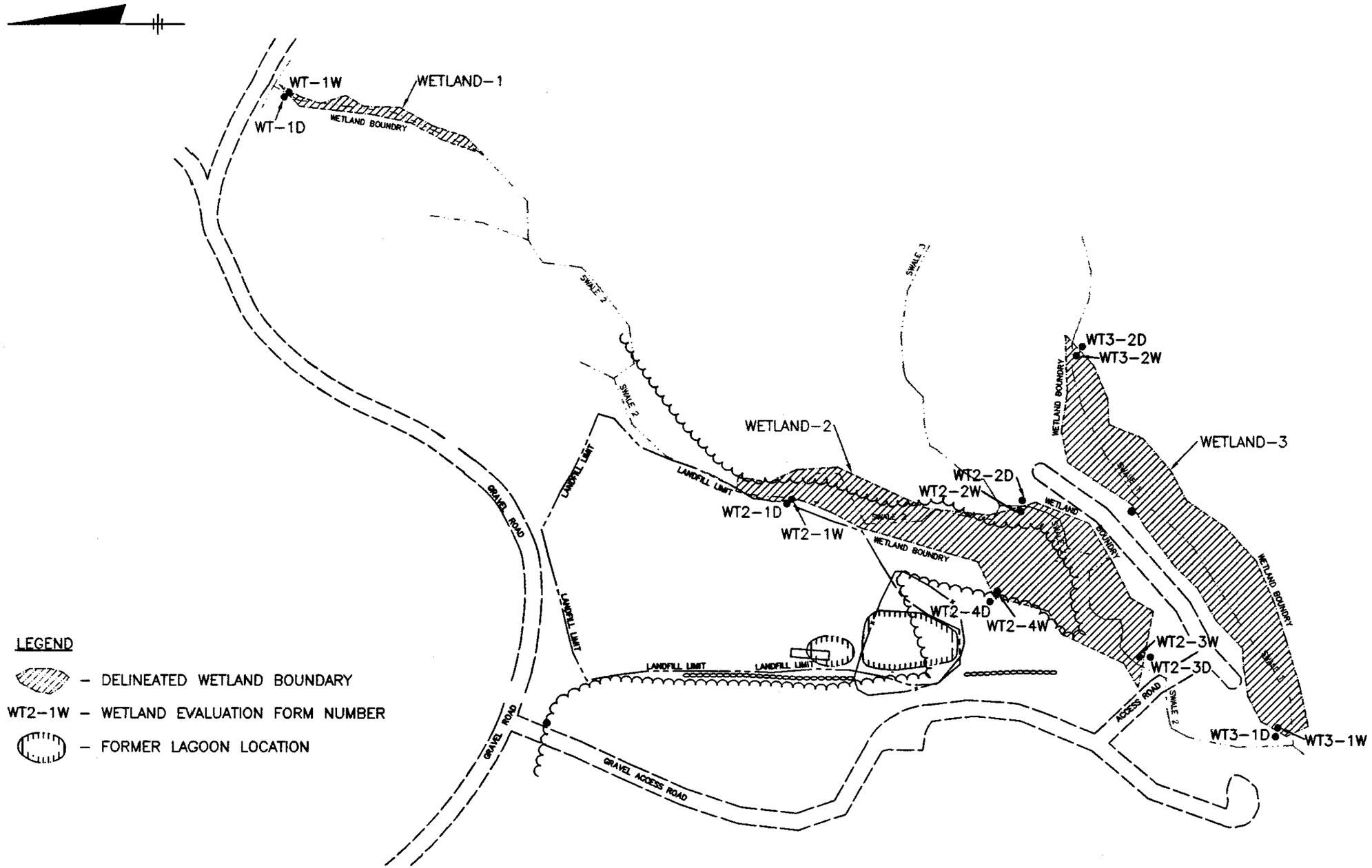
Note:

1) ND = Not Detected

2) NA = Not Available

3) Metal concentrations listed under column Vermont Average Surface Soils taken from Shacklette and Boergen publication presented in Appendix 18.

4) Metal concentrations listed under column Average Northeast U.S. Soils taken from background concentrations of soils with special regard to New York State, E. Carol McGover, Wildlife Pathology Unit, Wildlife Resources Center, New York State DEC, Delmar, NY, March 1988 publication. Concentrations based on soils collected from a depth of 24 cm.



LEGEND

- DELINEATED WETLAND BOUNDARY
- WT2-1W – WETLAND EVALUATION FORM NUMBER
- FORMER LAGOON LOCATION

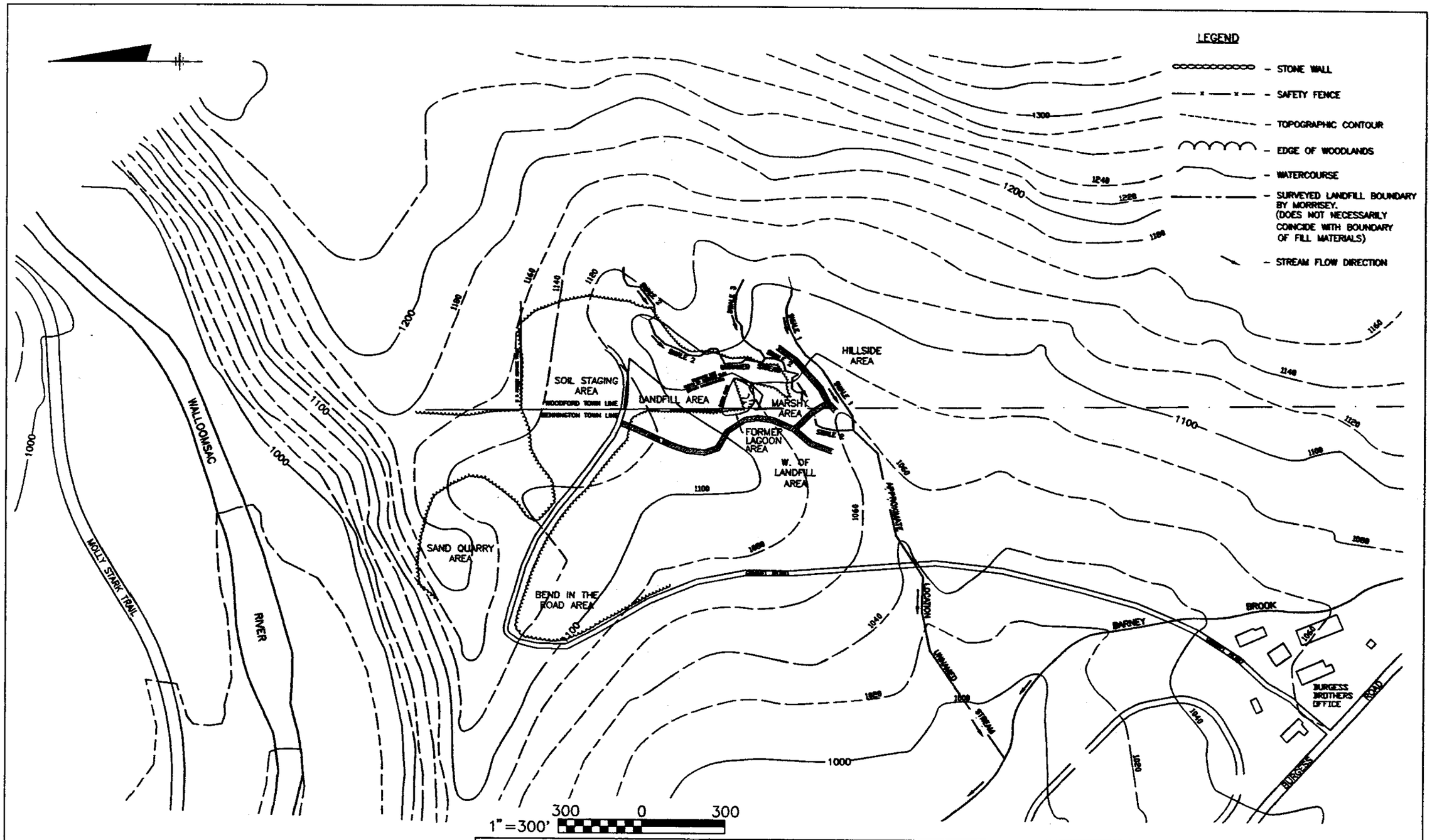
O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WETLAND BOUNDARIES

FILE NO. 5271.003.49F

DATE NOVEMBER 1995

FIGURE 1



GENERAL NOTES

This location map is compiled and digitized from available sources including USGS 7.5 minute topographic mapping with 20' contour interval, Quadrangles, 1:24,000, Aerial Photographs exposed 3-6-91 by Keystone Aerial Surveys, Inc., 1=7920', and field survey by Foresight Land Services during 1992-1993. Locations of digitized features is only approximate and shown for relative location. Critical locations should be verified by survey.

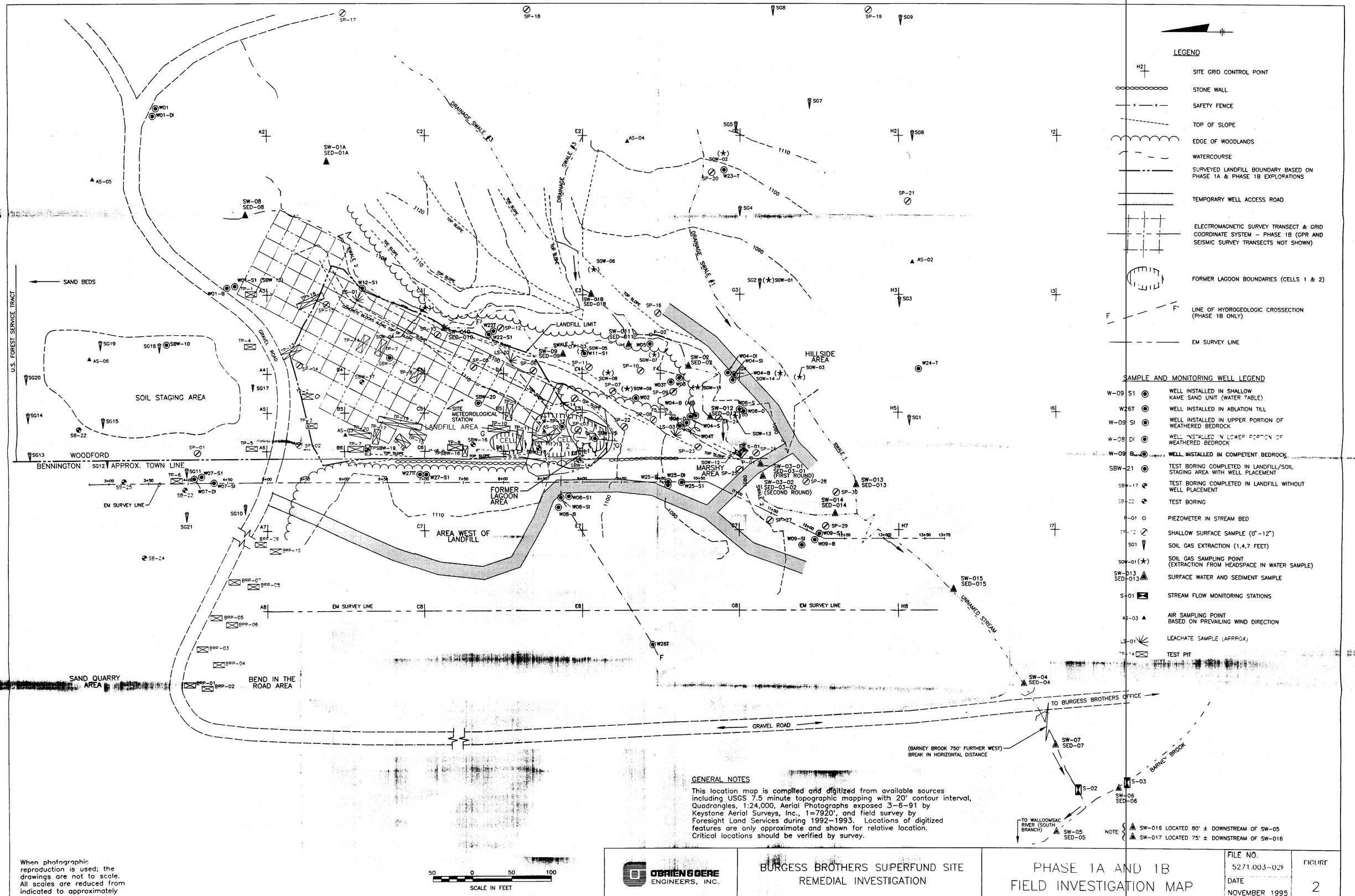
O'BRIEN & GERE ENGINEERS, INC.

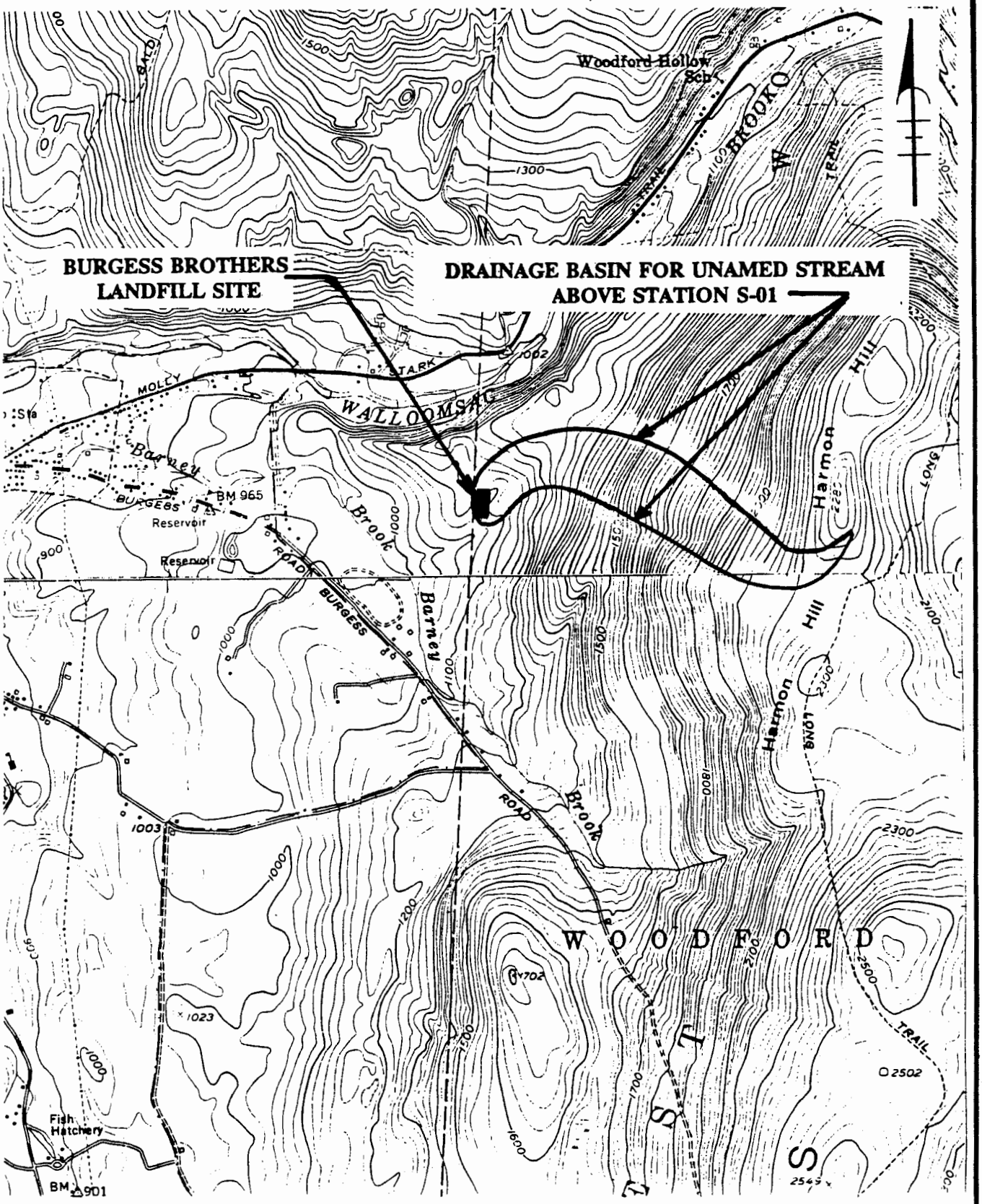
BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
SITE PLAN

FILE NO. 5271.003.51P

DATE FEBRUARY 1995

FIGURE 1B


LEGEND
SITE GRID CONTROL POINT
STONE WALL
SAFETY FENCE
TOP OF SLOPE
EDGE OF WOODLANDS
WATERCOURSE
SURVEYED LANDFILL BOUNDARY BASED ON PHASE 1A & PHASE 1B EXPLORATIONS
TEMPORARY WELL ACCESS ROAD
ELECTROMAGNETIC SURVEY TRANSECT & GRID COORDINATE SYSTEM – PHASE 1B (GPR AND SEISMIC SURVEY TRANSECTS NOT SHOWN)
FORMER LAGOON BOUNDARIES (CELLS 1 & 2)
LINE OF HYDROGEOLOGIC CROSSECTION (PHASE 1B ONLY)
EM SURVEY LINE
SAMPLE AND MONITORING WELL LEGEND
WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
WELL INSTALLED IN ABLATION TILL
WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
WELL INSTALLED IN COMPETENT BEDROCK
TEST BORING COMPLETED IN LANDFILL/SOIL STAGING AREA WITH WELL PLACEMENT
TEST BORING COMPLETED IN LANDFILL WITHOUT WELL PLACEMENT
TEST BORING
PIEZOMETER IN STREAM BED
SHALLOW SURFACE SAMPLE (0"–12")
SOIL GAS EXTRACTION (1,4,7 FEET)
SOIL GAS SAMPLING POINT (EXTRACTION FROM HEADSPACE IN WATER SAMPLE)
SURFACE WATER AND SEDIMENT SAMPLE
STREAM FLOW MONITORING STATIONS
AIR SAMPLING POINT BASED ON PREVAILING WIND DIRECTION
LEACHATE SAMPLE (APPROX)
TEST PIT
SAND BEDS
U.S. FOREST SERVICE TRACT
SOIL STAGING AREA
LANDFILL AREA
LANDFILL LIMIT
CELL 1
CELL 2
TEST PIT 1
TEST PIT 2
SITE METEOROLOGICAL STATION
HILLSIDE AREA
MARSHY AREA
FORMER LAGOON AREA
AREA WEST OF LANDFILL
SAND QUARRY AREA
BEND IN THE ROAD AREA
WOODFORD
BENNINGTON
APPROX. TOWN LINE
GRAVEL ROAD
DRAINAGE SWALE #1
DRAINAGE SWALE #2
DRAINAGE SWALE #3
SWALE 1
SWALE 2
SWALE 3
UNNAMED STREAM
BARNEY BROOK
TO BURGESS BROTHERS OFFICE
TO WALLOOMSAC RIVER (SOUTH BRANCH)
(BARNEY BROOK 750' FURTHER WEST) BREAK IN HORIZONTAL DISTANCE
EM SURVEY LINE
EM SURVEY LINE
EM SURVEY LINE
SW-01A SED-01A
SW-01B SED-01B
SW-02 SED-02
SW-03-01 SED-03-01 (FIRST ROUND)
SW-03-02 SED-03-02 (SECOND ROUND)
SW-04 SED-04
SW-05 SED-05
SW-06 SED-06
SW-07 SED-07
SW-08 SED-08
SW-09 SED-09
SW-010 SED-010
SW-011 SED-011
SW-012 SED-012
SW-013 SED-013
SW-014 SED-014
SW-015 SED-015
SW-016 LOCATED 80' ± DOWNSTREAM OF SW-05
SW-017 LOCATED 75' ± DOWNSTREAM OF SW-016
NOTE:
GENERAL NOTES
This location map is compiled and digitized from available sources including USGS 7.5 minute topographic mapping with 20' contour interval, Quadrangles, 1:24,000, Aerial Photographs exposed 3–6–91 by Keystone Aerial Surveys, Inc., 1=7920', and field survey by Foresight Land Services during 1992–1993. Locations of digitized features are only approximate and shown for relative location. Critical locations should be verified by survey.
When photographic reproduction is used; the drawings are not to scale. All scales are reduced from indicated to approximately half size.
50 0 50 100
SCALE IN FEET
O'BRIEN & GERE ENGINEERS, INC.
BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
PHASE 1A AND 1B
FIELD INVESTIGATION MAP
FILE NO. 5271.003-02F
DATE NOVEMBER 1995
FIGURE 2

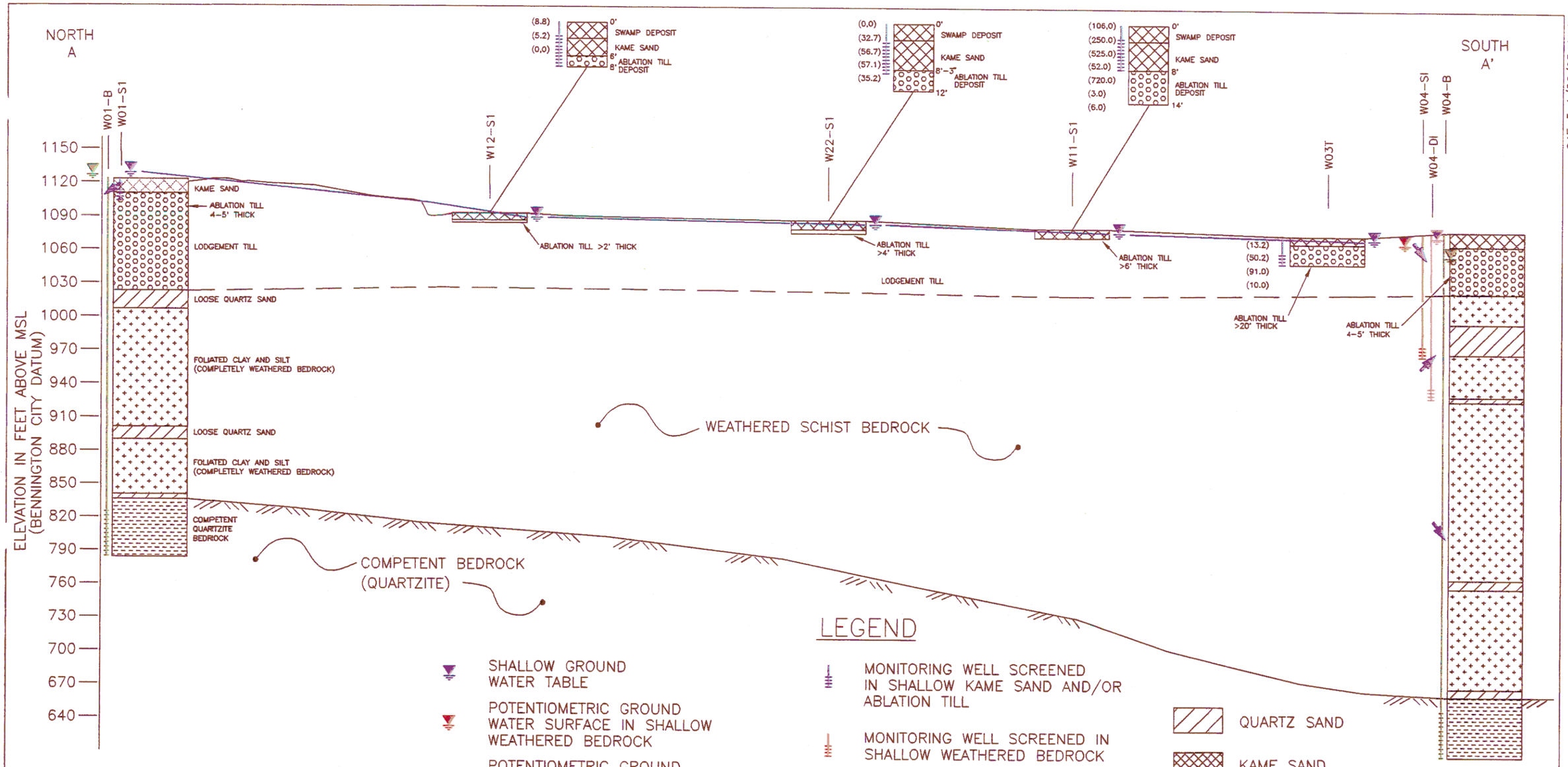


O'BRIEN & GERE
ENGINEERS, INC.
Syracuse. New York

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
DRAINAGE BASIN MAP

FILE NO. 5271.003
DATE February 1995
DWG NO. FIGURE 3

063396



LEGEND

- MONITORING WELL SCREENED IN SHALLOW KAME SAND AND/OR ABLATION TILL
- MONITORING WELL SCREENED IN SHALLOW WEATHERED BEDROCK
- MONITORING WELL SCREENED IN DEEP WEATHERED BEDROCK
- MONITORING WELL SCREENED IN COMPETENT BEDROCK
- WATER TABLE
- SHALLOW GROUND WATER TABLE
- POTENTIOMETRIC GROUND WATER SURFACE IN SHALLOW WEATHERED BEDROCK
- POTENTIOMETRIC GROUND WATER SURFACE IN DEEP WEATHERED BEDROCK
- POTENTIOMETRIC GROUND WATER SURFACE IN COMPETENT BEDROCK
- (35.2) TOTAL VOC CONCENTRATION BY PID IN HEADSPACE (ppmv)
- VERTICAL FLOW POTENTIAL WERE INDICATED
- QUARTZ SAND
- KAME SAND
- ABLATION & LODGEMENT TILL
- WEATHERED SCHIST BEDROCK (CLAY, SILT WITH MINOR QUARTZ SAND)
- COMPETENT QUARTZITE BEDROCK

NOTES:

1. AT SAMPLE INTERVALS WHERE MORE THAN ONE HEADSPACE READING WAS PERFORMED– THE HIGHEST READING WAS PRESENTED.
2. ABLATION TILL NOT PENETRATED IN SHALLOW BORINGS

APPROX. SCALE:
VERTICAL 1"=90'
HORIZONTAL 1"=50'

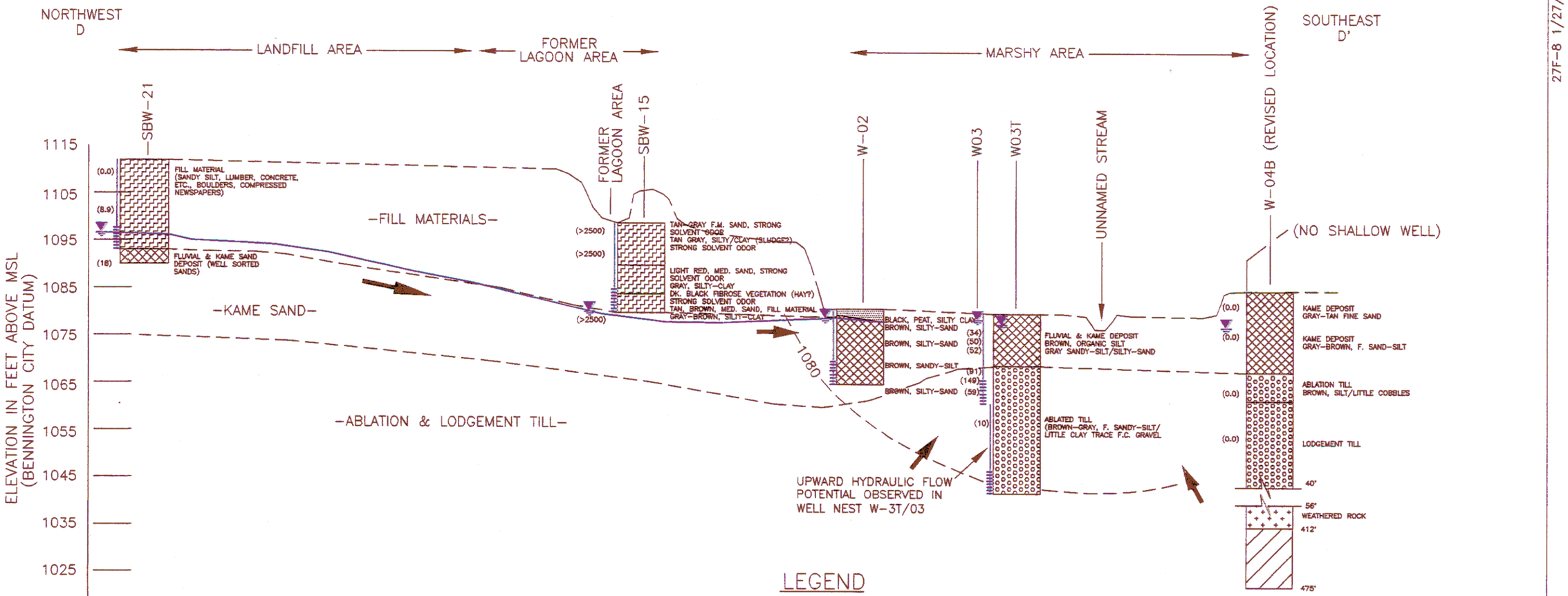
O'BRIEN & GERE
ENGINEERS, INC.

BURGESS BROS. SUPERFUND SITE
REMEDIAL INVESTIGATION
HYDROSTRATIGRAPHIC CROSS-SECTION
A–A'

FILE NO.
5271.003–24P

DATE
FEBRUARY 1995

FIGURE
5



27F-8 1/27/95 1=1

LEGEND

- SHALLOW GROUND WATER TABLE
- GROUND WATER FLOW DIRECTION (SHALLOW ZONE)
- BOUNDARY BETWEEN STRATIGRAPHIC UNITS (APPROXIMATE)
- (52) VOC CONCENTRATION BY PID IN HEADSPACE (PPMV)
- ELEVATION OF GROUND WATER TABLE (JUNE 1993)
- WELL LOCATION AND SCREEN INTERVAL
- 1080 GROUNDWATER EQUIPOTENTIAL CONTOUR (MARSHY AREA ONLY)
- LANDFILL MATERIAL
- KAME SAND
- ORGANIC SWAMP
- ABLATION & LODGEMENT TILL (SEE NOTE 1)
- WEATHERED SCHIST (CLAY, SILT, MINOR SAND)
- COMPETENT QUARTZITE BEDROCK

NOTES: 1. ABLATION AND LODGEMENT TILL BOUNDRY NOTED ON BORING PROFILE.

2. GLACIAL TILL/KAME SAND BOUNDRY INFERRED IN AREAS OF NO BORING DATA, BASED ON SURROUNDING BORING DATA.

APPROX. SCALE:

VERTICAL 1"=20'
HORIZONTAL 1"=30'

O'BRIEN & GERE ENGINEERS, INC.

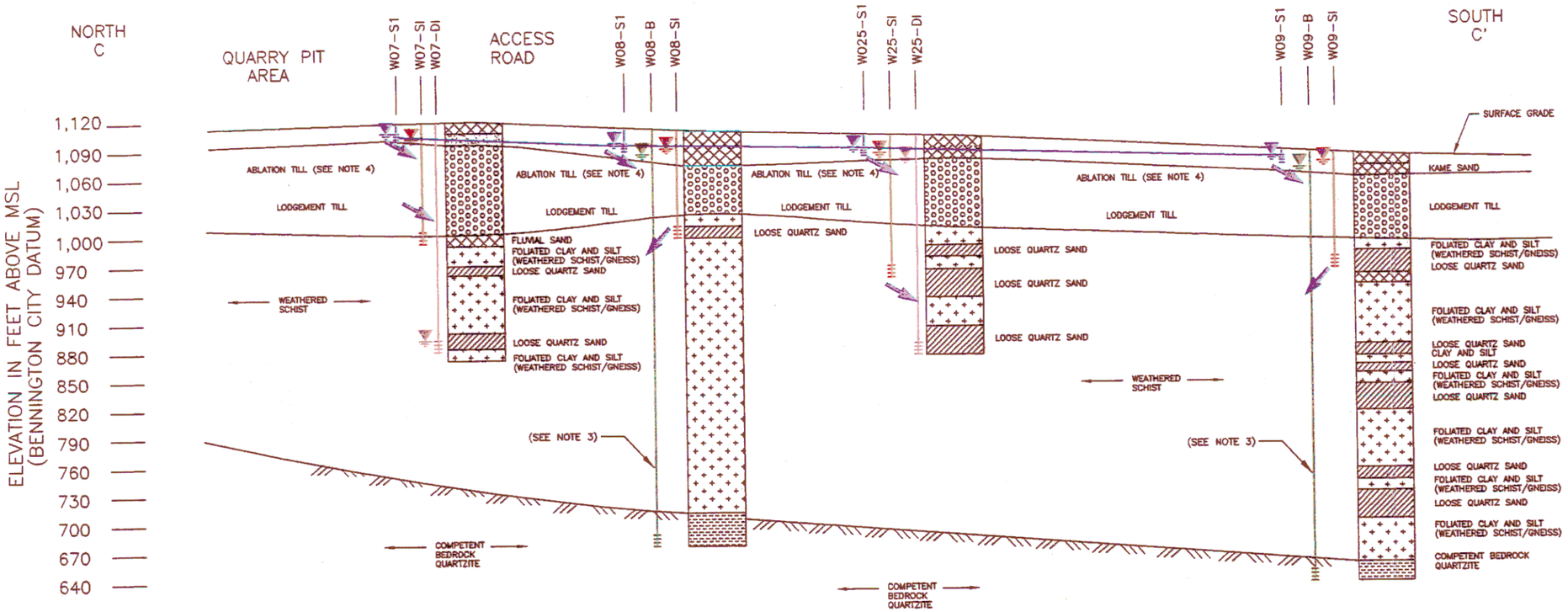
BURGESS BROS. SUPERFUND SITE
REMEDIAL INVESTIGATION
HYDROSTRATIGRAPHIC CROSS-SECTION
D-D'

FILE NO. 5271.003-27F

DATE NOVEMBER 1995

FIGURE 8

25F-7 1/27/95 1=1



NOTES:

1. GROUND WATER ELEVATIONS TAKEN ON 6/21/93.
2. (8.0)=HIGHEST PID READING PRESENTED FROM SOIL SCREENING ANALYSIS (PPMV)
3. DETECTABLE PID READINGS WERE NOTED ON BORING LOGS BUT WERE LIKELY ATTRIBUTED TO MOISTURE INTERFERENCES.
4. ABLATION TILL SEQUENCE 6–18 FEET THICK.

APPROX. SCALE:

VERTICAL 1"=120'
HORIZONTAL 1"=90'

LEGEND

- SHALLOW GROUND WATER TABLE
- POTENTIOMETRIC GROUND WATER SURFACE IN SHALLOW WEATHERED BEDROCK
- POTENTIOMETRIC GROUND WATER SURFACE IN DEEP WEATHERED BEDROCK
- POTENTIOMETRIC GROUND WATER SURFACE IN COMPETENT BEDROCK
- VERTICAL FLOW POTENTIAL AT EACH WELL NEST
- MONITORING WELL SCREENED IN SHALLOW KAME SAND AND/OR ABLATION TILL
- MONITORING WELL SCREENED IN DEEP GLACIAL TILL AND/OR SHALLOW WEATHERED BEDROCK
- MONTORING WELL SCREENED IN DEEP WEATHERED BEDROCK
- MONITORING WELL SCREENED IN COMPETENT BEDROCK
- KAME SAND
- ABLATION & LODGEMENT TILL
- QUARTZITE (SAND)
- WEATHERED SCHIST (CLAY, SILT, MINOR SAND)
- COMPETENT BEDROCK QUARTZITE

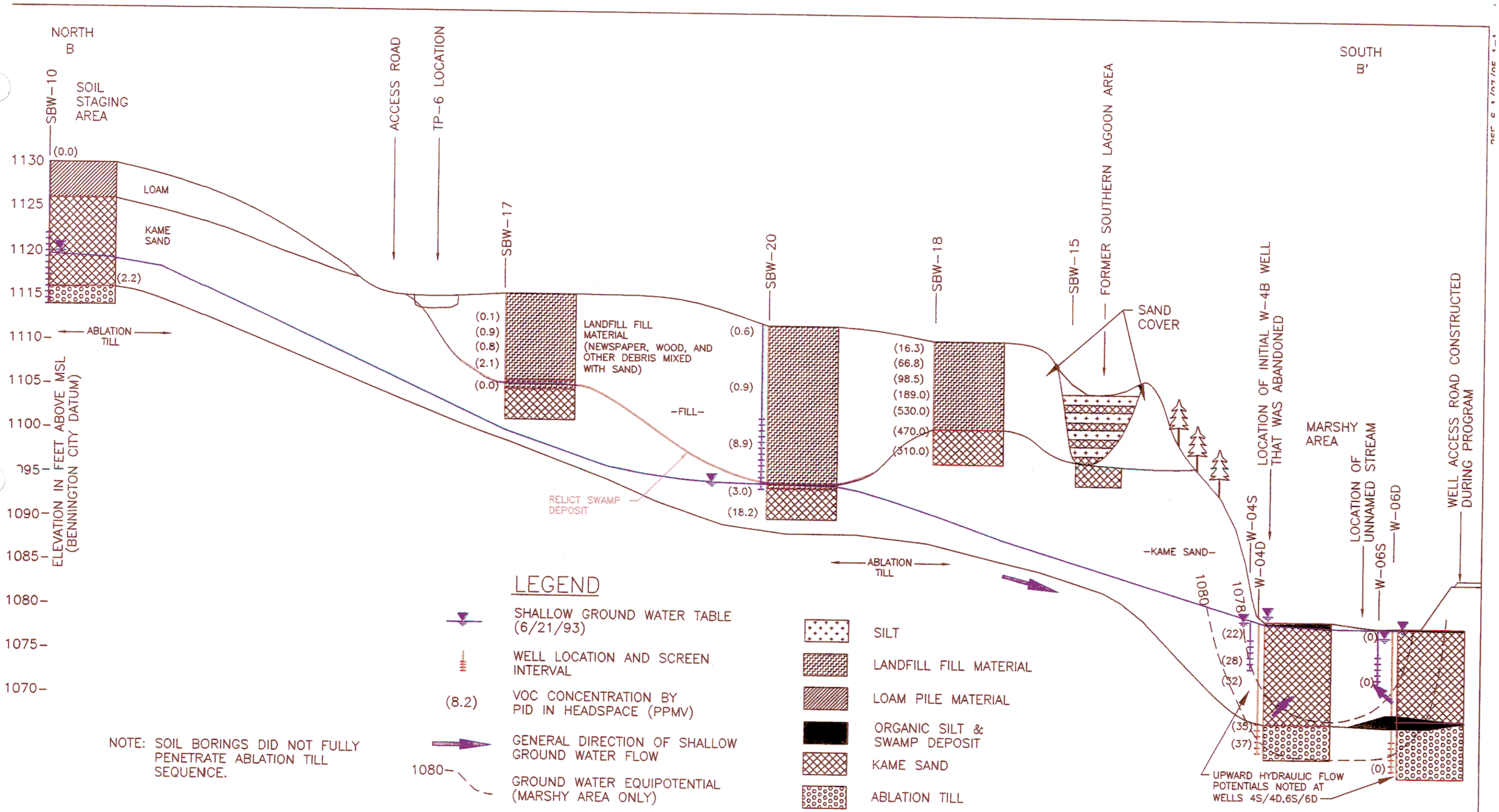
O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROS. SUPERFUND SITE
REMEDIAL INVESTIGATION
HYDROSTRATIGRAPHIC CROSS-SECTION
C–C'

FILE NO. 5271.003–25P

DATE FEBRUARY 1995

FIGURE 7



LEGEND

- SHALLOW GROUND WATER TABLE (6/21/93)
- WELL LOCATION AND SCREEN INTERVAL
- (8.2) VOC CONCENTRATION BY PID IN HEADSPACE (PPMV)
- GENERAL DIRECTION OF SHALLOW GROUND WATER FLOW
- 1080 GROUND WATER EQUIPOTENTIAL (MARSHY AREA ONLY)

- SILT
- LANDFILL FILL MATERIAL
- LOAM PILE MATERIAL
- ORGANIC SILT & SWAMP DEPOSIT
- KAME SAND
- ABLATION TILL

NOTE: SOIL BORINGS DID NOT FULLY PENETRATE ABLATION TILL SEQUENCE.

APPROX. SCALE:
VERTICAL 1"=10'
HORIZONTAL 1"=50'

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROS. SUPERFUND SITE
REMEDIAL INVESTIGATION
HYDROSTRATIGRAPHIC CROSS SECTION
B-B'

FILE NO. 5271.003-26P

DATE FEBRUARY 1995

FIGURE 6

NORTH
E

SOUTH
E'

LANDFILL AREA

FORMER LAGOON AREA

MARSHY AREA

SBW-16

SBW-18

SBW-14

FORMER LAGOON

LOCATION OF INITIAL W04-B WELL THAT WAS ABANDONED

W04-D
W04-S

W06-S2

ELEVATION IN FEET (MSL)

1115
1105
1095
1085
1075
1065
1055
1045

(0.2) DK. BROWN, F.SANDY-SILT VEGATATION
(4.2) FILL MATERIAL (BROWN, GRAY, F-M SAND/ COMPRESSED NEWSPAPERS)
(4.6)
(1.4) KAME DEPOSIT (LT BROWN, STRATIFIED F.SAND W/ LITTLE SILT)
(0.3)

KAME SAND

FILL MATERIAL (LT BROWN, F.SAND/SOME SILT HARD RED MATERIAL AT END OF SPOON, LT BROWN, F.SAND/SOME SILT TRACE GRAVEL)

DK BROWN, Y.F.SAND/SILT, SLIGHT BLACK STAIN THROUGHOUT SAMPLE

DK BLACK, F.SAND/SILT TAN SILTY/F.SAND/TRACE GLASS

KAME DEPOSIT WELL SORTED, F-M SAND/TRACE SILT (DAMP)

(16.3)
(66.8)
(98.5)
(789)
(530) 10'
(470)
(270) 11' (927)
(146)

FILL

(6.9)
(12.6)
(13.7)
(535)
(903)

KAME DEPOSIT (LT TAN/BROWN, SANDY SILT) DAMP

-KAME SAND-
(POSSIBLY REWORKED)

1080'

(22)
(28)
(32)
(35)
(37)

FLUVIAL & KAME DEPOSIT (BLACK ORGANIC MAT. AND SILT)

(BROWN.F.SAND/SOME S.H./TRACE COBBLES) KAME DEPOSIT

ABLATION TILL BROWN, F. SAND/SOME SILT WITH FICS GRAVEL & COBBLES

13'

(0.0)
(0.0)
(0.0)

FLUVIAL & KAME DEPOSIT (BLACK)
BLACK/DK BROWN, SILTY SAND, WET
TAN, F-CS SAND LITTLE MED PEBBLES/TRACE SILT GRADING INTO SILTY FINE SAND/TRACE CS SAND MED PEBBLES
STRATIFIED F.SAND/SILT AND F.-M. SAND
ABLATION TILL (LT BROWN, SILTY-FINE SAND/ SOME F.-M. PEBBLES (ANGULAR)

UPWARD HYDRAULIC FLOW POTENTIAL NOTED AT WELLS 4S/4D

SHTE-H 1=5'

LEGEND

- SHALLOW GROUND WATER TABLE
- WELL LOCATION AND SCREEN INTERVAL
- BOUNDARY BETWEEN STRATIGRAPHIC UNITS (APPROXIMATE)
- (52) VOC CONCENTRATIONS BY PID IN HEAD SPACE **(PPMV)**
- ELEVATION OF GROUND WATER TABLE (JUNE 1993)
- **GROUNDWATER FLOW DIRECTION SHALLOW ZONE**
- 1080' **GROUNDWATER EQUIPOIENTIAL CONTOUR (MARSHY AREA ONLY)**

- SILT
- LANDFILL MATERIAL
- **ABLATION TILL**
- KAME SAND
- ORGANIC SILT & VEGETATION SWAMP DEPOSIT

NOTE: SOIL BORINGS SHOWN IN MARSHY AREA DID NOT FULLY PENETRATE ABLATION TILL

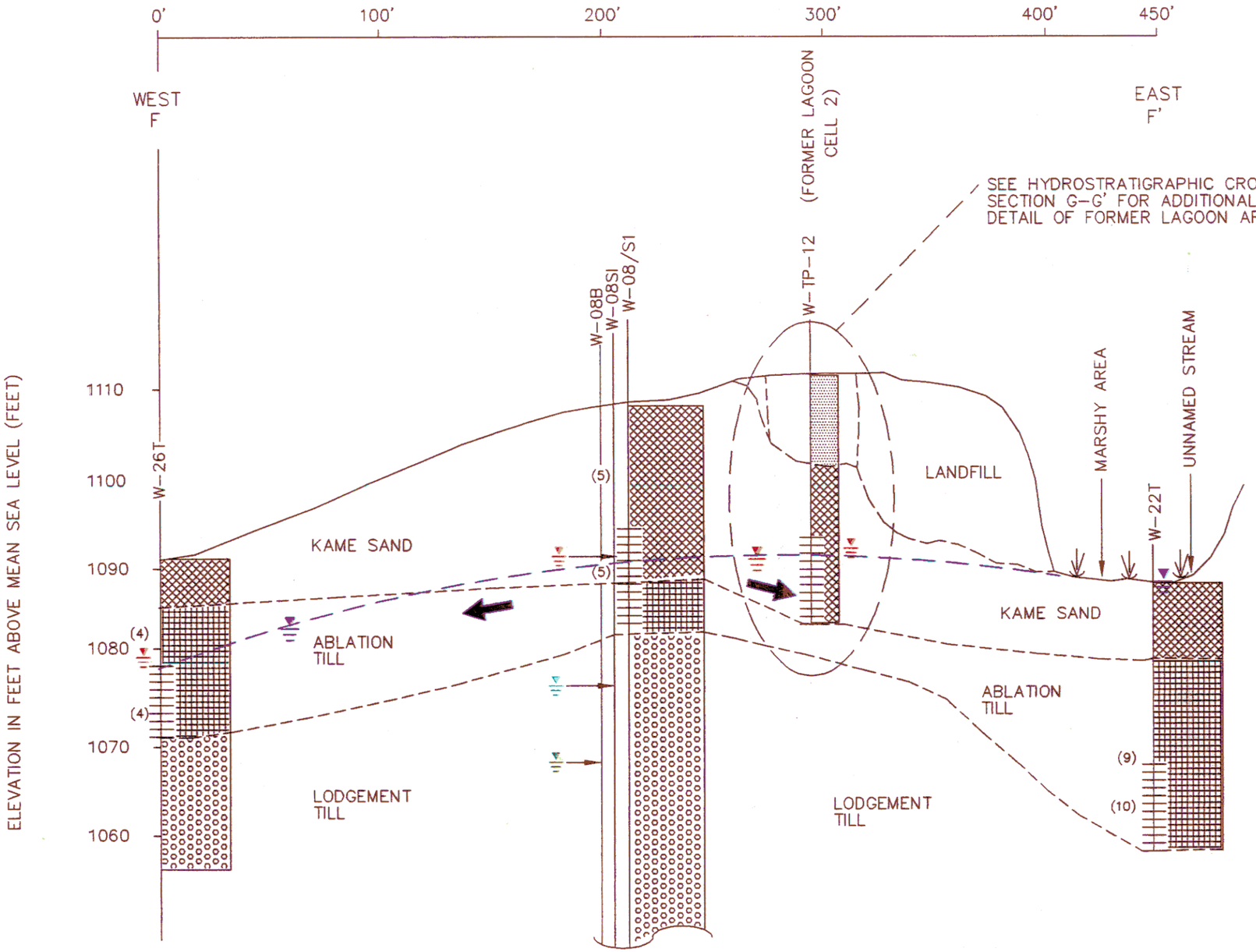
O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROS. SUPERFUND SITE
REMEDIAL INVESTIGATION
HYDROSTRATIGRAPHIC CROSS-SECTION
E-E'

FILE NO. 5271.003-28F

DATE FEBRUARY 1995

FIGURE 9



LEGEND

- MONITORING WELL SCREENED INTERVAL
- SHALLOW WATER TABLE
- POTENTIOMETRIC GROUND WATER SURFACE IN GLACIAL TILL
- POTENTIOMETRIC GROUND WATER SURFACE IN SHALLOW WEATHERED BEDROCK
- POTENTIOMETRIC GROUND WATER SURFACE IN BEDROCK
- GENERALIZED GROUND WATER FLOW DIRECTION
- (56) PID HEADSPACE DATA REPORTED IN PPMV.
- WATER TABLE
- GROUNDWATER FLOW DIRECTION SHALLOW ZONE
- LODGEMENT TILL
- ABLATION TILL
- KAME SAND
- FILL

NOTE:
- THE HIGHER OF THE TWO HEADSPACE READINGS IS PRESENTED.
- GROUND WATER ELEVATIONS TAKEN 7/5/94

VERT. SCALE 10 0 10 20

HORZ. SCALE 40 0 40 80

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
HYDROSTRATIGRAPHIC CROSS SECTION
F-F'

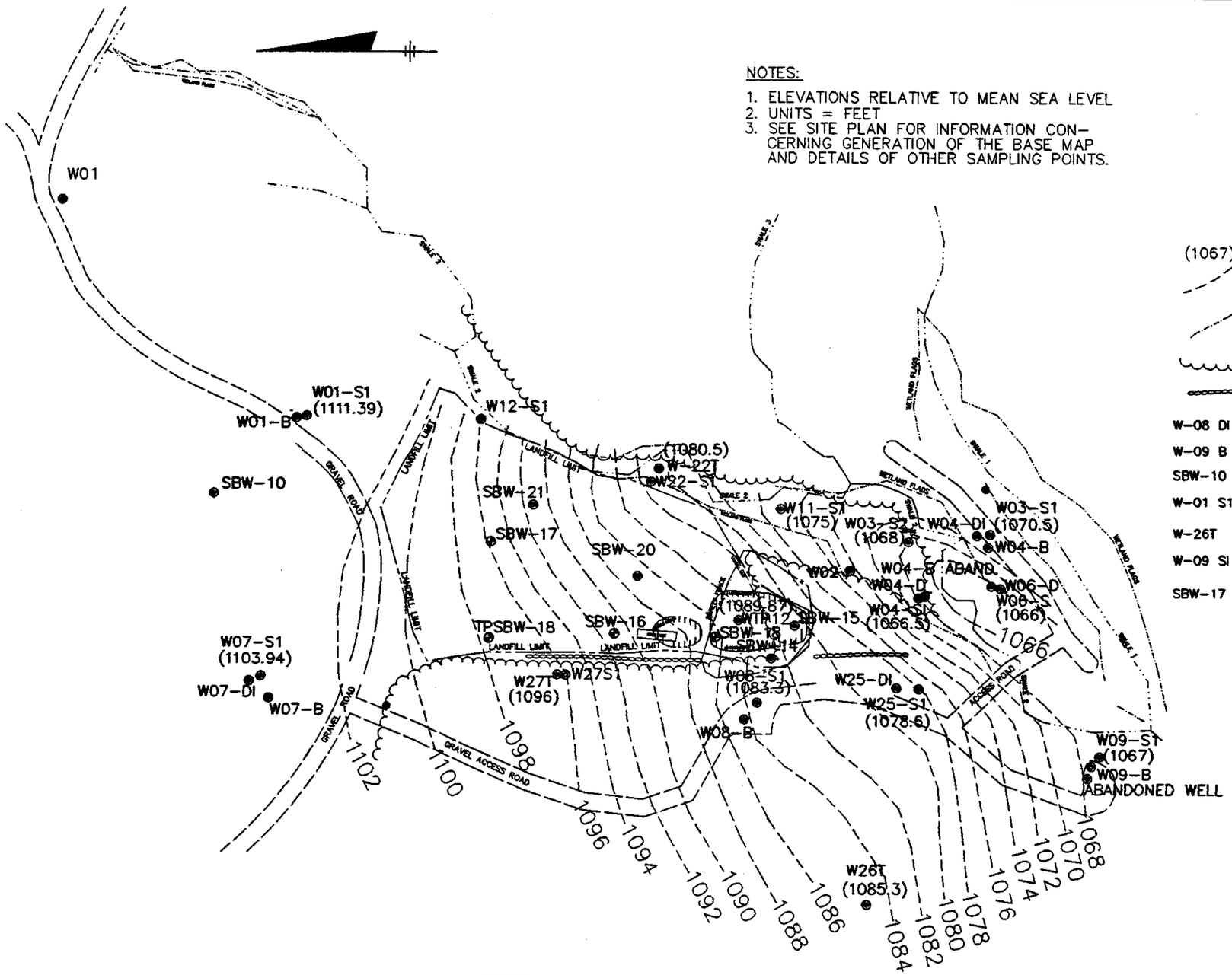
FILE NO. 5271.003.08F

DATE FEBRUARY 1995

FIGURE 10

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR INFORMATION CONCERNING GENERATION OF THE BASE MAP AND DETAILS OF OTHER SAMPLING POINTS.



LEGEND

- (1067) – ELEVATION OF TOP OF ABLATED TILL SURFACE AND CONTOUR
- – DRAINAGE SWALE OR UNNAMED STREAM
- – EDGE OF WOODLANDS
- – STONE WALL
- W-08 DI ● – WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- W-09 B ● – WELL INSTALLED IN COMPETENT BEDROCK
- SBW-10 ● – TEST BORING COMPLETED IN LANDFILL/SOIL STAGING AREA WITH WELL PLACEMENT
- W-01 S1 ● – WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- W-26T ● – WELL INSTALLED IN ABLATED TILL
- W-09 SI ● – WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- SBW-17 ⊕ – SOIL BORING COMPLETED WITHOUT WELL PLACEMENT

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
TOP OF ABLATION TILL
CONTOUR MAP

FILE NO. 5271.003.30F

DATE FEBRUARY 1995

FIGURE 40

LEGEND

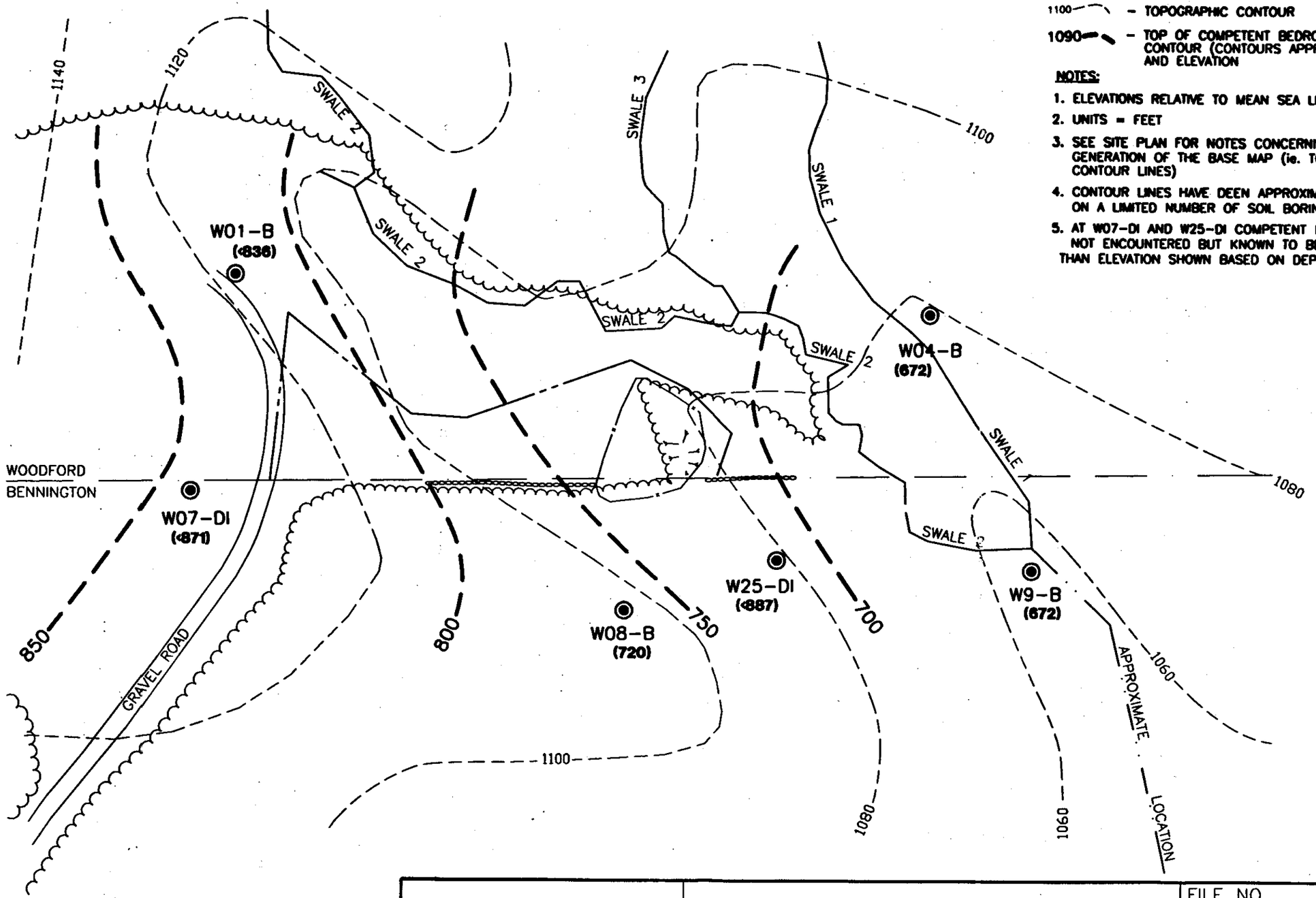
W9-B (672) – MONITORING WELL LOCATION AND TOP OF COMPETENT BEDROCK SURFACE ELEVATION

1100 – TOPOGRAPHIC CONTOUR

1090 – TOP OF COMPETENT BEDROCK SURFACE CONTOUR (CONTOURS APPROXIMATE) AND ELEVATION

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR NOTES CONCERNING THE GENERATION OF THE BASE MAP (ie. TOPOGRAPHIC CONTOUR LINES)
4. CONTOUR LINES HAVE DEEN APPROXIMATED BASED ON A LIMITED NUMBER OF SOIL BORINGS.
5. AT W07-DI AND W25-DI COMPETENT BEDROCK NOT ENCOUNTERED BUT KNOWN TO BE LESS THAN ELEVATION SHOWN BASED ON DEPTH OF BORING.



0 100 200
=100'-0"

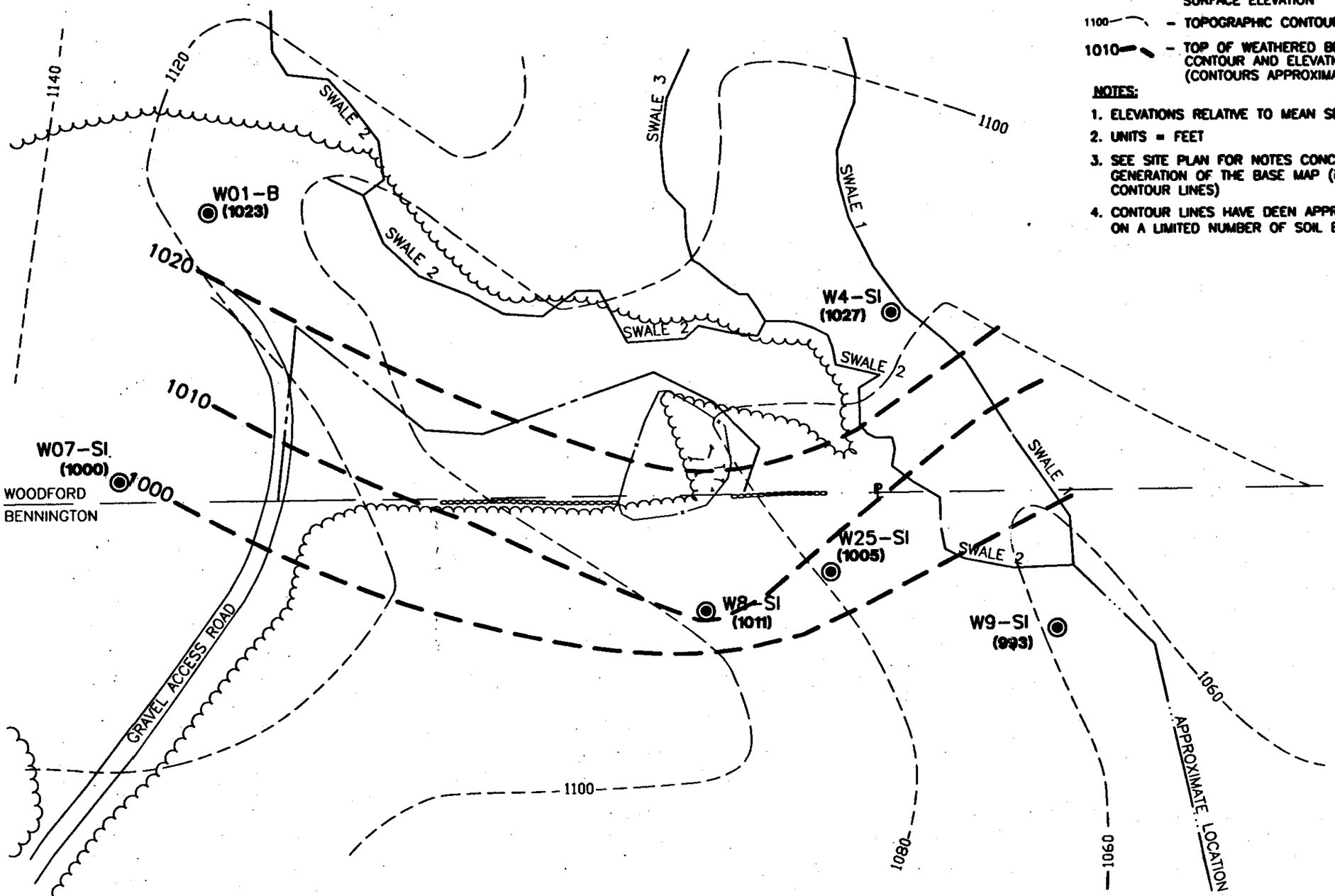
O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
COMPETENT BEDROCK SURFACE TOPOGRAPHY MAP

FILE NO. 5271.003-43P

DATE FEBRUARY 1995

FIGURE 39



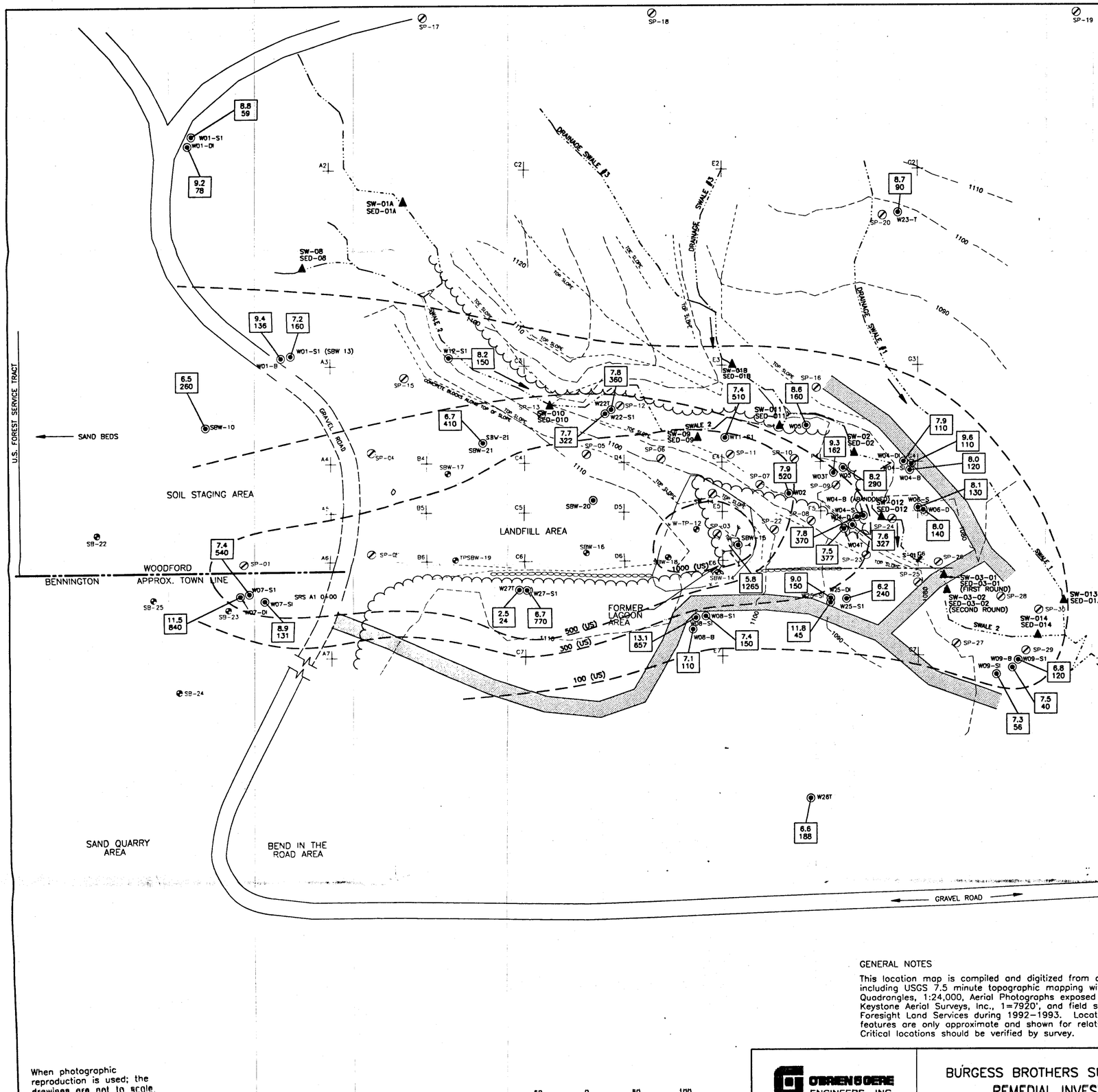
O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WEATHERED BEDROCK SURFACE
TOPOGRAPHY MAP

FILE NO. 5271.003-42P

DATE FEBRUARY 1995

FIGURE 38



When photographic reproduction is used; the drawings are not to scale. All scales are reduced from indicated to approximately

1" = 50'-0"

50 0 50 100

GENERAL NOTES

This location map is compiled and digitized from available sources including USGS 7.5 minute topographic mapping with 20' contour interval, Quadrangles, 1:24,000, Aerial Photographs exposed 3-6-91 by Keystone Aerial Surveys, Inc., 1=7920', and field survey by Foresight Land Services during 1992-1993. Locations of digitized features are only approximate and shown for relative location. Critical locations should be verified by survey.

LEGEND

- SITE GRID CONTROL POINT
- STONE WALL
- SAFETY FENCE
- TOP OF SLOPE
- EDGE OF WOODLANDS
- WATERCOURSE
- TEMPORARY WELL ACCESS ROAD
- PH READING / CONDUCTIVITY READING (US) (e.g. 6.2 / 240)

NOTE: READING REPORTED ARE LAST READINGS COLLECTED DURING PURGING JUST PRIOR TO SAMPLING.

- ISO CONTOUR OF SPECIFIC CONDUCTIVITY READING IN KAME SAND AND LANDFILL (SHALLOW ZONE)

SAMPLE AND MONITORING WELL LEGEND

- S1 WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- T WELL INSTALLED IN ABLATION TILL
- SI WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- DI WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- SBW WELL INSTALLED IN LANDFILL AREA
- B WELL INSTALLED IN COMPETENT BEDROCK (WELL ELEVATIONS ARE PRESENTED ON TABLE 4)
- TEST BORING COMPLETED IN LANDFILL/SOIL STAGING AREA WITHOUT WELL PLACEMENT
- SURFACE WATER AND SEDIMENT SAMPLE
- SHALLOW SURFACE SAMPLE (0"-6"/VOCs,0"-12"/SVOCs) WITH DETECTED ANALYTE AND CONCENTRATION (ug/kg)

NOTE: SURFACE SOIL SAMPLES COLLECTED AT SP-01 THROUGH SP-22 AND SOIL BORING LOCATIONS WERE SECURED 10/92. SURFACE SOIL SAMPLES COLLECTED AT SP-23 THROUGH SP-30 WERE SECURED 5/94.

O'BRIEN & GERE ENGINEERS, INC.

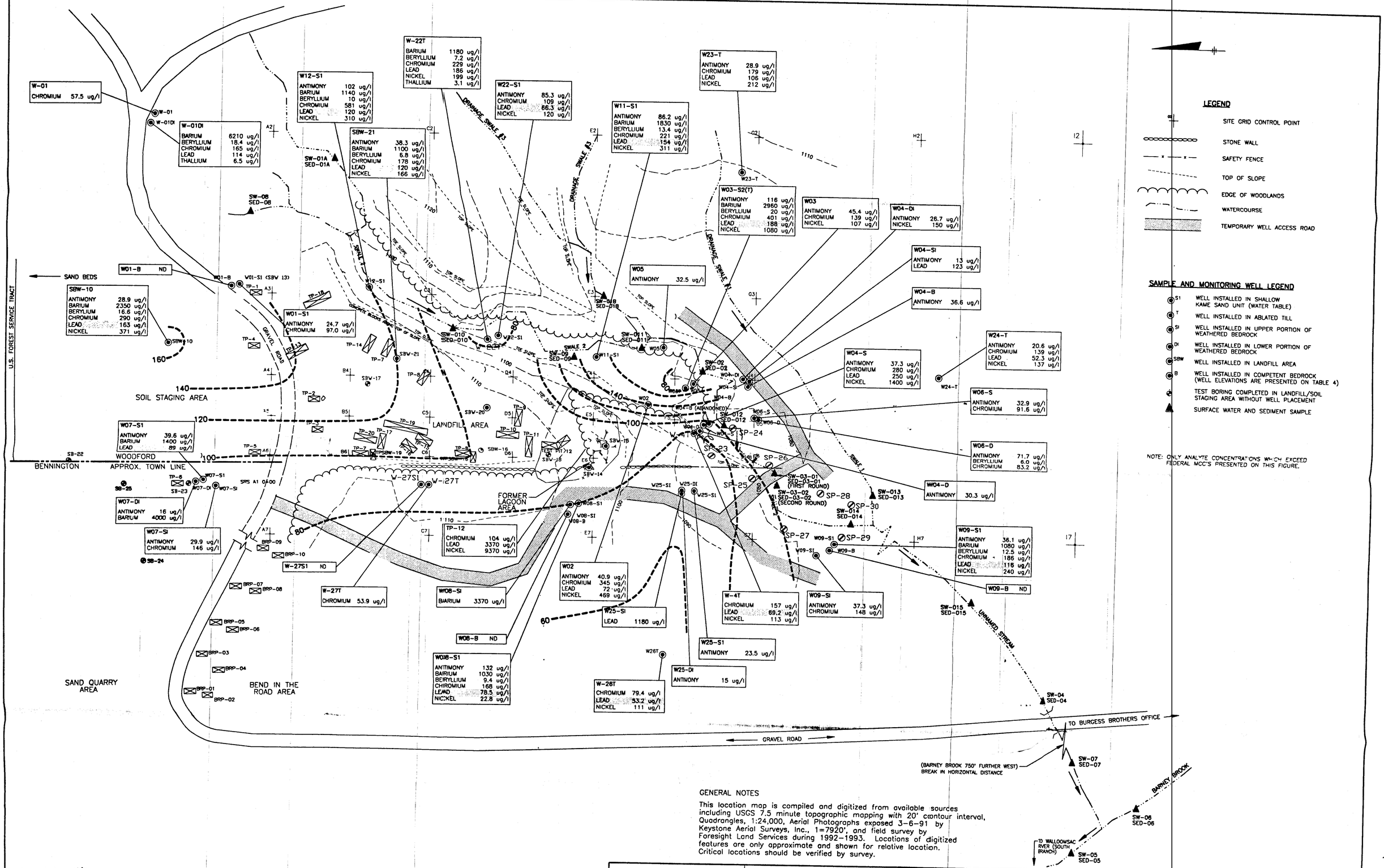
BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION

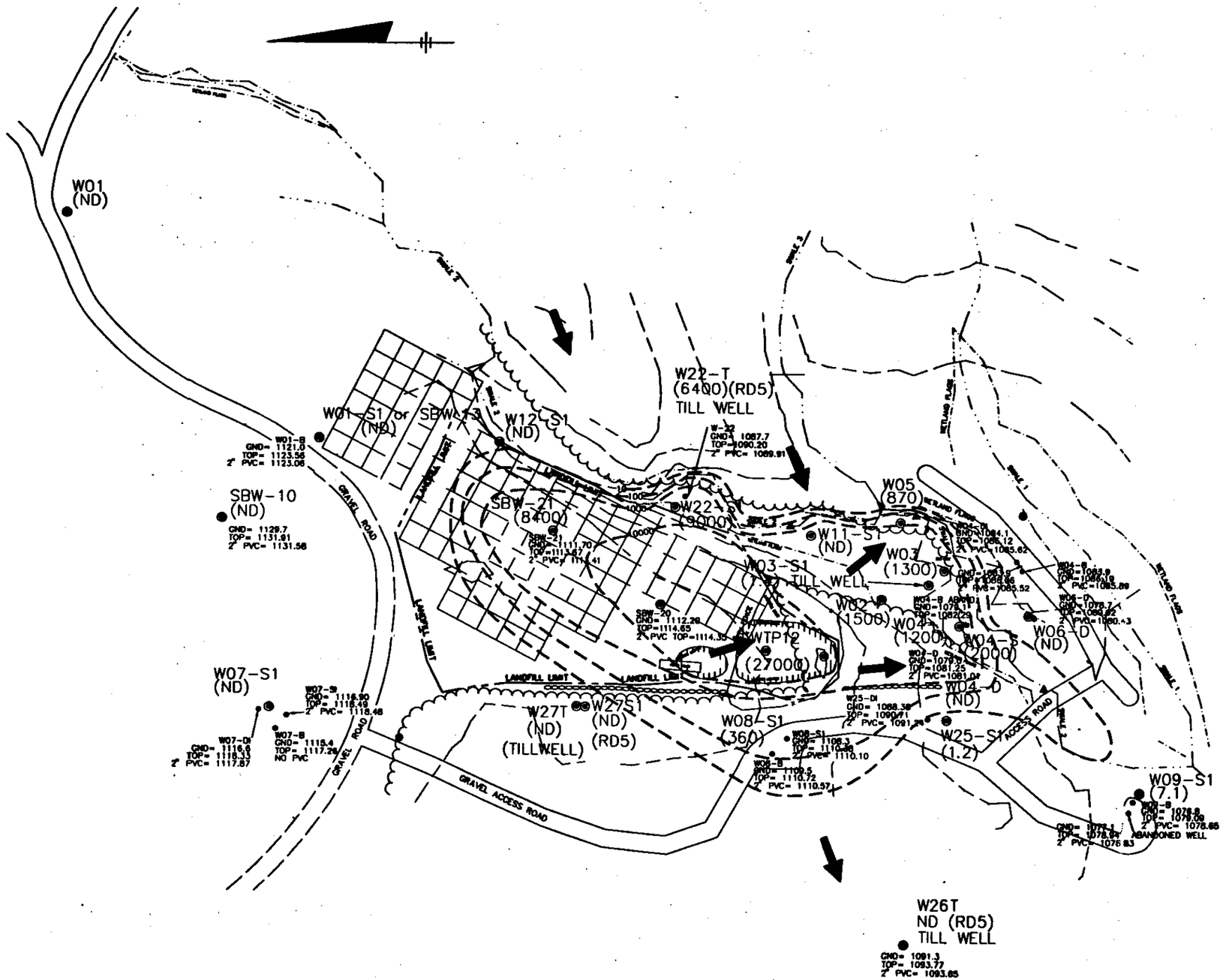
SPECIFIC CONDUCTIVITY AND PH READINGS FROM GROUNDWATER WELLS (NOV '93 AND JULY '94 WHERE INDICATED) CONTROL OF SPECIFIC CONDUCTANCE IN SHALLOW WELLS

FILE NO. 5271.003-54F

DATE FEBRUARY 1995

FIGURE 37


W-01
CHROMIUM 57.5 ug/l
W-01DI
BARIUM 6210 ug/l
BERYLLIUM 18.4 ug/l
CHROMIUM 165 ug/l
LEAD 114 ug/l
THALLIUM 6.5 ug/l
W12-S1
ANTIMONY 102 ug/l
BARIUM 1140 ug/l
BERYLLIUM 10 ug/l
CHROMIUM 581 ug/l
LEAD 120 ug/l
NICKEL 310 ug/l
W-22T
BARIUM 1180 ug/l
BERYLLIUM 7.2 ug/l
CHROMIUM 229 ug/l
LEAD 186 ug/l
NICKEL 199 ug/l
THALLIUM 3.1 ug/l
W22-S1
ANTIMONY 85.3 ug/l
CHROMIUM 109 ug/l
LEAD 66.3 ug/l
NICKEL 120 ug/l
W23-T
ANTIMONY 28.9 ug/l
CHROMIUM 179 ug/l
LEAD 106 ug/l
NICKEL 212 ug/l
W11-S1
ANTIMONY 86.2 ug/l
BARIUM 1830 ug/l
BERYLLIUM 13.4 ug/l
CHROMIUM 221 ug/l
LEAD 154 ug/l
NICKEL 311 ug/l
SBW-21
ANTIMONY 38.3 ug/l
BARIUM 1100 ug/l
BERYLLIUM 6.8 ug/l
CHROMIUM 178 ug/l
LEAD 120 ug/l
NICKEL 166 ug/l
SW-01A
SED-01A
SW-08
SED-08
DRAINAGE SWALE #3
DRAINAGE SWALE #2
DRAINAGE SWALE #1
W03-S2(T)
ANTIMONY 116 ug/l
BARIUM 2960 ug/l
BERYLLIUM 20 ug/l
CHROMIUM 401 ug/l
LEAD 188 ug/l
NICKEL 1080 ug/l
W03
ANTIMONY 45.4 ug/l
CHROMIUM 139 ug/l
NICKEL 107 ug/l
W04-DI
ANTIMONY 26.7 ug/l
NICKEL 150 ug/l
W04-SI
ANTIMONY 13 ug/l
LEAD 123 ug/l
W04-B
ANTIMONY 36.6 ug/l
W05
ANTIMONY 32.5 ug/l
SAND BEDS
W01-B ND
W01-S1 (SBW 13)
SBW-10
ANTIMONY 28.9 ug/l
BARIUM 2350 ug/l
BERYLLIUM 16.6 ug/l
CHROMIUM 290 ug/l
LEAD 163 ug/l
NICKEL 371 ug/l
W01-S1
ANTIMONY 24.7 ug/l
CHROMIUM 97.0 ug/l
GRAVEL ROAD
CONCRETE BLOCK RETAINING WALL
TOP OF SLOPE
TOE SLOPE
SW-010
SED-010
SW-011
SED-011
SW-09
SED-09
SW-018
SED-018
SW-02
SED-02
SW-012
SED-012
SW-013
SED-013
SW-014
SED-014
SW-03-01
SED-03-01
(FIRST ROUND)
SW-03-02
SED-03-02
(SECOND ROUND)
W04-S
ANTIMONY 37.3 ug/l
CHROMIUM 280 ug/l
LEAD 250 ug/l
NICKEL 1400 ug/l
W24-T
ANTIMONY 20.6 ug/l
CHROMIUM 139 ug/l
LEAD 52.3 ug/l
NICKEL 137 ug/l
W06-S
ANTIMONY 32.9 ug/l
CHROMIUM 91.6 ug/l
W06-D
ANTIMONY 71.7 ug/l
BERYLLIUM 6.0 ug/l
CHROMIUM 83.2 ug/l
W04-D
ANTIMONY 30.3 ug/l
W09-S1
ANTIMONY 36.1 ug/l
BARIUM 1080 ug/l
BERYLLIUM 12.5 ug/l
CHROMIUM 186 ug/l
LEAD 116 ug/l
NICKEL 240 ug/l
W09-B ND
W09-SI
ANTIMONY 37.3 ug/l
CHROMIUM 148 ug/l
W-4T
CHROMIUM 157 ug/l
LEAD 69.2 ug/l
NICKEL 113 ug/l
W25-S1
ANTIMONY 23.5 ug/l
W25-DI
ANTIMONY 15 ug/l
W25-SI
LEAD 1180 ug/l
W26T
W-26T
CHROMIUM 79.4 ug/l
LEAD 53.2 ug/l
NICKEL 111 ug/l
W08-SI
ANTIMONY 132 ug/l
BARIUM 1030 ug/l
BERYLLIUM 9.4 ug/l
CHROMIUM 168 ug/l
LEAD 78.5 ug/l
NICKEL 22.8 ug/l
W08-B ND
W02
ANTIMONY 40.9 ug/l
CHROMIUM 345 ug/l
LEAD 72 ug/l
NICKEL 469 ug/l
W08-SI
BARIUM 3370 ug/l
W-27T
CHROMIUM 53.9 ug/l
W-27S1 ND
TP-12
CHROMIUM 104 ug/l
LEAD 3370 ug/l
NICKEL 9370 ug/l
W07-S1
ANTIMONY 39.6 ug/l
BARIUM 1400 ug/l
LEAD 89 ug/l
W07-DI
ANTIMONY 16 ug/l
BARIUM 4000 ug/l
W07-SI
ANTIMONY 29.9 ug/l
CHROMIUM 146 ug/l
SOIL STAGING AREA
LANDFILL AREA
FORMER LAGOON AREA
SAND QUARRY AREA
BEND IN THE ROAD AREA
WOODFORD
BENNINGTON
APPROX. TOWN LINE
SR5 A1 0+00
SB-22
SB-25
SB-23
SB-24
SW-015
SED-015
UNNAMED STREAM
SW-04
SED-04
SW-07
SED-07
SW-06
SED-06
SW-05
SED-05
BARNEY BROOK
TO BURGESS BROTHERS OFFICE
GRAVEL ROAD
(BARNEY BROOK 750' FURTHER WEST)
BREAK IN HORIZONTAL DISTANCE
TO WALLOOMSAC RIVER (SOUTH BRANCH)
SP-23
SP-24
SP-25
SP-26
SP-27
SP-28
SP-29
SP-30
LEGEND
SITE GRID CONTROL POINT
STONE WALL
SAFETY FENCE
TOP OF SLOPE
EDGE OF WOODLANDS
WATERCOURSE
TEMPORARY WELL ACCESS ROAD
SAMPLE AND MONITORING WELL LEGEND
WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
WELL INSTALLED IN ABLATED TILL
WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
WELL INSTALLED IN LANDFILL AREA
WELL INSTALLED IN COMPETENT BEDROCK (WELL ELEVATIONS ARE PRESENTED ON TABLE 4)
TEST BORING COMPLETED IN LANDFILL/SOIL STAGING AREA WITHOUT WELL PLACEMENT
SURFACE WATER AND SEDIMENT SAMPLE
NOTE: ONLY ANALYTE CONCENTRATIONS WHICH EXCEED FEDERAL MCC'S PRESENTED ON THIS FIGURE.
GENERAL NOTES
This location map is compiled and digitized from available sources including USGS 7.5 minute topographic mapping with 20' contour interval, Quadrangles, 1:24,000, Aerial Photographs exposed 3-6-91 by Keystone Aerial Surveys, Inc., 1=7920', and field survey by Foresight Land Services during 1992-1993. Locations of digitized features are only approximate and shown for relative location. Critical locations should be verified by survey.
U.S. FOREST SERVICE TRACT
When photographic reproduction is used; the drawings are not to scale. All scales are reduced from indicated to approximately half size.
1"=50'-0"
50 0 50 100
O'BRIEN & GERE ENGINEERS, INC.
BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
BURGESS BROTHERS SUPERFUND SITE
LEAD CONCENTRATIONS IN SHALLOW GROUND WATER
FILE NO. 5271.001-53F
DATE
FIGURE



LEGEND

1100 CONTOURS APPROXIMATE

W07-S1 MONITORING WELL LOCATION

SHALLOW GROUND WATER FLOW DIRECTION

(RD5) INDICATES DATA FROM ROUND 5 (JUNE 1994)

(6400) PPB

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR INFORMATION CONCERNING GENERATION OF THE BASE MAP AND DETAILS OF OTHER SAMPLING POINTS.

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
TCE CONCENTRATIONS IN SHALLOW GROUND WATER (CONCENTRATIONS IN KAME SAND CONTOURED) NOVEMBER 1993

FILE NO. 5271.003-52P

DATE FEBRUARY 1995

FIGURE 35

O'BRIEN & GERE ENGINEERS, INC.	BURGESS BROTHERS SUPERFUND SITE REMEDIAL INVESTIGATION TCE CONCENTRATIONS IN SHALLOW GROUND WATER ZONE (JUNE 1993)	FILE NO. 5271.003-48P DATE NOVEMBER 1994	FIGURE 34B

LEGEND

(ND) – NOT DETECTED

(34000) – TCE CONCENTRATION (ppb)

1100 – TOPOGRAPHIC CONTOUR

100 – TCE CONTOUR OF EQUAL CONCENTRATION (ppb)

– DRAINAGE SWALE OR UNNAMED STREAM

– LANDFILL BOUNDARY

W-08 DI ● – WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK

W-09 B ● – WELL INSTALLED IN COMPETENT BEDROCK

SBW-10 ● – TEST BORING COMPLETED IN LANDFILL/ SOIL STAGING AREA WITH WELL PLACEMENT

W-01 S1 ● – WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)

W-26T ● – WELL INSTALLED IN ABLATION TILL

W-09 SI ● – WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK

SBW-17 ⊕ – SOIL BORING COMPLETED WITHOUT WELL PLACEMENT

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR NOTES CONCERNING THE GENERATION OF THE BASE MAP (ie TOPOGRAPHIC CONTOUR LINES)
4. 10000 & 25000 PPB CONTOUR EXTRAPOLATED AROUND FORMER LAGOON AREA BASED ON SOIL CONCENTRATIONS AND JULY 94' RESULTS AT W-TP-12.
5. CONTOURS TERMINATED AT UNNAMED STREAM BASED UPON ND LEVELS AT W-06.

W01-B W01-S1 OR SBW 13 (ND)

W12-S1 (9)

W22-S1 (34000)

SBW 10 (ND)

SBW-21 (9000)

SBW-17

W11-S1 (ND)

W05 (270)

W04-DI

W04-SI

W04-B

(9500) W03

W03T

(4600) W02

W04-B ABANDONED

W06-S2

W06-S (ND)

W06-D

W04-S (750)

W04-D

SBW-20

25000

10000

W-TP-12

SBW-15

SBW-16

SBW-19

SBW-18

S-01

WOODFORD/BENNINGTON TOWN LINE

SBW-14

W25-DI

W25-S1 (12)

W25+SI

W07-DI W07-S1 (ND) W07-SI W07-B

GRAVEL ROAD

W08-SI W08-S1 (150) W08-B

1100 1110 1090 1000 100 10

0 50 100

1"=50'-0"

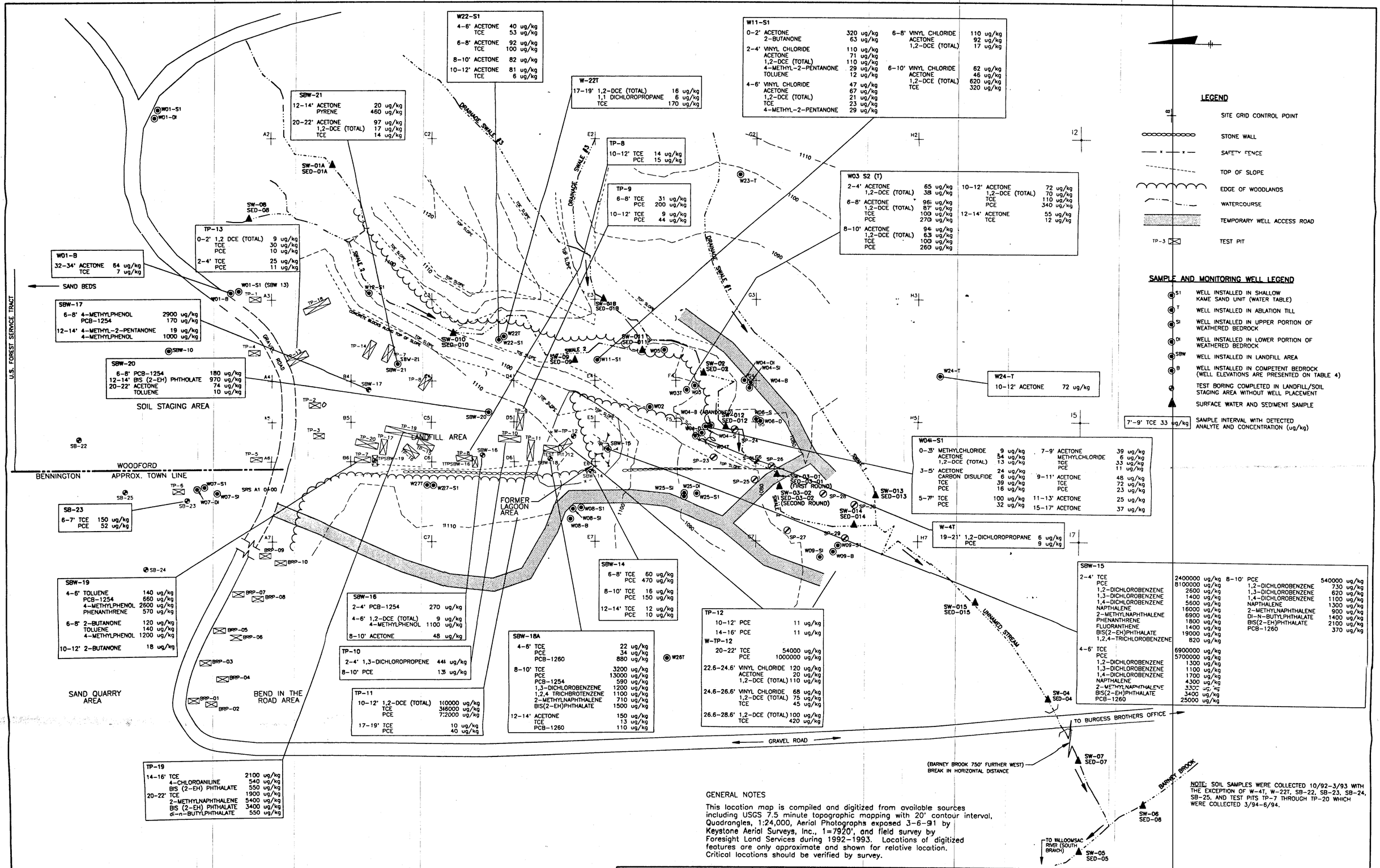
O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
TCE CONCENTRATIONS IN
SHALLOW GROUND WATER ZONE
(MAY 1993)

FILE NO. 5271.003-47P

DATE NOVEMBER 1994

FIGURE 34A



GENERAL NOTES

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NOTE: SOIL SAMPLES WERE COLLECTED 10/92-3/93 WITH THE EXCEPTION OF W-4T, W-22T, SB-22, SB-23, SB-24, SB-25, AND TEST PITS TP-7 THROUGH TP-20 WHICH WERE COLLECTED 3/94-6/94.

When photographic reproduction is used; the drawings are not to scale. All scales are reduced from indicated to approximately

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION

SOIL BORING RESULTS
(VOCs, SVOCs, AND PCBs)

FILE NO. 5271.003-31F

DATE FEBRUARY 1995

FIGURE 33

22F-25 1/26/95 1=50

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR NOTES CONCERNING THE GENERATION OF THE BASE MAP (ie. TOPOGRAPHIC CONTOUR LINES)
4. IN LOCATIONS WHERE GROUND WATER WAS ENCOUNTERED BEFORE THE DESIRED SAMPLING DEPTH WAS REACHED, GROUND WATER SAMPLES WERE COLLECTED AND HEADSPACE ANALYSIS WAS PERFORMED.

LEGEND

(1060.05) – TOTAL SOIL GAS VOC CONCENTRATIONS IN PPMV

1100 – TOPOGRAPHIC CONTOUR

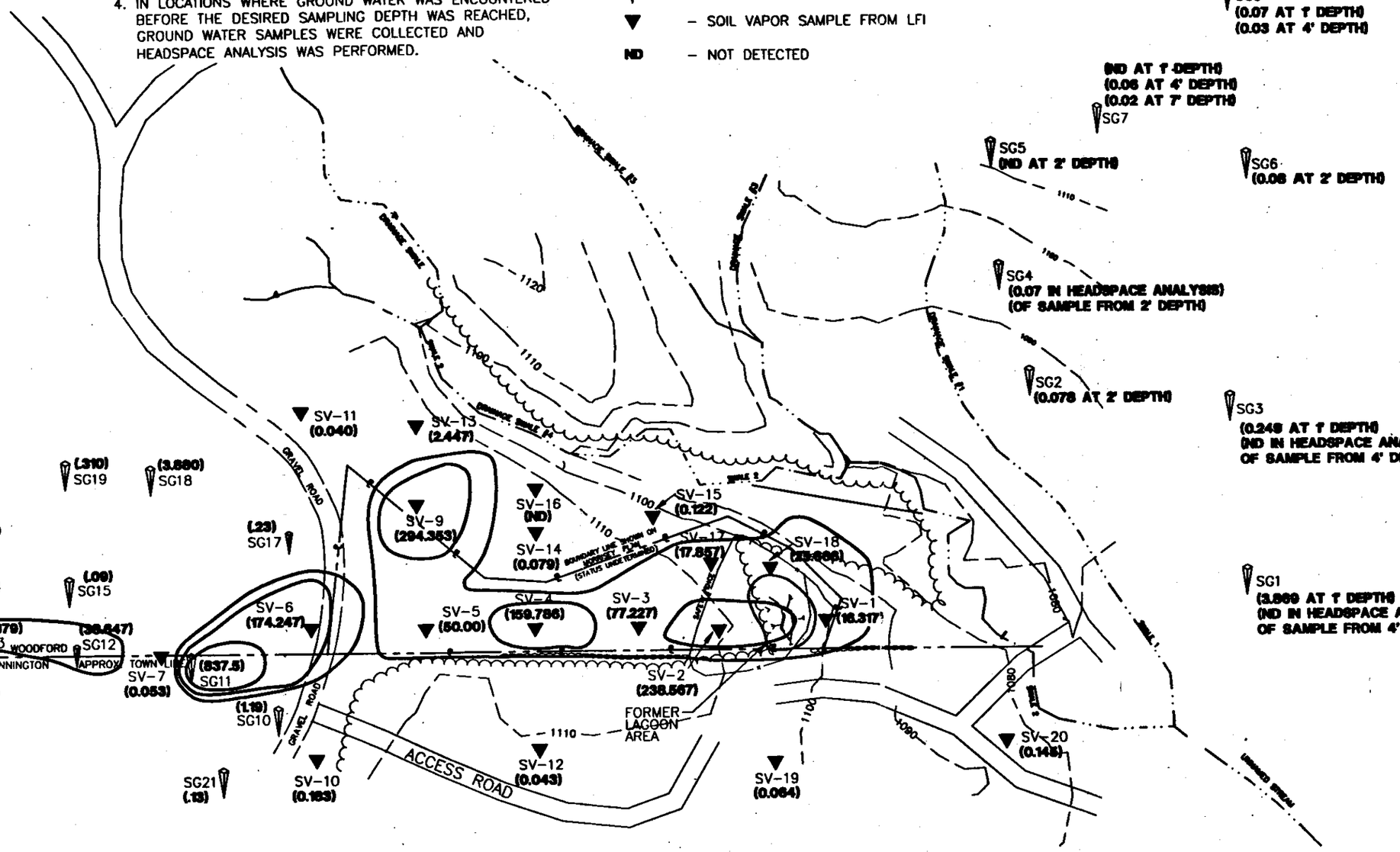
– DRAINAGE SWALE OR UNNAMED STREAM

– EDGE OF WOODLANDS

SG7 – SOIL VAPOR SAMPLE FROM ISCR

▼ – SOIL VAPOR SAMPLE FROM LFI

ND – NOT DETECTED



0 100 200

1" = 100'-0"

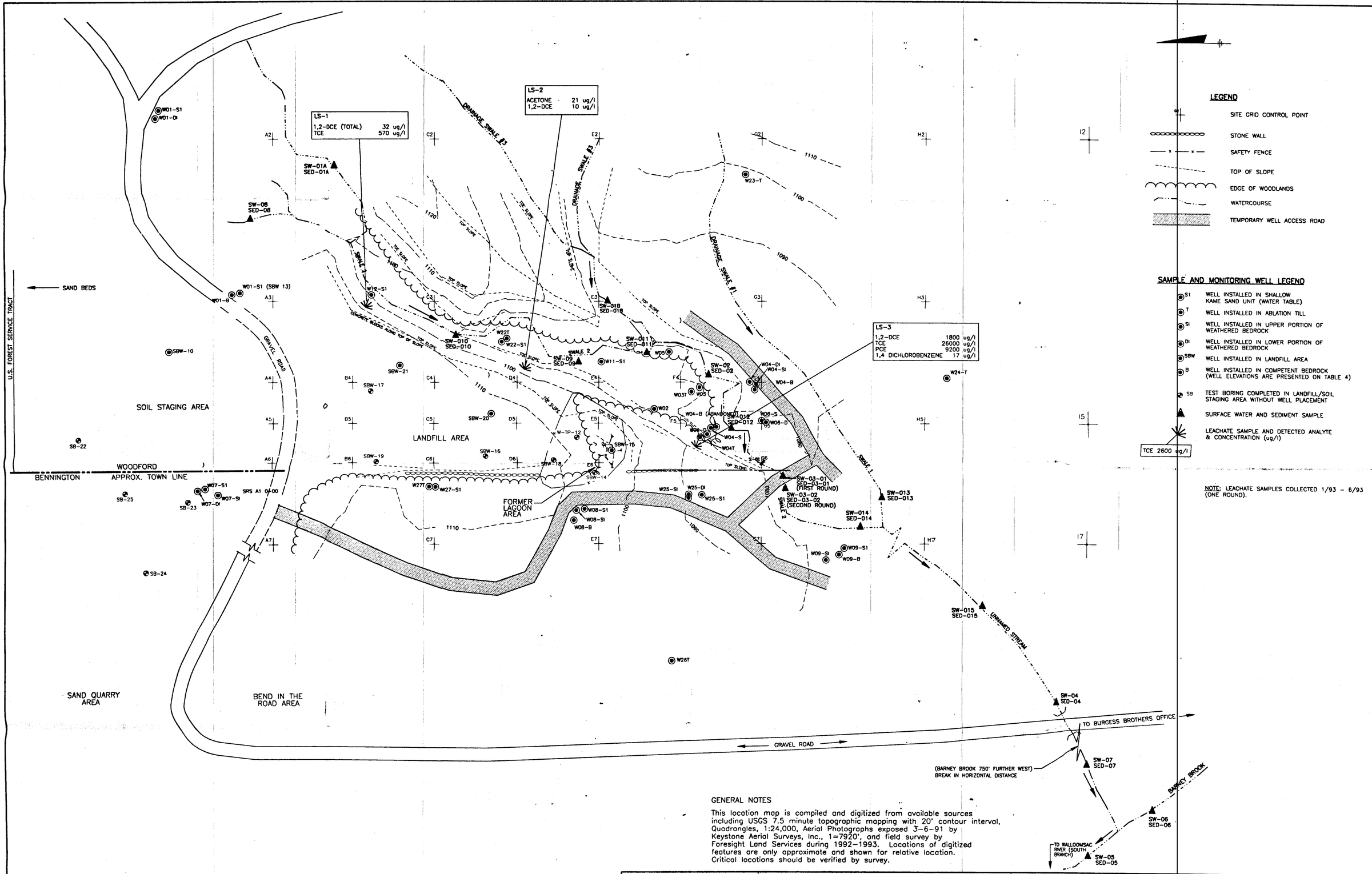
O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
TOTAL VOC CONCENTRATIONS IN SOIL VAPOR SAMPLES

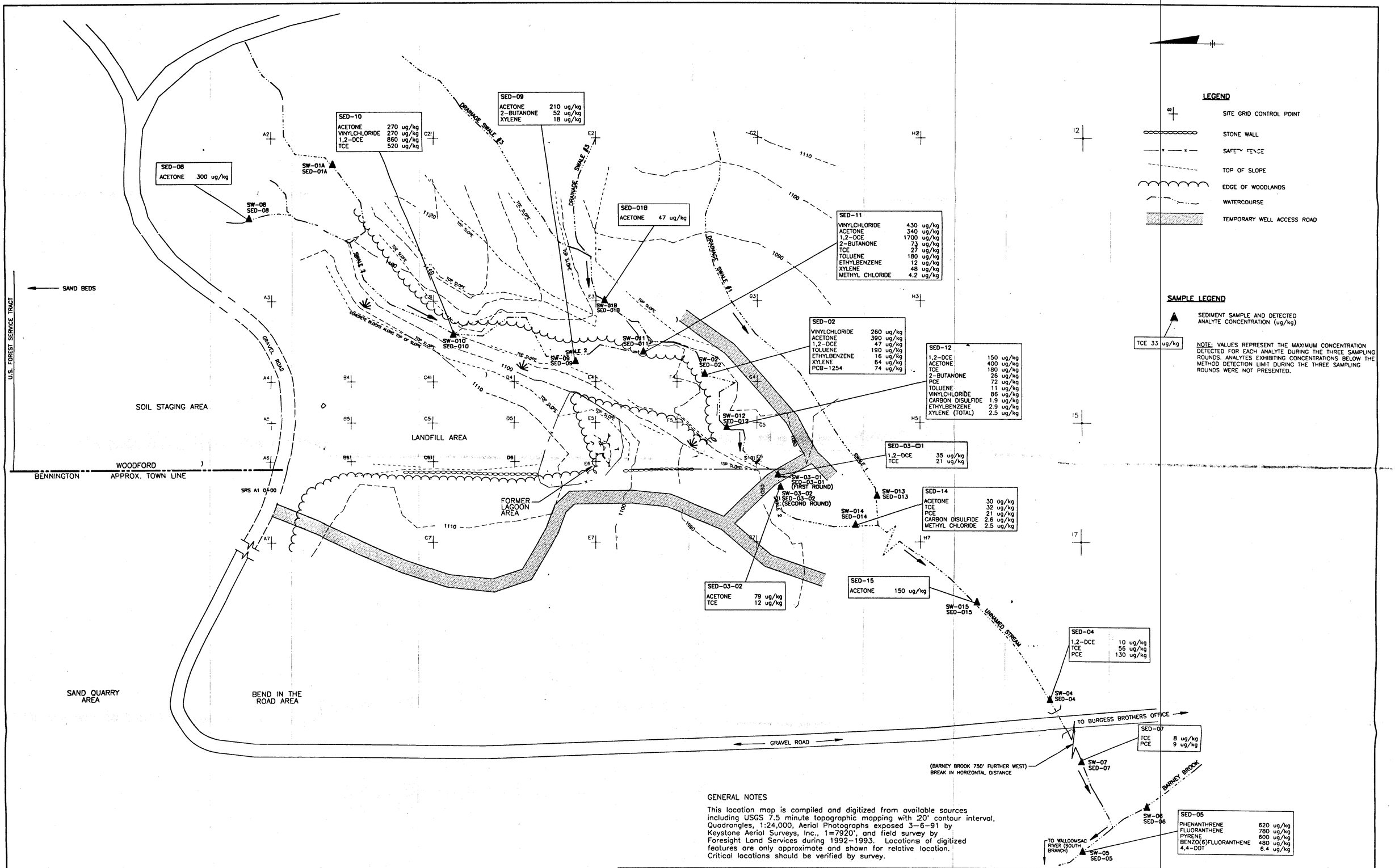
FILE NO. 5271.003-22P

DATE FEBRUARY 1995

FIGURE 32



O'BRIEN & GERE ENGINEERS, INC.	BURGESS BROTHERS SUPERFUND SITE REMEDIAL INVESTIGATION	LEACHATE RESULTS-ORGANIC	FILE NO. 5271.003-36F DATE FIGURE 31



GENERAL NOTES

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When photographic reproduction is used; the drawings are not to scale. All scales are reduced from indicated to approximately

1"=50'-0" 50 0 50 100

O'BRIEN & GERE ENGINEERS, INC.

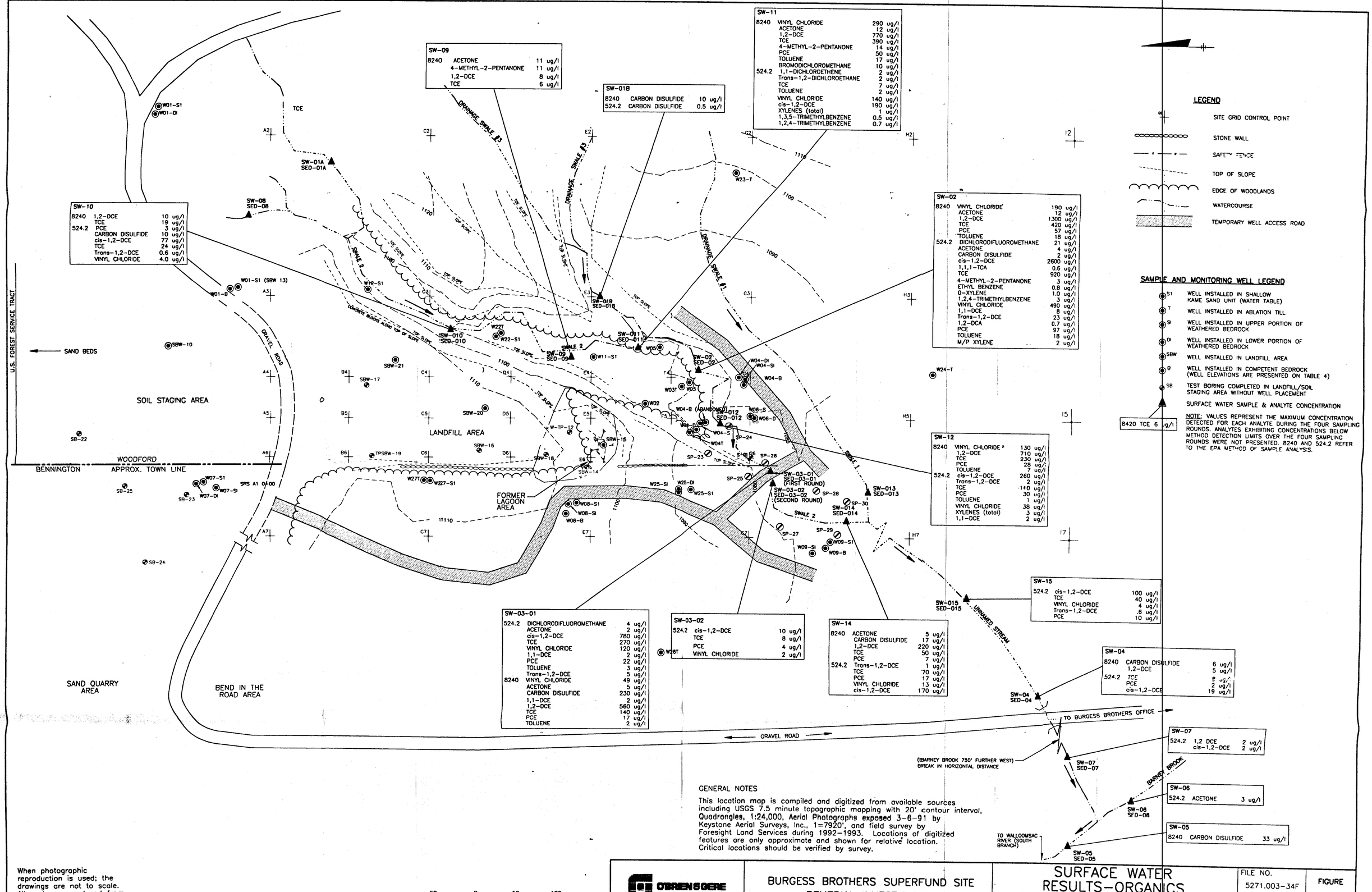
BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION

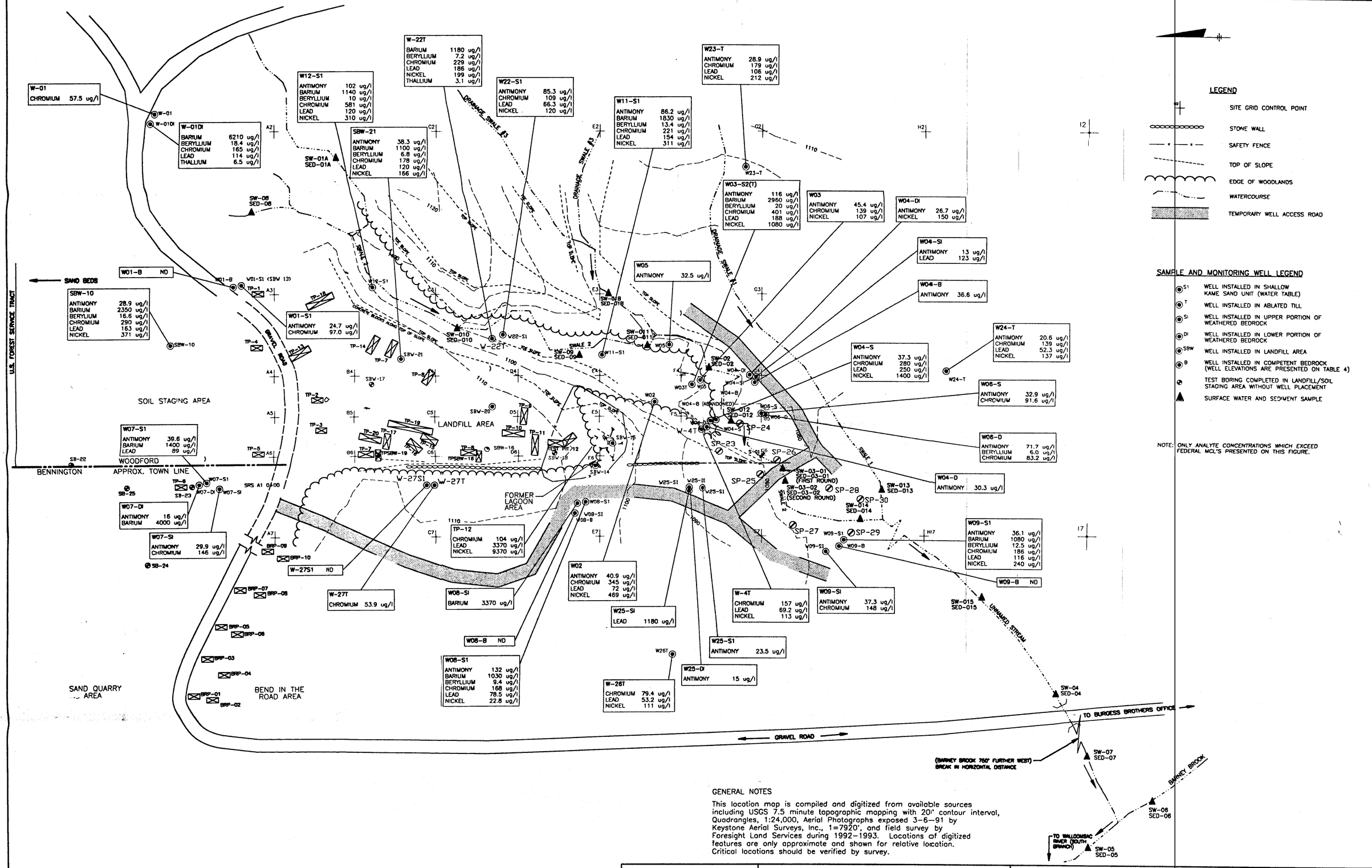
SEDIMENT RESULTS-ORGANICS
(MAXIMUM CONCENTRATIONS DETECTED DURING THREE SAMPLING ROUNDS)

FILE NO. 5271.003-35F

DATE FEBRUARY 1995

FIGURE 30


SW-09
8240 ACETONE 11 ug/l
4-METHYL-2-PENTANONE 11 ug/l
1,2-DCE 8 ug/l
TCE 6 ug/l
SW-018
8240 CARBON DISULFIDE 10 ug/l
524.2 CARBON DISULFIDE 0.5 ug/l
SW-11
8240 VINYL CHLORIDE 290 ug/l
ACETONE 12 ug/l
1,2-DCE 770 ug/l
TCE 390 ug/l
4-METHYL-2-PENTANONE 14 ug/l
PCE 50 ug/l
TOLUENE 17 ug/l
BROMODICHLOROMETHANE 10 ug/l
524.2 1,1-DICHLOROETHENE 2 ug/l
Trans-1,2-DICHLOROETHANE 2 ug/l
TCE 7 ug/l
TOLUENE 2 ug/l
VINYL CHLORIDE 140 ug/l
cis-1,2-DCE 190 ug/l
XYLENES (total) 1 ug/l
1,3,5-TRIMETHYLBENZENE 0.5 ug/l
1,2,4-TRIMETHYLBENZENE 0.7 ug/l
SW-10
8240 1,2-DCE 10 ug/l
TCE 19 ug/l
524.2 PCE 3 ug/l
CARBON DISULFIDE 10 ug/l
cis-1,2-DCE 77 ug/l
TCE 24 ug/l
Trans-1,2-DCE 0.6 ug/l
VINYL CHLORIDE 4.0 ug/l
SW-02
8240 VINYL CHLORIDE 190 ug/l
ACETONE 12 ug/l
1,2-DCE 1300 ug/l
TCE 420 ug/l
PCE 57 ug/l
TOLUENE 18 ug/l
524.2 DICHLORODIFLUOROMETHANE 21 ug/l
ACETONE 4 ug/l
CARBON DISULFIDE 2 ug/l
cis-1,2-DCE 2600 ug/l
1,1,1-TCA 0.6 ug/l
TCE 920 ug/l
4-METHYL-2-PENTANONE 3 ug/l
ETHYL BENZENE 0.8 ug/l
O-XYLENE 1.0 ug/l
1,2,4-TRIMETHYLBENZENE 3 ug/l
VINYL CHLORIDE 490 ug/l
1,1-DCE 8 ug/l
Trans-1,2-DCE 23 ug/l
1,2-DCA 0.7 ug/l
PCE 97 ug/l
TOLUENE 18 ug/l
M/P XYLENE 2 ug/l
SW-12
8240 VINYL CHLORIDE 130 ug/l
1,2-DCE 710 ug/l
TCE 230 ug/l
PCE 28 ug/l
TOLUENE 7 ug/l
524.2 cis-1,2-DCE 260 ug/l
Trans-1,2-DCE 2 ug/l
TCE 140 ug/l
PCE 30 ug/l
TOLUENE 1 ug/l
VINYL CHLORIDE 38 ug/l
XYLENES (total) 3 ug/l
1,1-DCE 2 ug/l
SW-15
524.2 cis-1,2-DCE 100 ug/l
TCE 40 ug/l
VINYL CHLORIDE 4 ug/l
Trans-1,2-DCE .6 ug/l
PCE 10 ug/l
SW-03-01
524.2 DICHLORODIFLUOROMETHANE 4 ug/l
ACETONE 2 ug/l
cis-1,2-DCE 780 ug/l
TCE 270 ug/l
VINYL CHLORIDE 120 ug/l
1,1-DCE 2 ug/l
PCE 22 ug/l
TOLUENE 3 ug/l
Trans-1,2-DCE 5 ug/l
8240 VINYL CHLORIDE 49 ug/l
ACETONE 5 ug/l
CARBON DISULFIDE 230 ug/l
1,1-DCE 2 ug/l
1,2-DCE 560 ug/l
TCE 140 ug/l
PCE 17 ug/l
TOLUENE 2 ug/l
SW-03-02
524.2 cis-1,2-DCE 10 ug/l
TCE 8 ug/l
PCE 4 ug/l
VINYL CHLORIDE 2 ug/l
SW-14
8240 ACETONE 5 ug/l
CARBON DISULFIDE 17 ug/l
1,2-DCE 220 ug/l
TCE 50 ug/l
PCE 7 ug/l
524.2 Trans-1,2-DCE 1 ug/l
TCE 70 ug/l
PCE 17 ug/l
VINYL CHLORIDE 13 ug/l
cis-1,2-DCE 170 ug/l
SW-04
8240 CARBON DISULFIDE 6 ug/l
1,2-DCE 5 ug/l
524.2 TCE 3 ug/l
PCE 2 ug/l
cis-1,2-DCE 19 ug/l
SW-07
524.2 1,2 DCE 2 ug/l
cis-1,2-DCE 2 ug/l
SW-06
524.2 ACETONE 3 ug/l
SW-05
8240 CARBON DISULFIDE 33 ug/l
8420 TCE 6 ug/l
SW-01A SED-01A
SW-08 SED-08
SW-018 SED-018
SW-011 SED-011
SW-02 SED-02
SW-09 SED-09
SW-010 SED-010
SW-012 SED-012
SW-03-01 SED-03-01 (FIRST ROUND)
SW-03-02 SED-03-02 (SECOND ROUND)
SW-013 SED-013
SW-014 SED-014
SW-015 SED-015
SW-04 SED-04
SW-07 SED-07
SW-06 SED-06
SW-05 SED-05
DRAINAGE SWALE #3
DRAINAGE SWALE #2
DRAINAGE SWALE #1
SWALE 1
SWALE 2
UNNAMED STREAM
BARNEY BROOK
TOP SLOPE
TOE SLOPE
CONCRETE BLOCKS ALONG TOP OF SLOPE
GRAVEL ROAD
TO BURGESS BROTHERS OFFICE
TO WALLOOMSAC RIVER (SOUTH BRANCH)
(BARNEY BROOK 750' FURTHER WEST) BREAK IN HORIZONTAL DISTANCE
SAND BEDS
SOIL STAGING AREA
LANDFILL AREA
FORMER LAGOON AREA
SAND QUARRY AREA
BEND IN THE ROAD AREA
WOODFORD
BENNINGTON
APPROX. TOWN LINE
U.S. FOREST SERVICE TRACT
SRS A1 0+00
W01-S1
W01-DI
W01-B
W01-S1 (SBW 13)
W12-S1
W22T
W22-S1
W11-S1
W05
W03T
W03
W02
W04-B (ABANDONED)
W04-DI
W04-SI
W04-B
W04-S
W06-S
W06-D
W04-D
W04-S
W04T
SP-23
SP-24
SP-25
SP-26
SP-27
SP-28
SP-29
SP-30
W-TP-17
W23-T
W24-T
W25-S1
W25-DI
W25-SI
W26T
W27T
W27-S1
W08-S1
W08-SI
W08-B
W09-S1
W09-SI
W09-B
W07-S1
W07-DI
W07-SI
SBW-10
SBW-21
SBW-17
SBW-20
SBW-16
SBW-15
SBW-18
SBW-14
TPSBW-19
SB-22
SB-25
SB-23
SB-24
1120
1110
1100
1090
1080
1070
1060
1050
1040
1030
1020
1010
1000
990
980
970
960
950
940
930
920
910
900
890
880
870
860
850
840
830
820
810
800
790
780
770
760
750
740
730
720
710
700
690
680
670
660
650
640
630
620
610
600
590
580
570
560
550
540
530
520
510
500
490
480
470
460
450
440
430
420
410
400
390
380
370
360
350
340
330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
LEGEND
SITE GRID CONTROL POINT
STONE WALL
SAFETY FENCE
TOP OF SLOPE
EDGE OF WOODLANDS
WATERCOURSE
TEMPORARY WELL ACCESS ROAD
SAMPLE AND MONITORING WELL LEGEND
S1 WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
T WELL INSTALLED IN ABLATION TILL
SI WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
DI WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
SBW WELL INSTALLED IN LANDFILL AREA
B WELL INSTALLED IN COMPETENT BEDROCK (WELL ELEVATIONS ARE PRESENTED ON TABLE 4)
SB TEST BORING COMPLETED IN LANDFILL/SOIL STAGING AREA WITHOUT WELL PLACEMENT
SURFACE WATER SAMPLE & ANALYTE CONCENTRATION
NOTE: VALUES REPRESENT THE MAXIMUM CONCENTRATION DETECTED FOR EACH ANALYTE DURING THE FOUR SAMPLING ROUNDS. ANALYTES EXHIBITING CONCENTRATIONS BELOW METHOD DETECTION LIMITS OVER THE FOUR SAMPLING ROUNDS WERE NOT PRESENTED. 8240 AND 524.2 REFER TO THE EPA METHOD OF SAMPLE ANALYSIS.
GENERAL NOTES
This location map is compiled and digitized from available sources including USGS 7.5 minute topographic mapping with 20' contour interval, Quadrangles, 1:24,000, Aerial Photographs exposed 3-6-91 by Keystone Aerial Surveys, Inc., 1=7920', and field survey by Foresight Land Services during 1992-1993. Locations of digitized features are only approximate and shown for relative location. Critical locations should be verified by survey.
When photographic reproduction is used; the drawings are not to scale. All scales are reduced from indicated to approximately half-size.
1"=50'-0"
50 0 50 100
O'BRIEN & GERE ENGINEERS, INC.
BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
SURFACE WATER RESULTS-ORGANICS (MAXIMUM CONCENTRATIONS DETECTED
FILE NO. 5271.003-34F
DATE
FIGURE 29



LEGEND

- SITE GRID CONTROL POINT
- STONE WALL
- SAFETY FENCE
- TOP OF SLOPE
- EDGE OF WOODLANDS
- WATERCOURSE
- TEMPORARY WELL ACCESS ROAD

SAMPLE AND MONITORING WELL LEGEND

- S1 — WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- T — WELL INSTALLED IN ABLATED TILL
- SI — WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- DI — WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- SBW — WELL INSTALLED IN LANDFILL AREA
- B — WELL INSTALLED IN COMPETENT BEDROCK (WELL ELEVATIONS ARE PRESENTED ON TABLE 4)
- TEST BORING COMPLETED IN LANDFILL/SOIL STAGING AREA WITHOUT WELL PLACEMENT
- SURFACE WATER AND SEDIMENT SAMPLE

NOTE: ONLY ANALYTE CONCENTRATIONS WHICH EXCEED FEDERAL MCL'S PRESENTED ON THIS FIGURE.

GENERAL NOTES

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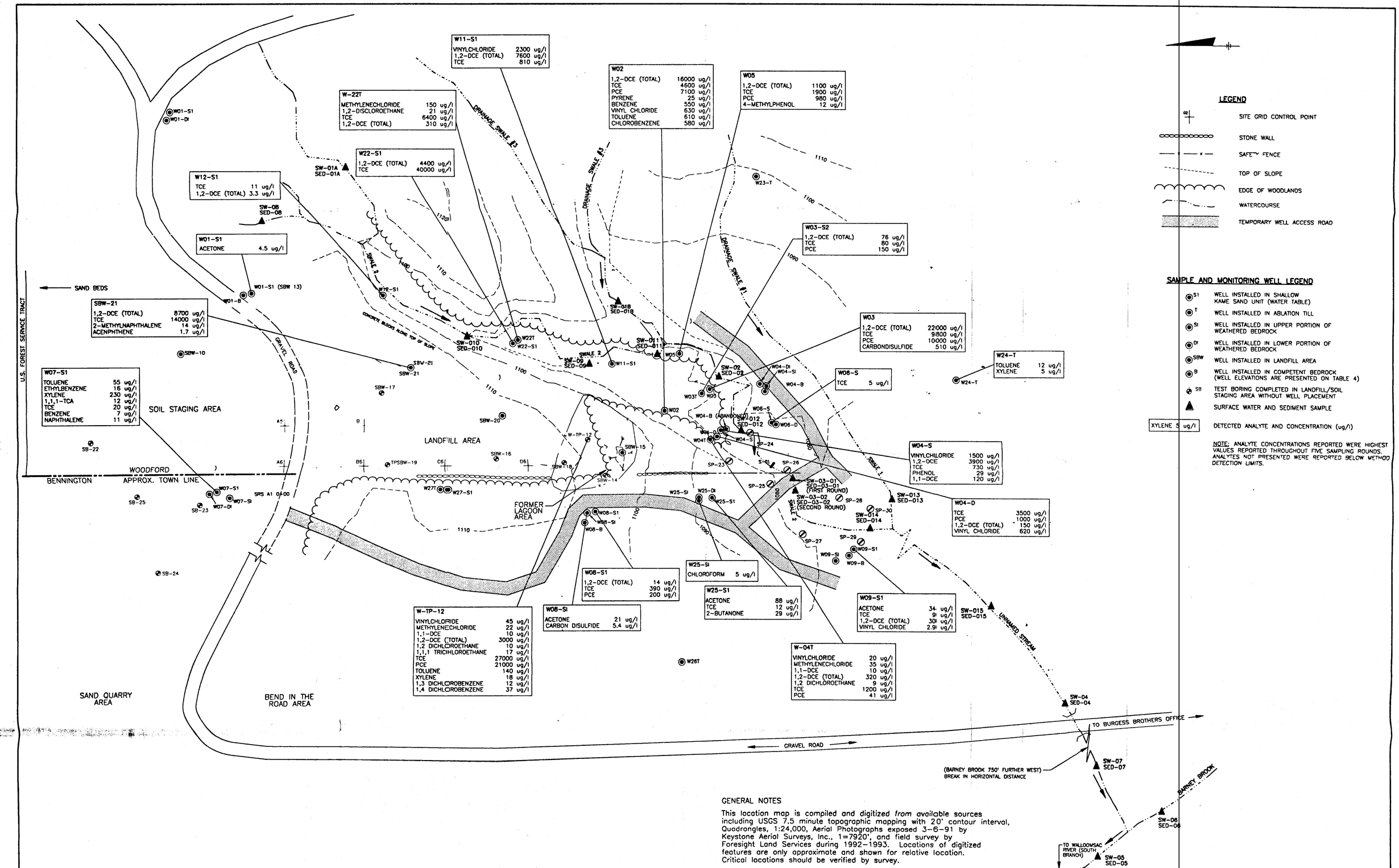
550 0 50 100

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION

BURGESS BROTHERS SUPERFUND SITE
INORGANIC GROUND WATER RESULTS
(MAX. CONCENTRATIONS DETECTED

FILE NO.	FIGURE
5271.001-46F	28
DATE	



GENERAL NOTES

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When photographic reproduction is used; the drawings are not to scale. All scales are reduced from indicated to approximately

1" =50'-0" 50 0 50 100

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION

GROUND WATER RESULTS (VOCs, SVOCs, AND PCBs)
(MAXIMUM CONCENTRATIONS DETECTED DURING FIVE SAMPLING ROUNDS)

FILE NO. 5271.003-33F

DATE FEBRUARY 1995

FIGURE 27A

U.S. FOREST SERVICE TRACT

SP-17
VOCs ND

SP-11
VINYL CHLORIDE 8 ug/kg
1,2-DCE (total) 1700 ug/kg
TCE 1500 ug/kg
DCE 5300 ug/kg
TOLUENE 13 ug/kg

SP-10
VINYL CHLORIDE 17 ug/kg
ACETONE 280 ug/kg
CARBON DISULFIDE 11 ug/kg
2-BUTANONE 92 ug/kg
TOLUENE 1700 ug/kg
ETHYL BENZENE 32 ug/kg
XYLENE (total) 110 ug/kg
1,2-DCE (total) 11 ug/kg

SP-19
ACETONE 15 ug/kg

SP-12
ACETONE 44 ug/kg
TOLUENE 9 ug/kg

SP-21
ACETONE 18 ug/kg
1,2-DCE (total) 16 ug/kg

SP-07
VINYL CHLORIDE 4900 ug/kg
ACETONE 1100 ug/kg
CARBON DISULFIDE 37 ug/kg
1,1-DCE 48 ug/kg
1,1-DCA 20 ug/kg
1,2-DCE (total) 66000 ug/kg
2-BUTANONE 390 ug/kg
1,1,1-TCA 21 ug/kg
TCE 100 ug/kg
BENZENE 20 ug/kg
4-METHYL-2-PENTANONE 68 ug/kg
PCE 380 ug/kg
TOLUENE 15000 ug/kg
ETHYL BENZENE 230 ug/kg
XYLENE 840 ug/kg
AECNAPTHYLENE 910 ug/kg
PHENANTHENE 14000 ug/kg
ANTHRACENE 1500 ug/kg
FLUORANTHENE 12000 ug/kg
PYRENE 12000 ug/kg
BENZO(a)ANTHRACENE 4900 ug/kg
CHRYSENE 6100 ug/kg
BENZO(b)FLUORANTHENE 6700 ug/kg
BENZO(k)FLUORANTHENE 4900 ug/kg
BENZO(a)PYRENE 4600 ug/kg
INDENO(1,2,3-cd)PYRENE 3300 ug/kg

SP-16
ACETONE 12 ug/kg
TOLUENE 11 ug/kg

SP-13
ACETONE 220 ug/kg
2-BUTANONE 67 ug/kg
TOLUENE 98 ug/kg

SP-09
ACETONE 120 ug/kg
CARBON DISULFIDE 24 ug/kg
2-BUTANONE 36 ug/kg

SP-01
ACETONE 8 ug/kg
XYLENE (total) 14 ug/kg

SP-24
1,2-DCE (TOTAL) 20 ug/kg
TCE 19 ug/kg
PCE 22 ug/kg

SP-29
TCE 16 ug/kg

W07-SI
ACETONE 8 ug/kg

SP-03
PCE 13 ug/kg
4,4-DDT 62 ug/kg

SP-08
ACETONE 76 ug/kg
TCE 380 ug/kg
PCE 520 ug/kg

W08-SI
ACETONE 11 ug/kg

SP-22
ACETONE 11 ug/kg
TCE 15 ug/kg
PCE 26 ug/kg

W-04
ACETONE 170 ug/kg
2-BUTANONE 44 ug/kg

SP-23
TCE 21 ug/kg
PCE 99 ug/kg

ACETONE 1100 ug/kg

SAND BEDS

SOIL STAGING AREA

LANDFILL AREA

FORMER LAGOON AREA

SAND QUARRY AREA

BEND IN THE ROAD AREA

BENNINGTON

WOODFORD APPROX. TOWN LINE

GRAVEL ROAD

DRAINAGE SWALE #3

DRAINAGE SWALE #2

DRAINAGE SWALE #1

SWALE 1

SWALE 2

TOE SLOPE

TOP SLOPE

CONCRETE BLOCKS ALONG TOP OF SLOPE

SRS A1 0400

SW-01A SED-01A
SW-08 SED-08
SW-01B SED-01B
SW-010 SED-010
SW-09 SED-09
SW-011 SED-011
SW-02 SED-02
SW-012 SED-012
SW-03-01 SED-03-01 (FIRST ROUND)
SW-03-02 SED-03-02 (SECOND ROUND)
SW-013 SED-013
SW-014 SED-014
SW-015 SED-015
SW-04 SED-04
SW-07 SED-07
SW-06 SED-06
SW-05 SED-05

UNNAMED STREAM

BARNEY BROOK

TO BURGESS BROTHERS OFFICE

(BARNEY BROOK 750' FURTHER WEST) BREAK IN HORIZONTAL DISTANCE

TO WALLOOMSAC RIVER (SOUTH BRANCH)

W01-SI
W01-DI
W01-SI (SBW 13)
W01-B
W12-SI
W22-SI
W27-SI
W11-SI
W03I
W03
W04-DI
W04-SI
W04-B
W04-B (ABANDONED)
W04-S
W04-D
W04I
W05
W06-S
W06-D
W23-T
W24-T
W25-DI
W25-SI
W25-S1
W08-SI
W08-S1
W08-B
W09-SI
W09-S1
W09-B
W26T
W27I
W27-SI

SBW-10
SBW-21
SBW-17
SBW-20
SBW-16
SBW-18
SBW-14
SBW-15
TPSBW-19
SB-22
SB-25
SB-23
SB-24

SP-01 SP-02 SP-03 SP-04 SP-05 SP-06 SP-07 SP-08 SP-09 SP-10 SP-11 SP-12 SP-13 SP-14 SP-15 SP-16 SP-17 SP-18 SP-19 SP-20 SP-21 SP-22 SP-23 SP-24 SP-25 SP-26 SP-27 SP-28 SP-29 SP-30

W-TP-12

1090 1100 1110 1120

LEGEND

- SITE GRID CONTROL POINT
- STONE WALL
- SAFETY FENCE
- TOP OF SLOPE
- EDGE OF WOODLANDS
- WATERCOURSE
- TEMPORARY WELL ACCESS ROAD

SAMPLE AND MONITORING WELL LEGEND

- S1 WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- T WELL INSTALLED IN ABLATION TILL
- SI WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- DI WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- SBW WELL INSTALLED IN LANDFILL AREA
- B WELL INSTALLED IN COMPETENT BEDROCK (WELL ELEVATIONS ARE PRESENTED ON TABLE 4)
- TEST BORING COMPLETED IN LANDFILL/SOIL STAGING AREA WITHOUT WELL PLACEMENT
- SURFACE WATER AND SEDIMENT SAMPLE
- SHALLOW SURFACE SAMPLE (0"-6"/VOCs,0"-12"/SVOCs) WITH DETECTED ANALYTE AND CONCENTRATION (ug/kg)

NOTE: SURFACE SOIL SAMPLES COLLECTED AT SP-01 THROUGH SP-22 AND SOIL BORING LOCATIONS WERE SECURED 10/92. SURFACE SOIL SAMPLES COLLECTED AT SP-23 THROUGH SP-30 WERE SECURED 5/94.

GENERAL NOTES

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1"=50'-0" 50 0 50 100

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION

SURFACE SOIL RESULTS (VOCs & SVOCs)

FILE NO. 5271.003-32F

DATE FEBRUARY 1995

FIGURE 27

U.S. FOREST SERVICE TRACT

SP-17
BACKGROUND SEE NOTE 1

SP-18
BACKGROUND SEE NOTE 1

SP-19
BACKGROUND SEE NOTE 1

SP-12	
BARIUM	112 mg/kg
BERYLLIUM	0.72 mg/kg
CALCIUM	1980 mg/kg
COPPER	9.1 mg/kg
LEAD	22.3 mg/kg
MAGNESIUM	1560 mg/kg
NICKEL	29.1 mg/kg
SODIUM	287 mg/kg
THALIUM	0.24 mg/kg
ZINC	77 mg/kg

SP-06	
ANTIMONY	4.6 mg/kg
ARSENIC	3.4 mg/kg
BARIUM	165 mg/kg
CADMIUM	1.4 mg/kg
CALCIUM	2990 mg/kg
COPPER	19.6 mg/kg
IRON	25700 mg/kg
LEAD	78.3 mg/kg
MAGNESIUM	1830 mg/kg
MANGANESE	3050 mg/kg
NICKEL	177 mg/kg
POTASSIUM	576 mg/kg
SILVER	0.53 mg/kg
SODIUM	194 mg/kg
ZINC	715 mg/kg

SP-11	
BARIUM	63.3 mg/kg
CALCIUM	1090 mg/kg
COPPER	36.7 mg/kg
IRON	21800 mg/kg
LEAD	289 mg/kg
MAGNESIUM	1080 mg/kg
MERCURY	0.21 mg/kg
NICKEL	14.7 mg/kg
POTASSIUM	483 mg/kg
SODIUM	209 mg/kg
ZINC	182 mg/kg

SP-07	
ANTIMONY	5.5 mg/kg
ARSENIC	4.2 mg/kg
BARIUM	280 mg/kg
CALCIUM	1810 mg/kg
CHROMIUM	9.7 mg/kg
COPPER	51 mg/kg
IRON	29400 mg/kg
LEAD	1040 mg/kg
MERCURY	0.35 mg/kg
NICKEL	128 mg/kg
POTASSIUM	1530 mg/kg
SODIUM	1150 mg/kg
ZINC	506 mg/kg

SP-05	
CADMIUM	.29 mg/kg
CALCIUM	2220 mg/kg
COPPER	8.7 mg/kg
MAGNESIUM	2060 mg/kg
NICKEL	7.2 mg/kg
POTASSIUM	549 mg/kg

W12-S1	
CALCIUM	535 mg/kg
LEAD	22.5 mg/kg
SODIUM	237 mg/kg
VANDIUM	19.3 mg/kg

SP-13	
CALCIUM	2070 mg/kg
MAGNESIUM	1310 mg/kg
NICKEL	30.1 mg/kg
SODIUM	200 mg/kg

SBW-21	
ANTIMONY	3.4 mg/kg
ARSENIC	3.4 mg/kg
CADMIUM	0.33 mg/kg
CALCIUM	27100 mg/kg
COPPER	13 mg/kg
MAGNESIUM	11700 mg/kg
MERCURY	1.2 mg/kg
NICKEL	7.5 mg/kg
SODIUM	150 mg/kg
ZINC	375 mg/kg

SBW-13	
ANTIMONY	3.1 mg/kg
CALCIUM	18900 mg/kg
COPPER	9.8 mg/kg
MAGNESIUM	5800 mg/kg
NICKEL	7.2 mg/kg
POTASSIUM	573 mg/kg
SILVER	2.5 mg/kg
SODIUM	202 mg/kg

SP-20	
ALUMINUM	14600 mg/kg
BARIUM	63.6 mg/kg
CADMIUM	0.47 mg/kg
CALCIUM	2010 mg/kg
CHROMIUM	12.3 mg/kg
MAGNESIUM	1400 mg/kg
SODIUM	179 mg/kg
ZINC	50 mg/kg

SBW-10	
BARIUM	122 mg/kg
CADMIUM	0.3 mg/kg
CALCIUM	1190 mg/kg
COBALT	11.5 mg/kg
MAGNESIUM	1430 mg/kg
MANGANESE	2470 mg/kg
POTASSIUM	560 mg/kg
SODIUM	181 mg/kg

SP-15	
CALCIUM	1130 mg/kg
MAGNESIUM	1330 mg/kg
POTASSIUM	491 mg/kg

SP-16	
CALCIUM	553 mg/kg
SODIUM	185 mg/kg

SP-10	
BARIUM	130 mg/kg
BERYLLIUM	0.75 mg/kg
CALCIUM	1750 mg/kg
COPPER	10.6 mg/kg
LEAD	133 mg/kg
MAGNESIUM	1460 mg/kg
NICKEL	596 mg/kg
POTASSIUM	600 mg/kg
SODIUM	425 mg/kg
ZINC	90.1 mg/kg

SP-21	
SODIUM	156 mg/kg

W04-S2	
BARIUM	122 mg/kg
BERYLLIUM	0.70 mg/kg
CADMIUM	0.56 mg/kg
CALCIUM	2750 mg/kg
CHROMIUM	11 mg/kg
COPPER	22.3 mg/kg
LEAD	194 mg/kg
MAGNESIUM	1390 mg/kg
NICKEL	184 mg/kg
SODIUM	509 mg/kg
THALLIUM	0.26 mg/kg
ZINC	93.5 mg/kg

SP-09	
BARIUM	66.4 mg/kg
CADMIUM	0.49 mg/kg
CALCIUM	2080 mg/kg
LEAD	69.9 mg/kg
NICKEL	590 mg/kg
SODIUM	241 mg/kg
ZINC	54.3 mg/kg

SP-24	
BARIUM	59.4 mg/kg
CALCIUM	1370 mg/kg
MAGNESIUM	1100 mg/kg
NICKEL	15.6 mg/kg
POTASSIUM	564 mg/kg
SELENIUM	0.21 mg/kg
SODIUM	319 mg/kg
ZINC	52.7 mg/kg

SP-08	
LEAD	67.7 mg/kg
SODIUM	162 mg/kg
ZINC	57.3 mg/kg

SP-04	
ARSENIC	3.0 mg/kg
BERYLLIUM	0.67 mg/kg
CALCIUM	4810 mg/kg
CHROMIUM	12.1 mg/kg
COPPER	6.8 mg/kg
MAGNESIUM	3480 mg/kg
NICKEL	16.6 mg/kg
POTASSIUM	578 mg/kg
SODIUM	178 mg/kg
ZINC	57.9 mg/kg

SP-01	
CALCIUM	1140 mg/kg
COPPER	6.5 mg/kg
MAGNESIUM	1530 mg/kg
NICKEL	8.3 mg/kg
SODIUM	150 mg/kg

SP-26	
ARSENIC	3.6 mg/kg
BARIUM	123 mg/kg
CADMIUM	0.28 mg/kg
CALCIUM	3120 mg/kg
CHROMIUM	9.6 mg/kg
LEAD	93.9 mg/kg
MAGNESIUM	1860 mg/kg
NICKEL	28.2 mg/kg
POTASSIUM	772 mg/kg
SELENIUM	0.29 mg/kg
SODIUM	652 mg/kg
ZINC	78.6 mg/kg

SP-28	
CALCIUM	654 mg/kg
SELENIUM	0.35 mg/kg
SODIUM	439 mg/kg

W07-S2	
CALCIUM	608 mg/kg
MAGNESIUM	1500 mg/kg
POTASSIUM	718 mg/kg

SP-14	
CADMIUM	0.51 mg/kg
CALCIUM	608 mg/kg
COPPER	7.8 mg/kg
LEAD	1560 mg/kg
MAGNESIUM	1340 mg/kg
MERCURY	0.23 mg/kg
NICKEL	109 mg/kg
POTASSIUM	625 mg/kg
SODIUM	155 mg/kg

SP-02	
CALCIUM	1020 mg/kg
COPPER	7.4 mg/kg
MAGNESIUM	1090 mg/kg

SSP-03	
ARSENIC	3.4 mg/kg
BARIUM	279 mg/kg
CADMIUM	2.1 mg/kg
CALCIUM	2850 mg/kg
CHROMIUM	10.8 mg/kg
COPPER	41.6 mg/kg
LEAD	141 mg/kg
MAGNESIUM	2090 mg/kg
NICKEL	57.3 mg/kg
POTASSIUM	554 mg/kg
SODIUM	169 mg/kg
ZINC	585 mg/kg

SBW-18	
ANTIMONY	3.0 mg/kg
CALCIUM	1220 mg/kg
COPPER	7.1 mg/kg
MAGNESIUM	1510 mg/kg
NICKEL	8.7 mg/kg
POTASSIUM	666 mg/kg
SODIUM	216 mg/kg

SP-22	
ANTIMONY	2.7 mg/kg
CADMIUM	0.35 mg/kg
COPPER	8.0 mg/kg
LEAD	153 mg/kg
MAGNESIUM	1110 mg/kg
MERCURY	0.15 mg/kg
NICKEL	18.4 mg/kg
POTASSIUM	435 mg/kg

SP-23	
ANTIMONY	0.24 mg/kg
ALUMINUM	13200 mg/kg
CHROMIUM	11.4 mg/kg
MAGNESIUM	1400 mg/kg
POTASSIUM	611 mg/kg
SELENIUM	0.31 mg/kg
SODIUM	358 mg/kg
VANADIUM	25.2 mg/kg

W08-S2	
SODIUM	172 mg/kg

W25-S2	
SODIUM	159 mg/kg

SP-25	
COPPER	18.5 mg/kg
LEAD	31.4 mg/kg
MAGNESIUM	1130 mg/kg
POTASSIUM	621 mg/kg
SELENIUM	0.29 mg/kg
SODIUM	412 mg/kg

SP-27	
SELENIUM	0.22 mg/kg
SODIUM	287 mg/kg
ZINC	308 mg/kg

SP-29	
CALCIUM	571 mg/kg
MAGNESIUM	1150 mg/kg
SELENIUM	0.26 mg/kg
SODIUM	468 mg/kg

SP-30	
ANTIMONY	0.31 mg/kg
ALUMINUM	24500 mg/kg
ARSENIC	3.3 mg/kg
BARIUM	92.1 mg/kg
BERYLLIUM	1.3 mg/kg
CALCIUM	3450 mg/kg
CHROMIUM	19.8 mg/kg
COBALT	17 mg/kg
IRON	21200 mg/kg
LEAD	35.9 mg/kg
MAGNESIUM	1570 mg/kg
MANGANESE	1220 mg/kg
MERCURY	0.36 mg/kg
NICKEL	9 mg/kg
POTASSIUM	629 mg/kg
SELENIUM	0.52 mg/kg
SODIUM	688 mg/kg
VANADIUM	22.9 mg/kg
ZINC	75.4 mg/kg

SAND BEDS

SOIL STAGING AREA

LANDFILL AREA

FORMER LAGOON AREA

SAND QUARRY AREA

BEND IN THE ROAD AREA

WOODFORD

BENNINGTON

APPROX. TOWN LINE

SRS A1 04-08

DRAINAGE SWALE #5

DRAINAGE SWALE #3

DRAINAGE SWALE #1

SWALE 1

SWALE 2

SWALE 3

CONCRETE BLOCKS ALONG TOP OF SLOPE

GRAVEL ROAD

UNNAMED STREAM

BARNEY BROOK

TO BURGESS BROTHERS OFFICE

(BARNEY BROOK 750' FURTHER WEST) BREAK IN HORIZONTAL DISTANCE

TO WALLOOMSAC RIVER (SOUTH BRANCH)

SW-01A SED-01A
SW-06 SED-06
SW-010 SED-010
SW-018 SED-018
SW-011 SED-011
SW-09 SED-09
SW-02 SED-02
SW-012 SED-012
SW-03-01 SED-03-01 (FIRST ROUND)
SW-03-02 SED-03-02 (SECOND ROUND)
SW-013 SED-013
SW-014 SED-014
SW-015 SED-015
SW-04 SED-04
SW-07 SED-07
SW-06 SED-06
SW-05 SED-05

LEGEND

- SITE GRID CONTROL POINT
- STONE WALL
- SAFETY FENCE
- TOP OF SLOPE
- EDGE OF WOODLANDS
- WATERCOURSE
- TEMPORARY WELL ACCESS ROAD

SAMPLE AND MONITORING WELL LEGEND

- S1 — WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- T — WELL INSTALLED IN ABLATION GLACIAL TILL
- SI — WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- DI — WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- SBW — WELL INSTALLED IN LANDFILL AREA
- B — WELL INSTALLED IN COMPETENT BEDROCK (WELL ELEVATIONS ARE PRESENTED ON TABLE 4)
- SB — TEST BORING COMPLETED IN LANDFILL/SOIL BORING AREAS WITHOUT WELL PLACEMENT
- SURFACE WATER AND SEDIMENT SAMPLE
- SHALLOW SURFACE SAMPLE (0"-12")

BACKGROUND DATA (SP-17, SP-18, & SP-19) HIGHEST DETECTED CONCENTRATION PER ANALYTE	
ALUMINUM	11500 mg/kg
ANTIMONY	NOT DETECTED
ARSENIC	3.0 mg/kg
BARIUM	54.9 mg/kg
BERYLLIUM	0.65 mg/kg
CADMIUM	NOT DETECTED
CALCIUM	470 mg/kg
CHROMIUM	9.3 mg/kg
COBALT	9.9 mg/kg
COPPER	6.4 mg/kg
IRON	20100 mg/kg
LEAD	19.6 mg/kg
MAGNESIUM	1050 mg/kg
MANGANESE	708 mg/kg
MERCURY	NOT DETECTED
NICKEL	7.0 mg/kg
POTASSIUM	423 mg/kg
SELENIUM	NOT DETECTED
SILVER	NOT DETECTED
SODIUM	146 mg/kg
THALLIUM	0.23 mg/kg
VANADIUM	17.9 mg/kg
ZINC	42.9 mg/kg

NOTES:

1. SURFACE SOIL SAMPLE NUMBERS SP-17, SP-18, AND SP-19 WERE USED AS BACKGROUND DATA POINTS. HIGHEST DETECTED CONCENTRATION FOR EACH INORGANIC ANALYTE FROM THESE THREE BACKGROUND POINTS WERE USED FOR COMPARISONS TO SITE DATA.
2. "S2" WELLS WERE NOT INSTALLED AT W-04, W-07, W-08, W-12, AND W-25 LOCATIONS. SURFACE SOIL SAMPLES WERE TAKEN AT PROPOSED "S2" WELL LOCATIONS. WELLS WERE NOT INSTALLED DUE TO LIMITED SATURATED THICKNESS WITHIN KAME DEPOSIT. THESE LOCATIONS WERE CHANGED TO DEEPER BORINGS.
3. SURFACE SOIL SAMPLES WERE COLLECTED 10/92 WITH THE EXCEPTION OF SP-23 THROUGH SP-30 WHICH WERE SECURED 5/94.

GENERAL NOTES

This location map is compiled and digitized from available sources including USGS 7.5 minute topographic mapping with 20' contour interval, Quadrangles, 1:24,000, Aerial Photographs exposed 3-6-91 by Keystone Aerial Surveys, Inc., 1=7920', and field survey by Foresight Land Services during 1992-1993. Locations of digitized features are only approximate and shown for relative location. Critical locations should be verified by survey.

When photographic reproduction is used; the drawings are not to scale. All scales are reduced from indicated to approximately

1"=50'-0" 50 0 50 100

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION

SURFACE SOIL RESULTS- INORGANICS
(EXCURSIONS FROM BACKGROUND)

FILE NO. 5271.003-45F

DATE FEBRUARY 1995

FIGURE 26

FIGURE 25

LEGEND

- BORRROW PITS
- LANDFILL
- OPEN FIELD/LAWN
- MIXED HARDWOOD FOREST
- WETLANDS
- SURFACE WATER *
- INTERMITTENT SURFACE WATER *
- QUARRY
- C & D LANDFILL

SURFACE WATER NOT TO SCALE. LOCATIONS BASED ON SITE VISITS AND INFORMATION PROVIDED BY BURGESS BROTHERS, INC..

BURGESS BROTHERS SUPERFUND SITE
WOODFORD AND BENNINGTON, VERMONT

PHASE I REMEDIAL INVESTIGATION

COVERTYPE MAP

250 0 250

APPROX. SCALE IN FEET

5271.001.302

O'BRIEN & GERE
ENGINEERS, INC.

SOURCE: 1982 USDA AERIAL PHOTO Sep/17/93

H:\PROJECTS\111111\76, SCALE FACTOR: 1=1
BURGESS1 1.2 .3

21 1/28/94 1=50

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR NOTES CONCERNING THE GENERATION OF THE BASE MAP (ie. TOPOGRAPHIC CONTOUR LINES)

LEGEND

- W-08 DI – WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- W-09 B – WELL INSTALLED IN COMPETENT BEDROCK
- SBW-10 – TEST BORING COMPLETED IN LANDFILL/ SOIL STAGING AREA WITH WELL PLACEMENT
- W-01 S1 – WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- W-26T – WELL INSTALLED IN ABLATION TILL
- W-09 SI – WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- SBW-17 – SOIL BORING COMPLETED WITHOUT WELL PLACEMENT
- (1080.05) – GROUND WATER POTENTOMETRIC ELEVATION IN COMPETENT BEDROCK WELL (JUNE 21,1993)
- 1100 – TOPOGRAPHIC CONTOUR
- PROBABLE GROUND WATER FLOW POTENTIAL IN COMPETENT BEDROCK
- DRAINAGE SWALE OR UNNAMED STREAM
- TEMPORARY ROADWAY
- LANDFILL BOUNDARY

W01-B (1068.41)
W01-S1 OR SBW 13
W12-S1
W22-S1
SBW-21
SBW-10
SBW-17
W11-S1
W05
W04-DI
W04-SI
W04-B (1069.74)
W03
W03T
W02
W04-B ABANDONED
W04-D
W04-S
W06-S2
W06-S
W06-D
SBW-20
W-TP-12
SBW-16
SBW-15
SBW-19
SBW-18
SBW-14
W07-DI
W07-S1
W07-SI
ROAD
GRAVEL
WOODFORD/BENNINGTON TOWN LINE
W08-SI
W08-S1
W08-B (1068.27)
W25-DI
W25-S1
W25-SI
W09-S1 (1069.33)
W09-B
W09-SI
1090
1100
1110

0 50 100
1"=50'-0"

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
COMPETENT BEDROCK POTENTIOMETRIC GROUND WATER SURFACE ELEVATION MAP
(JUNE 21,1993)
(NO CONTOURING SHOWN)

FILE NO. 5271.003-40P

DATE FEBRUARY 1995

FIGURE 24

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR NOTES CONCERNING THE GENERATION OF THE BASE MAP (ie. TOPOGRAPHIC CONTOUR LINES)

LEGEND

- W-08 DI – WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- W-09 B – WELL INSTALLED IN COMPETENT BEDROCK
- SBW-10 – TEST BORING COMPLETED IN LANDFILL/ SOIL STAGING AREA WITH WELL PLACEMENT
- W-01 S1 – WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- W-26T – WELL INSTALLED IN ABLATION TILL
- W-09 SI – WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- SBW-17 – SOIL BORING COMPLETED WITHOUT WELL PLACEMENT
- (1080.05) – GROUND WATER POTENTIOMETRIC ELEVATION IN DEEP INTERMEDIATE WELL (JUNE 23,1993)
- 1100 – TOPOGRAPHIC CONTOUR
- – DRAINAGE SWALE OR UNNAMED STREAM
- – TEMPORARY ROADWAY
- – LANDFILL BOUNDARY

W01-B
W01-S1 OR SBW 13
W12-S1
W22-S1
SBW-21
SBW-10
SBW-17
SBW-20
W-TP-12
SBW-16
SBW-19
SBW-15
SBW-18
SBW-14
W11-S1
W05
W03
W03T
W02
W04-B ABANDONED
W04-D
W04-S
(1081.06)
W04-DI
W04-SI
W04-B
W06-S2
W06-S
W06-D
W07-DI
(699.77)
W07-S1
W07-SI
GRAVEL ROAD
WOODFORD/BENNINGTON TOWN LINE
W08-SI
W08-S1
W08-B
W25-DI
(1072.03)
W25-SI
W25-S1
W09-S1
W09-B
W09-SI
1100
1090
1110

0 50 100
1" = 50'-0"

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
DEEP WEATHERED BEDROCK POTENTIOMETRIC GROUND WATER SURFACE ELEVATION MAP
JUNE 23,1993
(NO CONTOURING SHOWN)

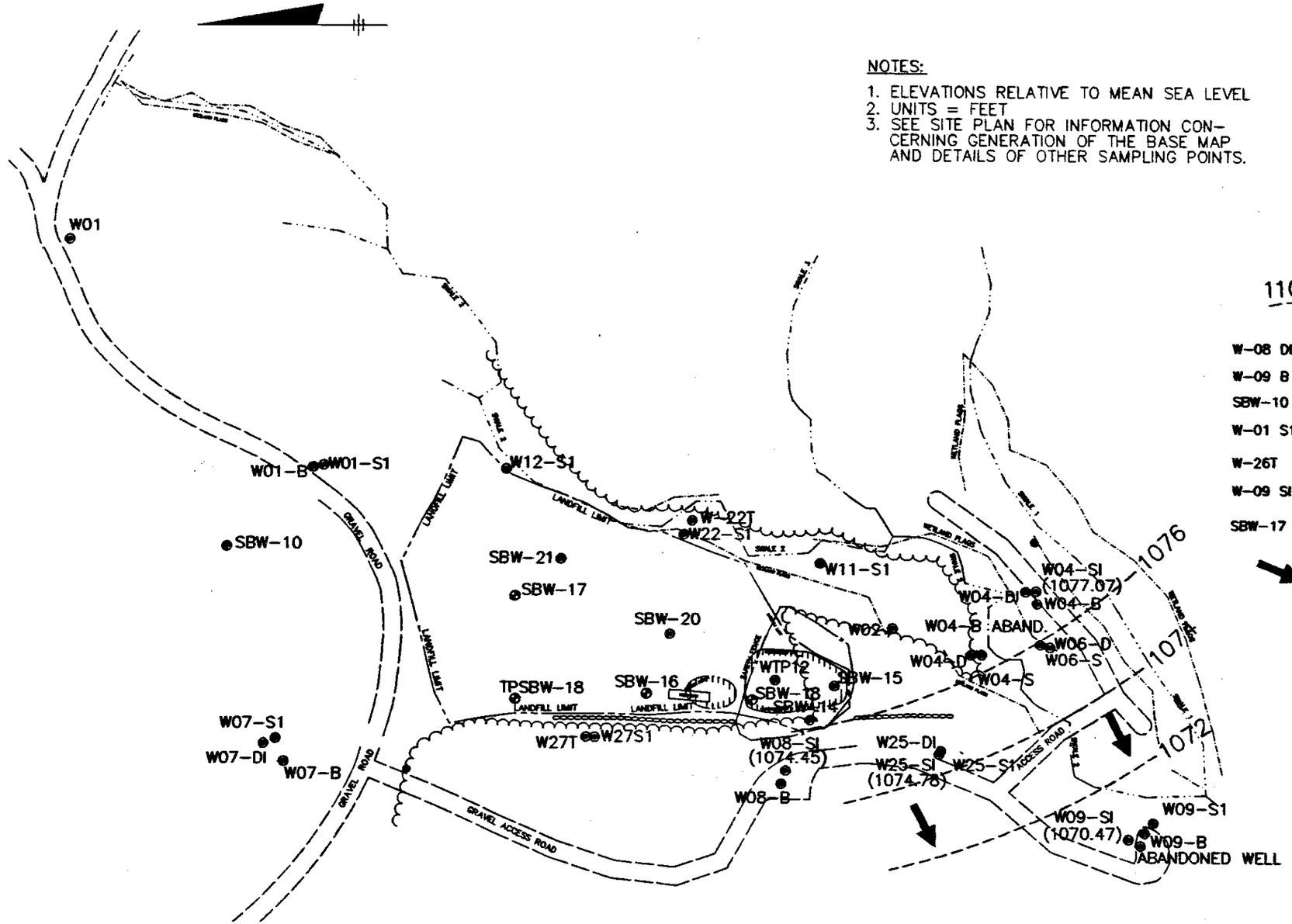
FILE NO. 5271.003-39P

DATE FEBRUARY 1995

FIGURE 23

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR INFORMATION CONCERNING GENERATION OF THE BASE MAP AND DETAILS OF OTHER SAMPLING POINTS.



LEGEND

- 1100 – POTENTIOMETRIC GROUND WATER ELEVATION CONTOUR IN SHALLOW WEATHERED BEDROCK WELLS
- W-08 DI ● – WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- W-09 B ● – WELL INSTALLED IN COMPETENT BEDROCK
- SBW-10 ● – TEST BORING COMPLETED IN LANDFILL/ SOIL STAGING AREA WITH WELL PLACEMENT
- W-01 S1 ● – WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- W-26T ● – WELL INSTALLED IN ABLATION TILL
- W-09 SI ● – WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- SBW-17 ⊘ – SOIL BORING COMPLETED WITHOUT WELL PLACEMENT
- – GROUND WATER FLOW DIRECTION POTENTIAL

1"=100' 100 0 100 200

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
SHALLOW WEATHERED BEDROCK
POTENTIOMETRIC GROUND WATER
SURFACE CONTOURS
JULY 5, 1994

FILE NO. 5271.003.29F

DATE FEBRUARY 1995

FIGURE 22

38F-18 1/28/95 1=50

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR NOTES CONCERNING THE GENERATION OF THE BASE MAP (ie. TOPOGRAPHIC CONTOUR LINES)
4. WATER LEVEL IN W-07SI NOT CONTOURED DUE TO HIGHER SCREENED INTERVALS THAN OTHER WELLS.

LEGEND

- W-08 DI – WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- W-09 B – WELL INSTALLED IN COMPETENT BEDROCK
- SBW-10 – TEST BORING COMPLETED IN LANDFILL/ SOIL STAGING AREA WITH WELL PLACEMENT
- W-01 S1 – WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- W-26T – WELL INSTALLED IN ABLATION TILL
- W-09 SI – WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- SBW-17 – SOIL BORING COMPLETED WITHOUT WELL PLACEMENT
- (1080.05) – POTENTIOMETRIC ELEVATION IN SHALLOW INTERMEDIATE WELL (JUNE 23,1993)
- 1100 – TOPOGRAPHIC CONTOUR
- 1090 – POTENTIOMETRIC GROUND WATER ELEVATION CONTOUR (CONTOURS APPROXIMATE)
- GROUND WATER FLOW POTENTIAL IN SHALLOW WEATHERED BEDROCK
- DRAINAGE SWALE OR UNNAMED STREAM
- TEMPORARY ROADWAY
- LANDFILL BOUNDARY

W01-S1 OR SBW 13
W01-B
W12-S1
W22-S1
SBW-21
SBW-10
SBW-17
SBW-20
SBW-19
SBW-16
W-TP-12
SBW-15
SBW-18
SBW-14
W11-S1
SW-01
W05
W03T
W03
W02
W04-DI
W04-SI
(1077.23)
W04-B
W04-B ABANDONED
W04-D
W04-S
W06-S2
W06-S
W06-D
W07-DI
W07-S1
W07-SI
(1070.20)
NOTE: WELL IS ALMOST DRY
W25-DI
W25-S1
W25-SI
(1074.99)
W08-SI
(1074.48)
W08-S1
W08-B
W09-SI
W09-B
W09-SI
(1070.53)
WOODFORD/BENNINGTON TOWN LINE
GRAVEL ROAD
1077
1075
1073
1090
1100
1110

0 50 100
1"=50'-0"

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
SHALLOW WEATHERED BEDROCK
POTENTIOMETRIC GROUND WATER SURFACE
CONTOUR MAP
(JUNE 23, 1993)

FILE NO. 5271.003-38P

DATE FEBRUARY 1995

FIGURE 21

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR INFORMATION CONCERNING GENERATION OF THE BASE MAP AND DETAILS OF OTHER SAMPLING POINTS.

LEGEND

- 1100 – POTENTIOMETRIC GROUND WATER ELEVATION IN ABLATED GLACIAL TILL
- W-08 DI – WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- W-09 B – WELL INSTALLED IN COMPETENT BEDROCK
- SBW-10 – TEST BORING COMPLETED IN LANDFILL/ SOIL STAGING AREA WITH WELL PLACEMENT
- W-01 S1 – WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- W-26T – WELL INSTALLED IN ABLATION TILL
- W-09 SI – WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- SBW-17 – SOIL BORING COMPLETED WITHOUT WELL PLACEMENT
- – GROUND WATER FLOW DIRECTION POTENTIAL

W01
W01-B
W01-S1
SBW-10
GRAVEL ROAD
LANDFILL LIMIT
W12-S1
SBW-21
SBW-17
SBW-20
TPSBW-18
SBW-16
LANDFILL LIMIT
W27S1
W27T (1099.22)
W07-S1
W07-DI
W07-B
GRAVEL ACCESS ROAD
W22-S1
W22T (1088.15)
W11-S1
WTP12
SBW-15
SBW-13
SBW-14
W23T (1096.91)
W03T (1080.33)
W02
W04-B ABAND.
W04-DI
W04-B
W06-D
W06-S
W04T (1079.77)
W25-DI
W25-S1
ACCESS ROAD
W08-B
W24T (1088.20)
W09-S1
W09-B
ABANDONED WELL
1100
1095
1090
1085
1080
W26T (1079.37)

1"=100' 100 0 100 200

O'BRIEN & GERE ENGINEERS, INC.

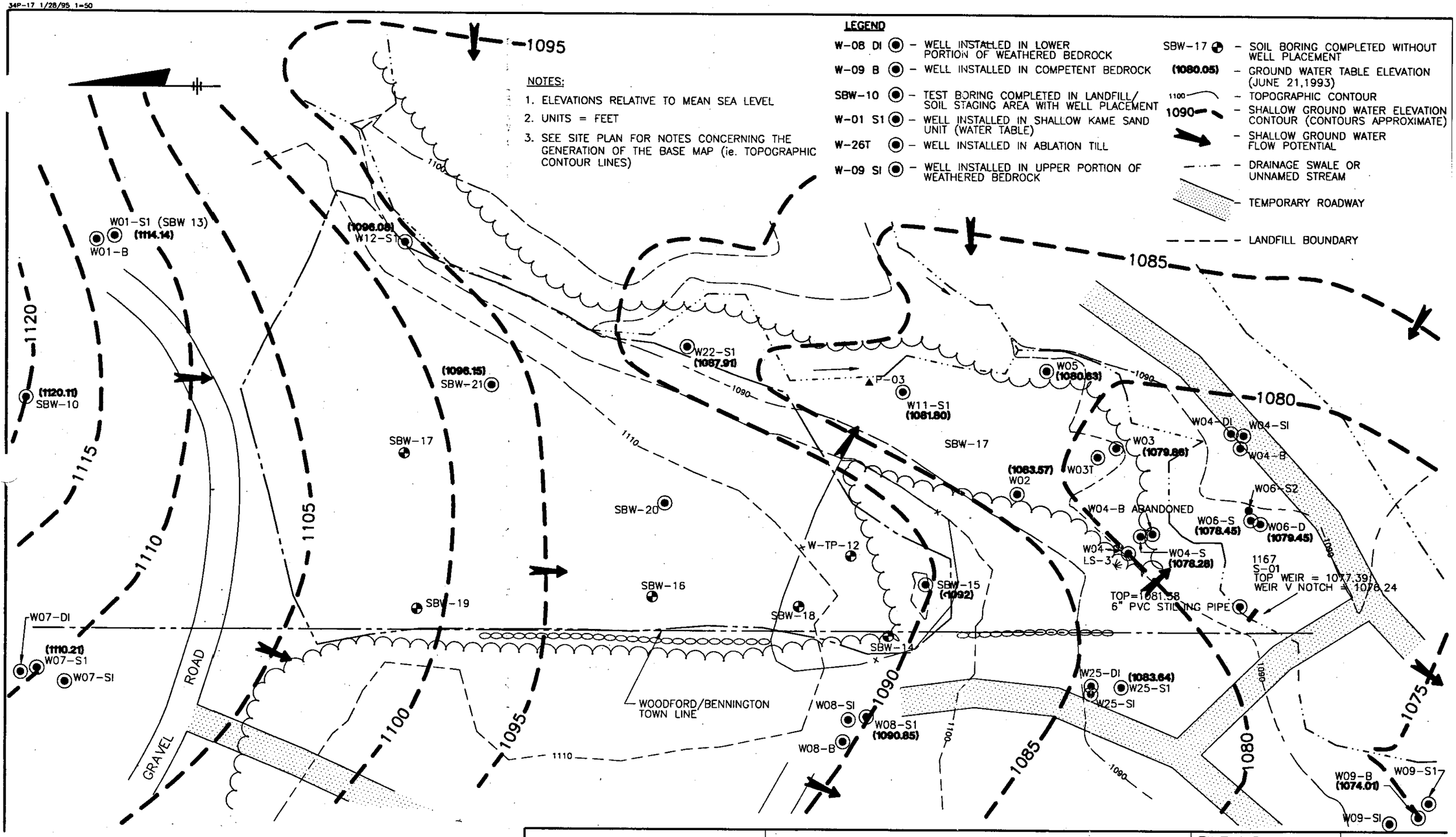
BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
ABLATION TILL GROUND WATER CONTOURS
JULY 5, 1994

FILE NO. 5271.003.12F

DATE FEBRUARY 1995

FIGURE 20

34P-17 1/28/95 1=50



O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
SHALLOW GROUND WATER TABLE CONTOUR MAP
(JUNE 21,1993)

FILE NO. 5271.003-34P

DATE FEBRUARY 1995

FIGURE 19

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR INFORMATION CONCERNING GENERATION OF THE BASE MAP AND DETAILS OF OTHER SAMPLING POINTS.
4. WELLS MONITORED JULY 5, 1994

LEGEND

1100 — POTENTIOMETRIC GROUND WATER ELEVATION CONTOUR IN SHALLOW WELLS

(1082.30) W07-S1 — MONITORING WELL LOCATION AND GROUND WATER ELEVATION

GROUND WATER FLOW DIRECTION

W01 (1140.89)
W01-B
W01-S1 or SBW-13 (1114.37)
W12-S1 (1096.09)
SBW-10 (1121.72)
SBW-21 (1096.55)
W22T
W22-S1 (1087.87)
W05 (1080.47)
W11-S1 (1081.77)
W04-DI
W04-B
W03 (1079.45)
SBW-20 (DRY)
W02 (1083.74)
W04-B ABAND.
W06-D
W06-S (1078.19)
W04-D
WTP12 (1090.09)
SBW-15 (DRY)
W04-S (1078.26)
W07-S1 (1110.50)
W07-DI
W07-B
W27T
W27S1 (1098.73)
W25-DI
W25-S1 (1082.81)
W08-S1 (1090.86)
W08-B
W09-S1 (1073.00)
W09-B ABANDONED WELL
W26T (1079.37)

1140 1135 1130 1125 1120 1115 1110 1105 1100 1095 1090 1085 1080 1075

GRAVEL ROAD
LANDFILL LIMIT
GRAVEL ACCESS ROAD
WETLAND FLAGS
SWALE 1
SWALE 2
SWALE 3
SWALE 4

1"=100' 100 0 100 200

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
SHALLOW GROUND WATER TABLE CONTOURS IN MARSHY AREA
JULY 5,1994

FILE NO. 5271.003.07F

DATE NOVEMBER 1995

FIGURE 17

21F-14 1/25/95 1=50

NOTES:

1. ELEVATIONS RELATIVE TO MEAN SEA LEVEL
2. UNITS = FEET
3. SEE SITE PLAN FOR NOTES CONCERNING THE GENERATION OF THE BASE MAP (ie. TOPOGRAPHIC CONTOUR LINES)
4. SURFACE WATER AND GROUNDWATER ELEVATIONS MEASURED ON APRIL 23, 1993.

LEGEND

- (1082.51) – GROUND WATER TABLE ELEVATION (APRIL 23, 1993)
- 1100 – TOPOGRAPHIC CONTOUR
- 1090 – GROUND WATER TABLE CONTOUR (CONTOURS APPROXIMATE)
- – GROUND WATER FLOW POTENTIAL IN SHALLOW SYSTEM
- W-09 S1 – WELL INSTALLED IN SHALLOW KAME SAND UNIT (WATER TABLE)
- W26T – WELL INSTALLED IN ABLATION TILL
- W-09 SI – WELL INSTALLED IN UPPER PORTION OF WEATHERED BEDROCK
- W-08 DI – WELL INSTALLED IN LOWER PORTION OF WEATHERED BEDROCK
- W-09 B – WELL INSTALLED IN COMPETENT BEDROCK
- SBW-21 – TEST BORING COMPLETED IN LANDFILL/ SOIL STAGING AREA WITH WELL PLACEMENT
- SBW-17 – TEST BORING COMPLETED IN LANDFILL WITHOUT WELL PLACEMENT
- SB-22 – TEST BORING
- P-01 – PIEZOMETER LOCATION
- – DRAINAGE SWALE OR UNNAMED STREAM
- 1082.08 – SURFACE WATER (STREAM) ELEVATION
- (1082.43) – POTENTIOMETRIC GROUND WATER SURFACE BELOW STREAM BED AS MEASURED IN PIEZOMETERS. ARROW INDICATES VERTICAL FLOW POTENTIAL FROM GROUND WATER TO SURFACE WATER, I.E. GAINING OR LOSING STREAM.

W01-B (1116.33)
W01-S1 OR SBW 13
(NO DATA) SBW 10
(1096.0) W12-S1
SBW-21 (1096.25)
SBW-17
SBW-20 (DRY <1094)
SBW-19
SBW-16
(LANDFILL MATERIALS UNSATURATED)
W-TP-12
SBW-18
SBW-15
SBW-14
(DRY <1092)
W22-S1 (1088.08)
1082.51 (1082.43)
(LOSING STREAM)
P-03 (1081.91)
W11-S1
(GAINING STREAM) 1079.85 (1080.15)
P-02
W05 (1081.03)
(1084.11) W02
W03 (1080.39)
W03T
W04-DI
W04-SI
W04-B
W04-B ABANDONED
W04-S (1078.65)
W04-D
W06-S2
W06-S (1078.62)
W06-D
P-01 1079.85 (1080.15) (GAINING STREAM)
W07-DI
W07-S1 (1111.08)
W07-SI
W07-B
GRAVEL ROAD
WOODFORD/BENNINGTON TOWN LINE
(1089.13) W08-S1
W08-SI
W08-B
W25-DI (1086.00) W25-S1
W25-SI
(1075.19) W09-S1
W09-B
W09-SI
1115
1110
1100
1095
1090
1085
1080
1076

0 50 100
1" =50'-0"

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
SHALLOW GROUND WATER TABLE CONTOUR MAP WITH SURFACE WATER ELEVATIONS IN MARSHY AREA
(APRIL 23, 1993)

FILE NO. 5271.003-21P

DATE NOVEMBER 1995

FIGURE 16

LANDFILL AREA

MARSHY AREA

TP-9
(6'-8': 0.0 ppmv)

DECONTAMINATION PAD

CELL 2
(CONTAMINATED MUN. WASTE)
TP-12 Extended
(4-6': 200 ppmv)

CELL 2
(IND. WASTE)

TP-11
(10'-12': 300 ppmv)

G

TP-10
(2'-4': 230 ppmv)

W-TP-12

SBW-15
(8-10': 2500 ppmv)

CELL 1

TEMPORARY FRAC TANK LOCATION

TP-12
(14-16': 520 ppmv)

G'

WOODED AREA

SBW-18
(0-2': 1015 ppmv)

CONTAINMENT BERM

WOODFORD
BENNINGTON TOWN LINE

STONE WALL

SBW-14
(12-14': 146 ppmv)

APPROXIMATE EDGE OF LANDFILL

WOODED AREA

TEMPORARY ACCESS ROAD

WOODED AREA

LEGEND

- PERIMETER OF DECONTAMINATION PAD
- TOPOGRAPHIC DEPRESSION ABOVE LAGOON CELL 2
- INDICATES DEPTH TO NATIVE SOIL
- TP-12 — TEST PIT
- (2'-4':230 ppmv) — DEPTH INTERVAL OF HIGHEST PID HEAD-SPACE READING
- BORING OR WELL LOCATION
- FORMER LAGOON AREA (APPROXIMATE)
- DIVISION BETWEEN INDUSTRIAL & MUNICIPAL WASTE IN CELL 2
- G' — G' — LOCATION OF HYDROSTRATIGRAPHIC CROSS SECTION
- REPRESENTS SLOPING TOPOGRAPHY

16 8 0 16
1" = 16'

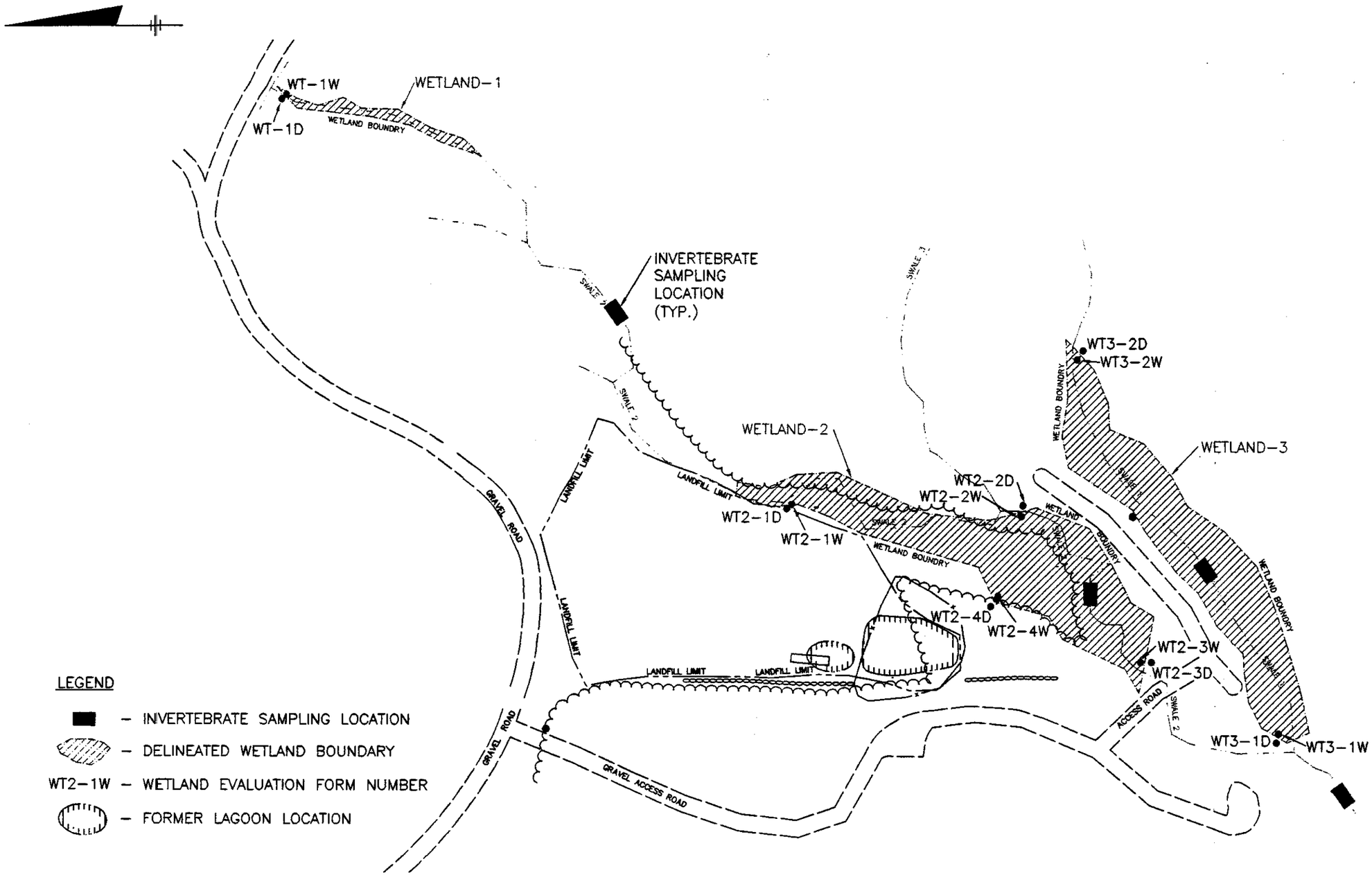
O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
FORMER LAGOON AREA
PLAN

FILE NO. 5271.003.09F

DATE FEBRUARY 1995

FIGURE 15



O'BRIEN & GERE ENGINEERS, INC.

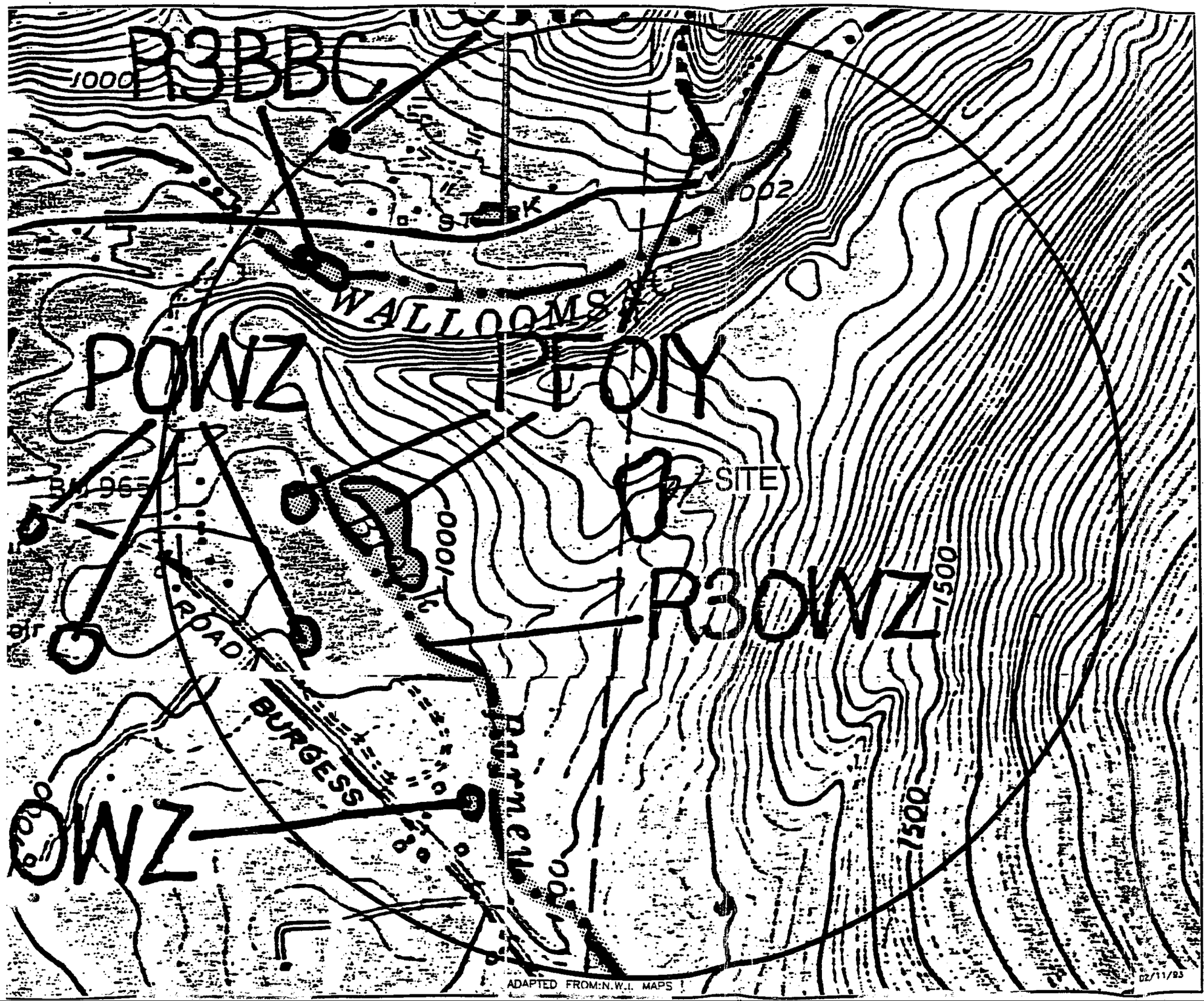
BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
WETLAND BOUNDARIES AND
INVERTEBRATE SAMPLING LOCATIONS

FILE NO. 5271.003.50F

DATE NOVEMBER 1995

FIGURE 13

FIGURE 12



LEGEND

WETLAND AREA

NWI WETLAND CLASSIFICATIONS

R3OWZ – RIVERINE, UPPER PERENNIAL OPEN WATER, INTER-MITTENTLY EXPOSED/ PERMANENT

PF01Y – PALUSTRINE, FORESTED BROAD LEAVED DECIDUOUS, SATURATE SEMI PERMANENT/ SEASONAL

POWZ – PALUSTRINE, OPEN WATER, INTERMITTENTLY EXPOSED/ PERMANENT

R3BBC – RIVERINE, UPPER PERENNIAL, SEASONALLY FLOODED

BURGESS BROTHERS
SUPERFUND SITE
WOODFORD AND
BENNINGTON, VERMONT
NATIONAL WETLAND
INVENTORY MAP

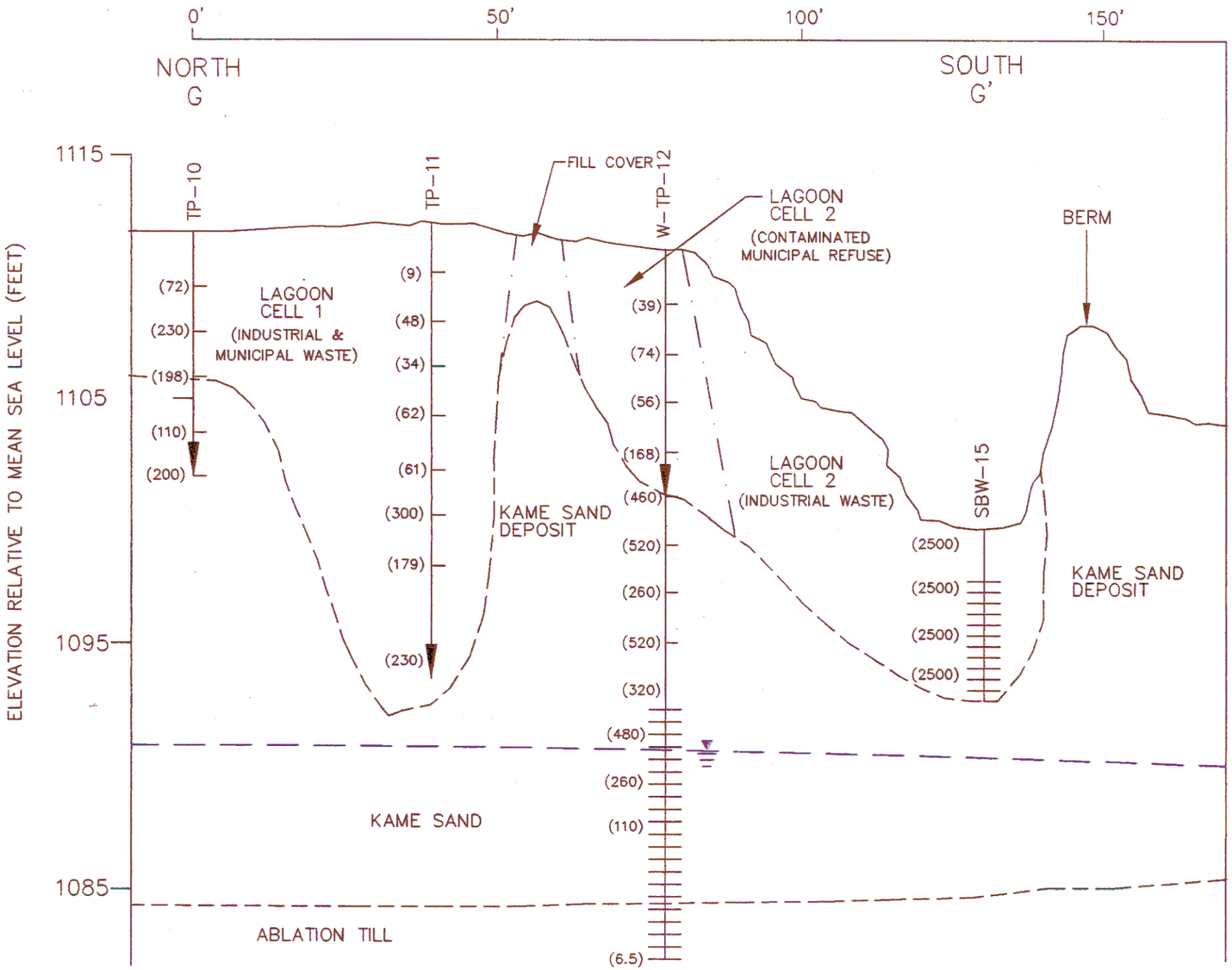
600 0 600

APPROX. SCALE IN FEET

FILE NO. 5271.001.302

O'BRIEN & GERE ENGINEERS, INC.

NOVEMBER 199



LEGEND

MONITORING WELL SCREENED INTERVAL

SHALLOW WATER TABLE

(56) PID HEADSPACE DATA REPORTED IN PPMV

TP-10 DENOTES LOCATION & DEPTH OF TEST PIT

SUBDIVISIONS WITHIN LAGOON CELL BOUNDARIES

NOTE: SEE FIGURE 15 FOR CROSS-SECTION LOCATION

VERT. SCALE 50 0 50 100

HORZ. SCALE 20 0 20 40

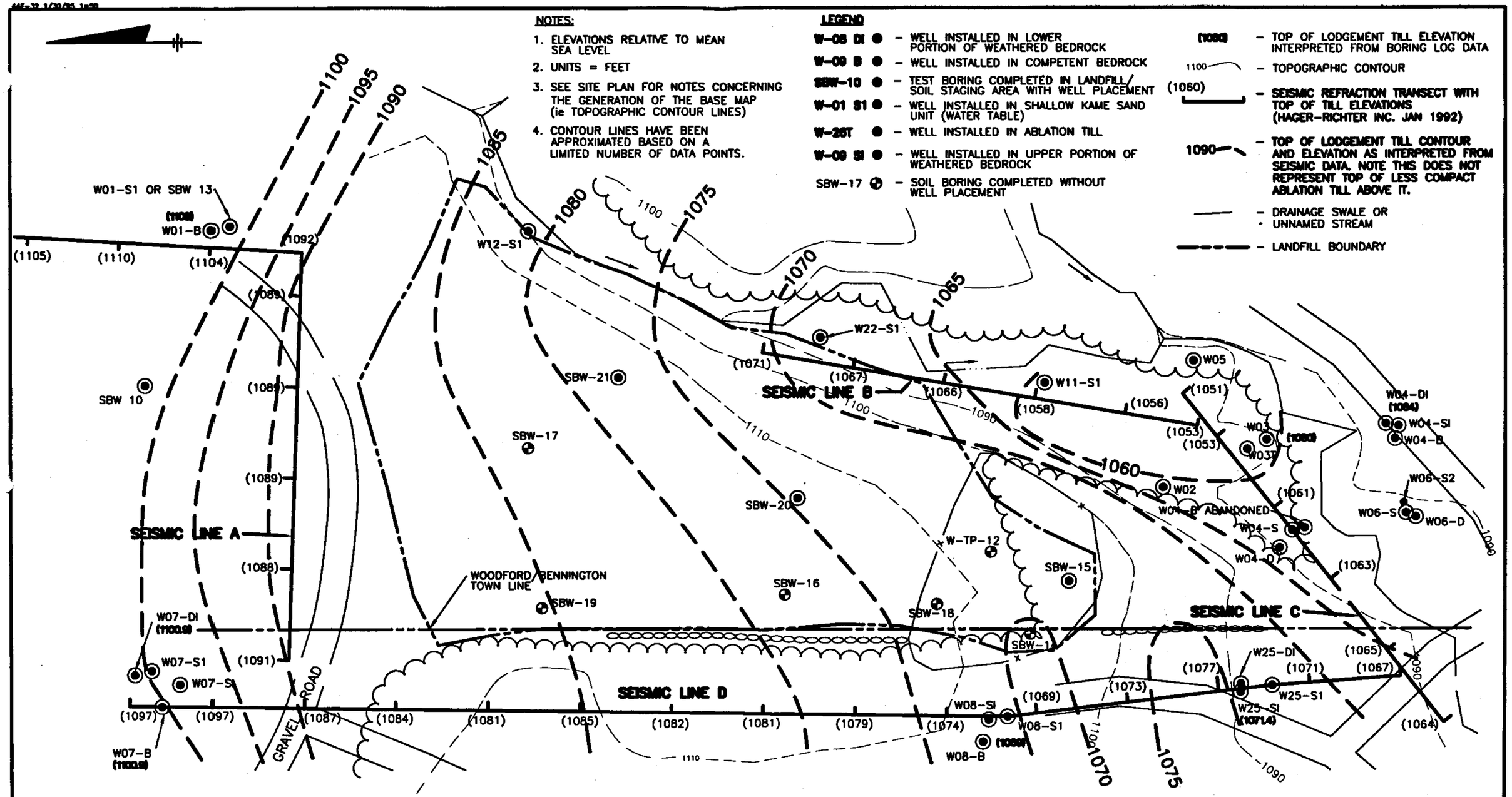
O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
HYDROSTRATIGRAPHIC CROSS SECTION
G-G'

FILE NO. 5271.003.10F

DATE FEBRUARY 1995

FIGURE 11



NOTES (CONTINUED):

5. THE 1100 FOOT CONTOUR, NEAR W-07 CLUSTER, WAS DRAWN BASED ON SOIL BORING DATA AND NOT SEISMIC DATA. ALTHOUGH THE CORRELATION BETWEEN SOIL BORING DATA AND SEISMIC DATA WAS GOOD (WITHIN 4 FEET), SOIL BORING DATA WAS USED DUE TO THE DIRECT INTERPRETATION OF THE TOP OF LODGEMENT TILL VERSUS THE INDIRECT INTERPRETATION ASSOCIATED WITH THE SEISMIC SURVEY.

0 50 100
1"=50'-0"

O'BRIEN & GERE ENGINEERS, INC.

BURGESS BROTHERS SUPERFUND SITE
REMEDIAL INVESTIGATION
CONTOUR MAP OF
TOP OF LODGEMENT TILL

FILE NO. 5271.003-44P

DATE NOVEMBER 1994
REVISED MAY 1996

FIGURE 41