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Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

FINAL DRAFT
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN

VOLUMES 1 AND 2

Submitted to:
Modern Trash Removal of York, Inc.
Windsor and Lower Windsor Townships, Pennsylvania

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EXECUTIVE SUMMARY

The Modern Sanitary Landfill (Modern Landfill), located near York, Pennsylvania is a municipal waste landfill that since 1974 has been operated by Modern Trash Removal of York, Inc. (Modern). Prior to Modern's acquisition of the landfill, Modern Landfill had been a waste repository since the 1940's. Modern Landfill has been included on the National Priorities List (NPL) for remedial activities under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

On November 4, 1987 Modern entered into a Consent Order and Agreement with the Pennsylvania Department of Environmental Resources (PADER) whereby the parties agreed, inter alia, that Modern is qualified to conduct a Remedial Investigation/Feasibility Study (RI/FS) as defind by CERCLA.

Modern has prepared this RI/FS Work Plan for Modern Landfill in accordance with the requirements of the National Contingency Plan (NCP) promulgated pursuant to Section 105 of CERCLA and the subsequent Superfund Amendments and Reauthorization Act (SARA) of 1986. In addition, extensive discussions have been held with PADER, EPA, and Ebasco (EPA's review contractor) to clearly understand, resolve, and incorporate, as appropriate, all comments made on previous drafts.

Data demonstrating that there had been a historic degradation of groundwater and surface water with leachate constituents (primarily volatile organic compounds) formed the basis for EPA's determination to list Modern Landfill on the NPL. Prior to EPA's inclusion of the site on the NPL, Modern initiated its own investigation of groundwater conditions at Modern landfill. This work included several hydrogeological investigations aimed at defining the lateral and vertical extent and nature of groundwater degradation at Modern Landfill.

Based upon the information generated in these studies, Modern has installed and is presently operating a sophisticated PADER approved groundwater extraction and treatment system and groundwater quality monitoring system. Due to this and the fact that Modern Landfill is a permitted, operating state of the art municipal waste landfill, the scope of work defined by this Plan is somewhat different than that typically required for an abandoned, uncontrolled hazardous waste site.

In scoping the RI/FS Workplan the baseline condition is the "No Action" alternative. At this baseline the remediation system would not have been installed. The current operating groundwater remediation system is included as an alternative remediation system. Since this system has only been recently installed (November 1986) data is not complete on its effectiveness and on the full effect it is having on baseline conditions. A key element of the RI/FS will be to evaluate these conditions, as well as to answer the remaining questions and data needs determined from the scoping process described in Section 2.

This Work Plan contains the following major elements:

- Executive Summary

1. Introduction - which provides a brief history of development of this workplan, site description, and summary of local conditions.

2. Scoping - which includes evaluation of existing data, identification of preliminary Applicable or Relevant and Appropriate Requirememts (ARARs), a preliminary risk assessment, development of general response actions, and definition of data

needs and data quality objectives (DQO's) to evaluate potential impacts and remedial alternatives

3. Phase 1 Remedial Investigation (RI - which describes the initial site characterization activities that will be conducted to collect and evaluate data needs identified in the scoping process. These include refining the site characterization, defining the nature and extent of contamination, evaluation of existing remediation systems, refining DQO's, and assessing the need for additional treatibility studies.

4. Phase 1 Feasibility Study (FS) - which involves the development of alternatives and describes potential response technologies and related ARAR's, assembles combinations of response actions into alternatives, and develops a range of alternatives attaining various levels of performance. This activity will be conducted concurrently with the Phase 1 Remedial Investigation.

5. Phase 2 Feasibility Study - this activity will follow the Phase 1 RI and FS activities and involves initial screening of remedial alternatives to narrow the field to be analyzed in detail.

6. Phase 2 Remedial Investigations - this activity will follow the Phase 2 FS and involves the collection of additional field data, if necessary, to further define site conditions, and will include any necessary bench/pilot studies identified in the remedial alternative screening process previous tasks.

7. Phase 3 Feasiblity Study - which is the detailed analysis of alternatives and includes the development of general performance criteria, analysis of relative costs, long and short term effectiveness, and implementability. In this phase each alternative will be verified and compared to ensure compliance with ARAR's, protectiveness of

public health and the environment, and compliance with the other goals of CERCLA.

8. Project Management and Time Schedule

The purpose of this Work Plan is to develop a series of tasks which will lead to the collection of data concerning existing site conditions, effectiveness of ongoing remedial activities and study of additional remedial alternatives. The phasing of these activities EPA Interim Guidance or Superfund Selection of Remedy (Reference 12 and Figure B1 Appendix B).

This approach ensures that the workplan for the RI/FS will result in the selection of a remedy that complies with the mandates of CERCLA (as amended by SARA of 1986) and the NCP. These mandates require that remedial activities are protective of public health and the environment, cost effective, attain state and federal ARARs, and use permanent solutions and alternative technologies to the maximum extent possible.

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1.0 INTRODUCTION

1.1 Background of Work Plan

In October 1984, the U.S. Environmental Protection Agency (EPA) proposed Modern Sanitary Landfill (Modern Landfill) for inclusion on the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. Sec. 9601 et seq. (CERCLA). At the direction of the Pennsylvania Department of Environmental Resources (PADER), Ecology & Environment, Inc. (E & E) prepared a draft Remedial Action Master Plan (RAMP) and Remedial Investigation/Feasibility Study Work Plan (RI/FS) dated May 1986 (Reference 31, Appendix A). EPA formally listed the site on the NPL in June 1986. While EPA was in the process of considering Modern Landfill for inclusion on the NPL, Modern Trash Removal of York, Inc. (Modern), operator of Modern Landfill, was already in the process of undertaking a remedial program. This remedial program is now in effect and is required pursuant to a September 20, 1984 Consent Order/Agreement between PADER and Modern, as modified by a December 3, 1986 Consent Assessment and Order.

Following the issuance of the E & E Work Plan, representatives from Modern met with EPA and PADER on a number of occasions to discuss the possibility of Modern performing the Remedial Investigation/Feasibility Study (RI/FS). As a result of these meetings, it was agreed that Modern would prepare an RI/FS Work Plan and that this Work Plan would address the changed conditions at the landfill reflected in Modern's current remedial activities. It was also agreed that Modern would perform the RI/FS. This agreement was memorialized in a Consent Order and Agreement (COA) executed on November 4, 1987. This document constitutes the required Work Plan. This Work Plan has been prepared in accordance with the requirements of CERCLA, the subsequent Superfund Amendments and Reauthorization Act of 1986 (SARA) and the COA. In addition, the following documents were reviewed and followed as appropriate:

1. "Guidance on Feasibility Studies Under CERCLA," Hazardous Waste Engineering Research Laboratory, U.S.E.P.A., June 1985. Reference 1, Appendix B.

2. "Guidance on Remedial Investigations Under CERCLA," Hazardous Waste Engineering Research Laboratory, U.S.E.P.A., June 1985. Reference 2, Appendix B.

3. "Superfund Public Health Evaluation Manual," submitted to the Office of Emergency and Remedial Response, USEPA by ICF Corporation, November 1986. Reference 3, Appendix B.

4. "Final Evaluation Report Review of Revised Draft RI/FS Work Plan Modern Sanitation Landfill York, Pennsylvania", Ebasco Services Incorporated, August 11, 1987. (submitted with the September 18, 1987 PADER comments below).

5. Comments from Pennsylvania Department of Environmental Resources, Letter dated September 18, 1987 regarding the Revised Draft RI/FS Work Plan, submitted June 1987.

6. "Draft Data Quality Objectives Development For Uncontrolled Hazardous Waste Site Remedial Response Activities", EPA OSWER Directive 9355.0-7 & 7A, October 1987, 2 volumes. Reference 4, Appendix B.

1.2 Location and Description

Modern Landfill is located southwest of the Borough of Yorkana in the townships of Windsor and Lower Windsor, Pennsylvania as shown in Figures 1 and 2. It is adjacent to Prospect Road and is approximately one-half mile south of Route 124. The coordinates of Modern Landfill are 39° 57' 34" North Latitude and 76° 35' 29" West Longitude.

1.3 Ownership History

Modern Landfill has been the site of an active waste disposal facility since the 1940's and has been operated by several different parties from then until the present day. All of the property upon which Modern Landfill is located is leased from Mr. Horace Heindel, a local farmer who resides adjacent to the site. Modern owns other property adjacent to the site.

Before waste disposal activities began at the site the property reportedly contained several iron ore pits. These pits probably formed the initial disposal sites (see Section 2.2.3.8).

From information obtained by Modern, it appears that the chronological history of ownership and operation of Modern Landfill since the 1940's is as follows:

1. From sometime in the early 1940's until sometime in 1973 or 1974, Horace Heindel and/or lessees of his property other than Modern accepted municipal and industrial wastes for disposal on the property upon which the site is presently located.

2. Between 1974 and October 1980 Modern Trash Removal of York, Pennsylvania, a wholly owned subsidiary of Riteway Services, Inc., operated the Modern Landfill.

3. In October 1980, SCA Services, Inc. purchased all of the outstanding stock of Riteway Services and its subsidiaries, including Modern , and continued operations at the Modern Sanitary Landfill under Modern's name. SCA Services, Inc. has a business address of 3003 Butterfield Road, Oak Brook, Illinois 60521.

4. In October 1984, SCA Services, Inc. was acquired by Waste Management Acquiring Corporation, a subsidiary of Waste Management Inc. In December 1985, Waste Management Acquiring Corporation contributed the stock of Riteway Services, Inc. including the stock of Modern, to Waste Management of North America, Inc. a corporation qualified to

do business in the Commonwealth of Pennsylvania with a Pennsylvania address of 1121 Bordentown Road, Morrisville, Pennsylvania, 19067.

5. Modern Landfill continues to be owned and operated by Modern, a subsidiary of Waste Management of North America, Inc.

1.4 Modern Landfill Permits

Modern Landfill is an active 75 acre landfill permitted by PADER under Solid Waste Permit No. 100113 to accept municipal waste and a number of non-hazardous industrial (residual) waste streams.

The initial 54 acres that were filled at the landfill utilize the natural renovation method of leachate control and now have groundwater collection systems to control the migration of leachate constituents from it. Completed sections of the 54 acres are presently being capped, with a PADER approved, with a low permeability (10^{-7} cm/sec) clay cap, as part of a final cover to reduce infiltration of precipitation and hence reduce the quantity of leachate generated by the landfill.

The remaining 21 acres of the landfill are at present being lined prior to any disposal, pursuant to the permit modification issued by PADER on December 12, 1986.

Modern operated four (4) surface impoundments to treat leachate seepage collected by a interceptor trench along the western perimeter of the landfill under a PADER Water Quality Management Permit No. 6786201 issued on September 24, 1976. On January 14, 1985 groundwater extraction wells along the western perimeter were brought on line. The extracted groundwater was conducted to these impoundments for treatment.

On November 20, 1986 PADER issued NPDES Permit No. PA0046680. Under this permit, Modern was to

1. Construct and operate a temporary treatment plant to treat groundwater from the eastern groundwater extraction wells;

2. To continue operation of the impoundment treatment system for the western extraction wells and interceptor trench;

3. Construct and operate a permanent treatment plant[1] consisting of physical/chemical and biological treatment.

The impoundments and temporary treatment plant were operated until the physical/chemical portion of the permanent treatment plant became operational on April 22, 1987. The temporary treatment plant and four surface impoundments were decommissioned by June 1987 in accordance with a May 27, 1987 agreement with PADER.

At the present time, the physical/chemical portion of the plant treats water from the interceptor trench and extracted groundwater from the western and eastern extraction systems. The physical/chemical portion of the plant includes an air stripper, permitted under PADER Air Quality Control Permit No. 67-330-004 to remove volatiles from the extracted groundwater.

The biological treatment portion of the permanent treatment plant is to be operational on or before March 21, 1988. The biological treatment portion is being added to enable treatment of leachate collected in the recently constructed double-lined landfill cells (the 21-acre expansion area).

[1]The treatment plant consisting of the physical/chemical amd biological treatment portions is considered to be "permanent" within the context that Modern intends to operate and maintain this plant until such time that leachate and extracted groundwater treatment is no longer required.

Further details about the western interceptor trench, western and eastern groundwater extraction system and the permanent treatment plant and given in Section 1.6.

1.5 Description of Facility

Modern Landfill facility contains several components:

1. The original portion of 54 acres.
2. The 21 acre expansion area comprised of three cells, with state of the art double synthetic liners and leachate collection systems.
3. Borrow areas for daily, intermediate and final cover.
4. Erosion and sedimentation control systems.
5. Eastern and western perimeter groundwater extraction systems.
6. The wastewater treatment plant.

The location and extent of these facility components are shown on Figure 3. The total area of the permitted facility is about 290 acres.

1.6 Current Remediation Systems

1.6.1 Western Groundwater Interceptor Trench

Leachate seeps and the presence of leachate constituents in the groundwater were noticed in the past on the west side of the landfill. As a result, a groundwater interceptor trench and lagoon treatment system were designed in 1976 and constructed in 1977 (as-built plans by William E. Sacra and Associates August 3, 1977). The groundwater interceptor trench is between 6 and 15 feet below ground and is approximately 2,200 feet in length (see Figure 3). Seepage water collected by this trench was conducted to the original treatment plant (see Section 1.6.4). This water is now conducted to the permanent treatment plant (see Section 1.6.4).

1.6.2 Western Perimeter Groundwater Extraction System

In 1984, a network of twelve groundwater extraction wells was designed to augment the western groundwater interceptor trench. These wells became operational on January 14, 1985. The required radius of influence and spacing of the wells were determined by REWAI (Reference 15, Appendix A). Table 1 presents the discharge rate from this extraction system for 1986.

Prior to startup of the western extraction wells the interceptor trench yielded from 24,000 to 46,000 gallons per day. After the start-up of the western extraction wells the trench yield varied between zero, on some occasions, and several thousand gallons per day after significant precipitation events. In 1986, the western groundwater extraction system pumped an average of 84,000 gallons per day.

In 1987, two additional wells, W62 and W64, were added to the western extraction well system, bringing the total number of extraction wells along the western perimeter to 14.

Water extracted by the system was pumped to the temporary treatment facility until the permanent physical/chemical plant was brought into operation in April 1987 (see Section 1.6.4).

1.6.3 Eastern Perimeter Groundwater Extraction System

The presence of leachate constituents, in the eastern tributary, determined the need for a remediation system along the eastern side of the landfill. In 1985, REWAI assessed the hydrogeology of this side of the landfill and designed a system of thirteen extraction wells, between 75 ft. and 100 ft. deep and positioned along the eastern tributary (Reference 21, Appendix A).

Since operation of this system began in November 1986 drawdown in the wells ranged from 13 to 33 feet. Pumping produced a depressed water level within the aquifer along the entire well line, allowing capture of groundwater migrating from the landfill and the area to the east of the system. The system is capable of intercepting groundwater flow from the southwestern two-thirds of the landfill. A 96 percent reduction in streamflow occurred at the most downstream monitoring point, MS112 (formerly ST-5) which is adjacent to W-21. All seeps and springs of the eastern perimeter were dried up by pumping.

During the first two months of operation the system produced an average yield of 105,000 gpd. Because of the flow capacity limits of the temporary treatment plant operating during that time period (see Section 1.6.4), the wells were only operated for one day at their design drawdown level. The yield of the system on that day was 119,000 gallons. Table 2 presents the average discharge of the wells in the system during November and December 1986.

On the basis of well testing and calculated infiltration rates along the eastern side of the landfill REWAI concluded that the extraction rate would decrease to 92,000 gpd (Reference 35, Appendix A). In July of this year the average daily flow was 78,000 gpd.

Water collected by this system was originally pumped to the temporary physical/chemical treatment plant until the permanent physical/chemical treatment plant was brought on line (see Section 1.6.4).

1.6.4 Groundwater and Leachate Treatment Facilities

The original surface impoundment system (see Figure 3) operated under Water Quality Management Permit No. 6786201 issued on September 24, 1976. The impoundment treatment system was designed to treat 72,000 gallons of groundwater per day. The treatment process consisted of pH elevation using a liquid lime slurry, metals precipitation, aeration, clarification, and chlorination. A process schematic is shown on Figure 4.

The four treatment impoundments consisted of:

1. Two - 303,000 gallon lime sludge settling impoundments.

2. One - 1,100,000 gallon aeration impoundment.

3. One - 604,000 gallon polishing impoundment.

The impoundment liners consisted of six to twelve inches of soil cement and an asphalt coating. The impoundments were decommissioned in accordance with a May 27, 1987 agreement with PADER.

On November 20, 1986 PADER granted Modern permits to construct and operate the permanent treatment facility which is designed to accept flow from both the east and west groundwater extraction systems and leachate from the 21 acre lined landfill expansion area. This facility is comprised of a 500,000 gpd physical/chemical plant to treat extracted groundwater and a biological plant to treat leachate from the expansion area. The permanent physical/chemical treatment portion includes an air stripper to remove volatile organic compounds. The biological portion of the permanent treatment plant is to be constructed by March 21, 1988. Process schematics for the permanent treatment plant are shown on Figures 5, 6, and 7.

In the six month period from May 1987 through October 1987 the system treated an average flow of 155,000 gallons per day from the east and west extraction systems. The maximum daily flow observed during this same period was 237,000 gallons.

1.7 Topography and Climate

Modern Landfill is located within the Conestoga Valley Section of the Piedmont Physiographic Province. Topographically this province is characterized by well-developed northeast-southwest trending valleys and drainage patterns. The landfill is located on a hill bounded on the north, east and west by streams (unnamed tributaries to Kreutz Creek). The ridge on the southern boundary of the site is at an elevation of approximately 700 feet above mean sea level (MSL). The site slopes towards the north to the 21 acre expansion area with a base grade elevation of about 510 ft. The land then rises via an east west ridge to about elevation 560 ft. and falls again to a roughly northwest-southeast trending valley through which flows the northern continuation of eastern tributary at elevation 500 ft. To the north of this the land rises again to a northeast-southwest trending ridge. Route 124, the main road to York, PA, is located on the southern flank of this ridge. The site topography and local area surface drainage patterns are shown on Figure 2.

The climate of the area is relatively mild and humid. The average precipitation observed at the York, Pennsylvania, meteorological station is 41 inches/year. Average snowfall is about 30 inches/year. Mean winter temperature is 34^{o} F and the mean summer temperature is 76^{o} F. However, temperature extremes above 95^{o} F and below 0^{o}F are common. The growing season averages about 160 days, extending from the beginning of May to early October.

1.8 Regional Hydrologic and Geologic Setting

The site is located within the Piedmont Province, close to the northern end of the Blue Ridge Province. These Physiographic provinces form part of the Appalachian mountain chain (see Figure 8).

The strata of the region are mainly comprised of sedimentary rocks which have been slightly metamorphosed by large scale tectonic deformations. These deformations took place during the break up of the ancient continents of Laurentia (North America) and Gondwana (Africa) about 300 million years ago (the Appalachian Orogeny or mountain building era).

During that event, the Appalachian region was compressed or pushed towards the northwest. This compression caused extensive, but stylized, deformation of the strata between these two protocontinents.

The tectonic style or character of this deformation in the Piedmont Province is that of a series of northeast-southwest trending anticlinal fold axes separated by parallel thrust faults. These folds are common in this section of Appalachia and are usually termed "anticlinal ramp structures".

In the vicinity of Modern Landfill this style of geologic structure was partially defined in 1938 by Stose et al.(Reference 7, Appendix B). This work identified two major fault structures to the north and south of the site. These are the Martic thrust fault located 1.5 miles to the south and the Stoner thrust fault located 2 miles to the north of the site (see Figure 9).

South of the Martic thrust is an extensive area of Marburg Schists (these were originally ocean floor sediments). Between the Martic and Stoner Faults, continental margin sediments of Lower Cambrian age are evident. These sediments have been folded into several anticlinal structures. To the north of the Stoner thrust fault, the Cambrian sediments are repeated, however they are nearly obscured by the overlying Ordovician age Conestoga Formation limestone which rests unconformably on the older sediments.

Figure 8 indicates the location of the site in relation to the geologic/physiographic provinces of the Appalachians. Figure 9 presents a regional geologic map and section developed from original mapping of the area by Stose in 1938. This figure shows the currently defined site geology, based on recent structural geology theory, and indicates the discrepancies that exist between the two maps. The identifiable rock units which outcrop within the site area have been correlated with the:

Antietam Formation	-	sandstone, phyllitic sandstone and quartzite
Harpers Formation	-	phyllite and phyllitic sandstone
Chickies Formations	-	highly weathered graphitic or Kinzers Formation saprolite

Drilling investigations, for the 21 acre expansion area, have determined the presence of a dolomite unit beneath the Antietam Formation sandstone and saprolite. This unit has been correlated with the Vintage Formation (see Section 2.2.3.5).

The drainage patterns evident in this area of York County vary between trellise and dendritic with a tendency towards north-south and northeast-southwest trending valleys. This is a reflection of the underlying geologic structure. The

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site is located in the drainage catchment area of Kreutz Creek and is bounded on the east, north and west by two unnamed tributaries. The tributaries are fed by springs and runoff. The flow from these springs has been greatly reduced by the groundwater extraction system which is currently operational along the eastern and western perimeters of the site as discussed in Section 1.6. The two tributaries flow effectively northwards and discharge into Kreutz Creek which then flows northwards and eastwards, eleven stream miles, into the Susquehanna River located about five miles to the east of the site. According to the E & E RI/FS Work Plan prepared for PADER (Reference 31 Appendix A), Kreutz Creek supplies water to the town of Wrightsville, Pennsylvania. This is not the case.

The regional groundwater flow is presently considered to be eastwards towards the Susquehanna River.

1.9 Regional Soils and Overburden

As this area of Southern Pennsylvania is located to the south of the maximum extent of Pleistocene glaciation, overburden in the region is comprised of essentially locally derived material. Generally, this is colluvium, residual soil and regolith. At Modern Landfill, the subsurface materials are defined by soil, saprolite, weathered bedrock and bedrock. The soil is residual or locally transported fine grained material (see Section 2.2.3.3). Saprolite is a soil-like material that has developed from the original bedrock by the in-situ chemical weathering of the rock and which displays the relic rock structure. Generally, saprolites grade into weathered bedrock with depth.

The thickness of saprolite is dependent on the nature and original fracture state of the parent rock material. As such, the thickness of saprolite and weathered bedrock potentially indicates fracture zones and or faults within a rock mass. The weathered bedrock generally grades into less weathered material beneath and consists of weathered rock fragments (partial or fully penetrating alteration) separated by the original rock fractures.

1.10 Population Distribution and Land Use

Approximately 800 people live within a one-mile radius of Modern Landfill. There are about 200 buildings within this area. Within a three-mile radius of Modern Landfill, approximately 3,100 people use private wells (Reference 3, Appendix A). Land use in the area is primarily farming and residential. Modern Landfill is bordered on the west by a dairy farm which lies beyond the western tributary of Kreutz Creek. Directly north of Modern Landfill is the small residential community of Snavelys, an automobile junk yard and, further north, the town of Yorkana. Prospect Road borders the east side of Modern Landfill. A transformer substation, farmland (arable and pasture), the J. Heindel residence and the eastern tributary stream are located to the east of Prospect Road. The southern edge of Modern Landfill is bordered by the former Druck and Brown properties and residences (See Figure 3). The Druck residence has been demolished; the present entrance to Modern Landfill is located on this land.

2.0 SCOPING OF RI/FS

2.1 General

The objectives of the RI/FS at Modern Landfill are to :

1. Characterize the source(s) of contamination;
2. Identify the nature and extent of contamination for the various routes of exposure.
3. Conduct a risk assessment of indicator compounds.
4. Develop performance objectives for remedial alternatives at the site.
5. Define and evaluate the effectiveness of a range of remedial alternatives, including the existing remedial measures.
6. Determine the range of remedial alternatives that meet the performance objectives.
7. Determine the most cost effective, environmentally sound, and permanent alternative.

This Work Plan presents a phased scope of work which will achieve these objectives.

The first stage of the development of this Work Plan was to develop the overall scope of work. The scoping process followed to develop the Work Plan contains five major components. These components include:

1. Collection and evaluation of existing data (Section 2.2).
2. Preliminary evaluation of and potential impacts to public health, welfare and the environment (Section 2.3).
3. Preliminary selection of indicator chemicals (Section 2.4).
4. Identification of preliminary Applicable or Relevant and Appropriate Requirements (ARARs) (Section 2.5).

5. Preliminary Assessment of general response actions (Section 2.6).

6. Definition of data needs to evaluate potential impacts and remedial actions and data quality objectives (Section 2.7).

These components are described in the sections indicated.

2.2 Evaluation of Existing Data

The hydrogeology and water quality at Modern Landfill have been the focus of a number of studies which provide a large body of information regarding the site.

In order to define the gaps in the available data base and scope the RI/FS Work Plan, the following work has been completed:

1. Review of the data provided by Modern regarding the disposal history at the landfill.

2. Review of all previous reports regarding the Modern Landfill, the expansion area, the well extraction system and the wastewater treatment plant (Appendix A provides a chronological catalogue and brief summary of the contents of each of these reports).

3. Review of all groundwater data obtained up to the first quarter 1987 and preliminary review of second quarter 1987.

The findings of these reviews are presented in the following subsections. Where appropriate a summary of the available data and conclusions drawn from the data are listed at end of each subsection. Also noted are the sections of this document which identify any data gaps and the data quality objectives appropriate to address those data gaps.

2.2.1 Disposal History/Source Characterization

A search of PADER and EPA files was performed in December 1986. This search indicated that large quantities of municipal, commercial and industrial waste materials were previously disposed of at Modern. In addition, the agencies' files indicate that limited quantities of potentially hazardous or radioactive materials may have been disposed of at the landfill. Materials which the file search indicates may be in the landfill include:

1. Pesticide wastes (deposited before summer of 1972) which unconfirmed discussions with Modern staff indicate were removed.
2. Rare Earth Chloride with 0.65% Thorium and 0.002% Uranium (dry weight) - about 750 dry tons (landfilled between 1975 and 1979).
3. Mixed residual and municipal waste from a local oil company which was saturated with petroleum liquid and had a strong organic smell (deposited in landfill March 10, 1987).
4. Liquid containing ethylene diamine was found in a rolloff box delivered to the landfill from a motor freight company (deposited in landfill December 13, 1980).
5. Sludge from a paper manufacturer with a low pH and high metals content (disposed after June 1972).
6. Thirteen 55 gallon drums of soil contaminated with fuel oil (deposited in landfill after June 1983).
7. Paint wastes (deposited in landfill prior to 1984).
8. Residues from the extraction of sodium molybdate which contain about 85% molybdenum, copper, silver and iron oxides (deposited in landfill before June 1972).

9. Waste polychlorinated biphenyls (deposited in landfill in 1977 or 1978 and removed in October 1985 and shipped to Model City Landfill, New York for disposal, Reference 27, Appendix A).

Examination of historic aerial photographs, completed by EPA (Reference 20, Appendix A) has allowed a rough assessment of the disposal sequence at Modern. The various chronologic areas of activity at the landfill are shown on Figure 10 and are listed below:

1. 1940 to 1952: Landfilled materials visible in the central area of the present landfill. This initial landfilling operation may have taken advantage of a pre-existing depression formed by an iron ore pit which was excavated in the 18th century.

2. 1952 to 1971: The landfill was extended southwards, southeastwards and to the east and west of the 1952 area. Trenching methods were evident in the southeast section of the 1971 landfill boundary.

3. 1971 to 1979: The landfill was extended towards the south and north across the full width of the present landfill area. Trenching methods of landfilling were evident.

4. 1979 to 1987: The landfill was extended northwards and vertically upwards to its present configuration.

The information provided above regarding the wastes disposed and activities conducted at Modern Landfill were based upon available record reviews and interviews with Modern Landfill personnel. Further information needs to be gathered, if possible, to:

1. Confirm the above reported waste types and activities;

2. Obtain approximate quantities of wastes disposal in the landfill; and,

3. Ascertain whether specific wastes were disposed in specific areas of the landfill.

The data needed associated with disposal history/source characterization are discussed in Section 2.7.3. This work will be conducted during Phase I of the Remedial Investigation (RI).

2.2.2 History of Site Investigations

Investigations of the Modern Landfill site since 1975 have been prompted by Modern's desire to obtain geotechnical, geologic, hydrogeologic, and groundwater chemistry data necessary for Modern to address concerns regarding degradation of the groundwater quality by leachate constituents, design of remediation systems, and move forward with plans for landfill expansion design. Appendix A provides a listing of the reports describing this work. Also provided in Appendix A are brief reviews regarding the contents of these documents.

Modern has drilled a total of about 290 wells, borings, and gas vents in and around Modern Landfill during the course of site investigations, gas control, groundwater monitoring, and groundwater remediation activities. Table 3 presents a listing of all of these holes.

In order to define their specific purpose, Modern has developed a hole series numbering system as follows:

Series	Investigative Purpose
A	Investigation of material beneath the landfill and collection of groundwater samples for analysis.
B	Investigation of soils and bedrock over large area of Modern Landfill and collection of groundwater samples for analysis.

C Drilled throughout the area to define the nature of the bedrock and the location of solution cavities in the Vintage Formation dolomite.

E Drilled to define bedrock and soil profile along the eastern and western perimeter.

HC Drilled to further define the geotechnical conditions in the 21 acre expansion area, especially in regard to location of solution cavities in the Vintage Formation dolomite.

MD Existing wells which have been upgraded to Modern's current standards or new wells constructed to the current standards and used to monitor groundwater chemistry in areas that potentially contain leachate constituents as of 1986.

MU Existing wells which were upgraded to Modern's current standards or new wells constructed to the current standards and used to monitor groundwater chemistry in areas considered to be free of leachate constituents as of 1986.

P Drilled to define depth to bedrock and to install piezometers along the western tributary and the western interceptor trench.

W Wells installed along the eastern and western perimeters to extract groundwater and monitor groundwater chemistry

T Active gas vents.

In order to ensure that unnecessary or redundant borings, wells, and gas vents do not provide pathways for the migration of leachate constituents, the majority of these holes have been decommissioned by overdrilling and/or pressure grouting with bentonite slurry (see Table 3 and Figure 11 for locations).

Figure 11 presents the locations of all the holes drilled at Modern, including decommissioned holes, which are not part of the present groundwater extraction and monitoring system (See Appendix C for logs). Figure 12 presents the location of the present groundwater extraction system wells and the groundwater monitoring wells and groundwater constituent wells presently used to determine groundwater quality (See Appendix D for logs). The groundwater constituent wells were installed to assess the effect of the present groundwater remediation systems. The groundwater monitoring wells were installed to determine the extent of migration and nature of leachate constituents.

2.2.3 Site Geology

2.2.3.1 General

Though Modern has completed several subsurface investigative studies including completion of numerous borings, drillholes and wells at Modern Landfill, most of the investigative work to date, with the exception of the 21-acre expansion area program, have been aimed primarily at defining groundwater conditions. Furthermore, most of the investigations have been directed towards assessing specific areas.

The initial interpretations of the geology of the landfill area by Applied Geotechnical and Environmental Service Corporation (AGES) and REWAI were relatively simple and based on the 1939 mapping by Stose, et. al. (Reference 7 Appendix B). Subsequent work by REWAI resulted in the identification of boundaries between the Harpers and Antietam Formations which are different from those defined by Stose. At that stage, the site geology was still considered to be relatively simple; Harpers Formation phyllite in fault contact with Antietam Formation phyllitic sandstone.

When well cluster W26 (see Figure 11) was installed, a previously unsuspected dolomite stratum was identified at depth below a cap rock of saprolitically weathered gray clay and shale material. This dolomite zone was subsequently shown to underlie the saprolitically weathered Antietam Formation and deposits of gray clay material across the southern edge of the 21-acre expansion area. During an extensive program of drilling, several infilled solution cavities, to either side of and within the 21 acre area boundaries, were defined. Geotechnical studies indicate that these features are stable and not prone to collapse (Reference 33, Appendix A).

The results of angled hole drilling and a collection of all the existing data across the 21-acre expansion area allowed a north-south geologic section to be prepared by REWAI (Reference 31, Appendix A). This indicated a complex history of faulting and folding and was presented in the draft version of their report (Reference 31, Appendix A). Subsequent work undertaken for this Work Plan, which was aimed at incorporating this structure into the regional geology, identified deficiencies in both the REWAI interpreted geologic section and the regional geology (Reference 7, Appendix B).

For the purpose of this Work Plan, a best estimate geologic map and section have been prepared which collate most of the available data regarding rock types, weathering profiles, fault zones, and the surrounding geologic environment (see Figure 13). This interpretation reflects the well documented structural style of the Appalachian deformations discussed in Section 1.8.

It is important to point out, however, that on the basis of the work undertaken for this Work Plan, that the geologic structure and stratigraphy at Modern Landfill and the associated hydrogeologic conditions are still open to interpretation, especially in relation to the dolomite zone. This clearly is an identified data gap and its resolution is critical to the development of the Feasibility Study (FS). The data needs associated with the geology and hydrogeology are discussed in Sections 2.7.4 and 2.7.5, respectively.

2.2.3.2 Photogeologic Studies

Interpretations of aerial photographs of the site have been completed by EPA and by REWAI (References 20 and 32, Appendix A). Though these interpretations identified somewhat different sets of photolineations the identified major photolineation or, earth fracture traces, paralleled the known northeast - southwest trending geologic structures. The much fainter features, trending west northwest-east southeast and roughly north-south, do not parallel any actual geologic structures identified to date in the field.

Further studies of historic sets of aerial photographs of the landfill area and local region are required to provide information important to the geologic interpretation of Modern Landfill and its environs. Section 2.7.4 discusses these data needs.

2.2.3.3 Surficial Soil

According to the York County Soil Survey, there were four soil types in the immediate site area. A moderately eroded, well-drained Chester silt loam is predominant, having either a 3% to 8% slope (ChB2) or 8% to 25% slope (ChC2) (U.S. Department of Agriculture, 1977). Both ChB2 and ChC2 are used for daily cover operations at the landfill. The north-central portion of the site includes severely eroded 8% to 15% sloping well-drained Glenelg channery silt loam (GcC3). To the west and south of the Gelnelg soil is Manor channery loam (MfD3). This soil has a slope of 15% to 25% and is generally well-drained and severely eroded (U.S. Department of Agriculture, 1977). Figure 14 presents the location of the soil types at Modern prior to major development at the site.

2.2.3.4 Saprolites

Assessment of the saprolite and weathered bedrock thickness at the site indicates that several zones of deep weathering are evident.

REWAI in its report regarding the 21-acre expansion area (Reference 32, Appendix A) identified a thick saprolite zone (20 to 130 ft) which they considered to be associated with a major thrust fault complex trending roughly east-west across the south side of the 21-acre expansion area. Other areas of deep saprolite weathering are indicated on Figure 13. These are presently interpreted as fault or fracture zones within the Harpers Formation and between the Harpers Formation and the Antietam Formation. Possible fault structures associated with the saprolite and deeply weathered bedrock are shown on Figure 13 and discussed in Section 2.2.3.6.

Drillhole B3 to the north of the now decommissioned leachate impoundment (see Figure 13) may also have been drilled through saprolite rock or fault zones. The well log is not clear in this respect.

The Harpers Formation develops a reddish orange to buff colored highly micaceaous saprolite; the Antietam Formation develops a buff brown silt, sand and clay saprolite. The gray graphitic clay material, located in the 21-acre expansion area, and exposed in test trenches excavated in that area, and for the Eastern Perimeter groundwater extraction system, has been correlated with the Chickies Formation by REWAI (Reference 32, Appendix A). It may also be correlated with the basal Kinzers Formation which is described by Stose, et. al. (Reference 7, Appendix B) as a dark grey shale (see Section 2.2.3.5).

It is considered likely that, in general, the thickness of saprolitic weathering is related to the location of fault zones. As such, a more detailed understanding of the variation of depth of this weathering is required to assist in defining the structural geology of the local area. Section 2.7.4 discusses this requirement.

2.2.3.5 Bedrock Geology

As numerous drillholes and wells have been drilled at the site, the areal extent of the surficial bedrock units is, for the most part, well documented. Figure 13 presents the current interpretation of this data which indicates that the strata beneath the site are of Cambrian Age and can be correlated with the following formations:

1. Harpers Formation phyllite - southern section of the site.
2. Antietam Formation phyllitic sandstone and quartzite - northern section of the site.
3. Chickies or Kinzers Formation slate or shales (weathered to saprolite) - located in the 21-acre expansion area.
4. Chickies Formation strata - located to the south of the Modern Landfill facility.
5. Dolomite, interpreted as being of the Vintage Formation - located beneath the Antietam Formation and deep saprolite in the northern section of the site.

The major portion of the existing landfill is located on top of Harpers Formation bluish-green and greenish-gray micaceous and chloritic phyllite with some dark green phyllitic sandstone. These rocks exhibit a dominant northeast-southwest striking foliation/cleavage and are considered to dip steeply southwards.

To the north of these strata, Antietam Formation forms the bedrock material within the 21-acre expansion and the hill to the north. It ranges from buff sandy clayey silt, saprolite to moderately weathered buff, fine grained, closely foliated, slightly to moderately micaceous phyllitic sandstone or fine to medium grained slightly foliated sandstone/quartzite. In the unweathered state, the Antietam Formation is medium gray in color.

In the base and northern slopes of the 21-acre expansion area, outcrops and exposures in test trenches indicate that the Antietam Formation is intensely folded (isoclinal folding). Bedding is essentially obliterated making it difficult to discern structure, however, the rare bedding planes observed tend to support the geologic section on Figure 13.

Beneath the saprolitically weathered Antietam Formation, drillholes and wells along the north edge of the existing landfill, identified a zone of dolomitic strata. Data from drillhole C-26 (see Figure 11) showed that the moderately weathered Antietam Formation grades continuously into the dolomite zone. Furthermore, core recovered from this hole, and several others drilled in and adjacent to the 21-acre expansion area, indicated that the dolomite contained elliptical nodular zones as does the Vintage Formation exposed elsewhere in the region. On the basis of this data, the dolomite strata has been correlated with the Vintage Formation which is stratigraphically above the Antietam Formation (see Figure 9). To place the Vintage dolomite beneath the Antietam, these strata must have been overturned and faulted into their present position. The recrystalized dolomite zones and intense cleavage observed in the recovered dolomite core, and the small scale isoclinal folding observed in the Antietam Formation strata exposed in the 21-acre area, further indicate that these strata have experienced intense compression and complex deformation.

Adjacent to the northern toe of the existing landfill and in the vicinity of well W26 (see Figure 9) are areas of dark gray clay/silt saprolite that is slightly graphitic. Test trenches dug through this material indicate intensely deformed strata with folding and faulting being indicated (Reference 32, Appendix A). These areas are discernible on aerial photographs of the site (Reference 20, Appendix A).

REWAI (Reference 32, Appendix A) interpreted this material as being Chickies Formation saprolite on the basis that the Chickies slates elsewhere have been described as graphitic. However, Dr. Ed Beutner, a geologist from Franklin and Marshall College in Pennsylvania, retained by REWAI to study this phenomenon, considered that the material could be derived from the Chickies slate or the Lower Kinzers shales. By ascribing this material to the Kinzer shales, the style of the deformations required to produce the disposition of lithologies at Modern, much more closely resembles the regional tectonic style, i.e. slightly overturned climbing ramped anticlines defined by and dissected by thrust faults and fault splays.

2.2.3.6 Structural Geology

The current interpretation of the overall geologic structure underlying Modern Landfill and the local area surrounding Modern Landfill conforms to recent concepts of the regional style of deformations. The main structural components beneath the area are overriding ramped anticlines, which were cut by several thrust fault splays. A schematic of the development of these structures is presented in Figure 15.

During the development of the ramp anticlines, a synclinal wedge of rock developed at the toe of an advancing ramp anticline. Major thrust fault splays developed within this syncline which was dissected and rotated clockwise (as shown in Figure 15) by the faults. The core of this syncline is located below the 21-acre expansion area with sections of the ramped anticlines located to the north and south.

The sequence of roughly northeast-southwest trending structures, parallel to the regional trends, and commencing at the north of the site is described below:

1. The most northerly fault structure in Figure 8 forms the back of one ramped anticline overwhich the Antietam Formation has been thrust.

2. To the south (in the east - west ridge and 21 acre expansion area) a series of essentially parallel very steep thrust slices of Antietam Formation are located.

3. The base of the 21 acre expansion area is comprised of synclinally folded Antietam Formation containing a core of Vintage dolomite and Kinzers shale which has been further dissected by thrust fault splays.

4. The next major thrust fault to the south has brought the Harpers Formation ramping up and over the Antietam Formation. To the south this is followed by a possible fault zone (indicated by deep saprolite and weathered bedrock) and an anticlinal ramp of Harpers Formation phyllite and Chickies Formation, which outcrops at the south of the landfill.

The indicated structural geology is complex and at present relatively speculative. Since an understanding of this aspect of the site is important both in terms of defining the location of the dolomitic strata and understanding the hydrogeology of the area, considerable attention has been given to this subject. The additional data required to adequately define the structural geology is presented in section 2.7.4.

2.2.3.7 Solution Cavities

During detailed investigations for the expansion area and development of the groundwater extraction system (Eastern Perimeter), borings encountered infilled solution cavities beneath the thick saprolite cover and Antietam Formation bedrock (References 32 and 33, Appendix A). Solution cavities found below the 21-acre lined landfill area are small; one to three feet in vertical height at depths of 23 feet to 78 feet below ground surface. To the east and west of the 21-acre area, identified solution cavities are 1.6 to 18 feet in vertical height at depths of 35 feet to 85 feet.

The located solution cavities have developed within a few feet of the dolomite/non-dolomite contact. The locations of holes and wells which intersected infilled solutions cavities are shown on Figure 13.

As stated previously all these cavities were infilled. Fred C. Hart and Associates (Reference 33, Appendix A) concluded that these features are not prone to collapse.

2.2.3.8 Mineralization

Iron ore mines were reportedly operated on the property before the 1800's. One of these excavations is reported to be located in the north central area of the existing landfill. One other possible iron ore pit is located in the south central section of the site (see Figure 13).

The southern most depression was noted on the original site topographic contour map and existed prior to landfilling operations. This depression is located at the head of a "ravine", also indicated on Figure 13.

The probable pit location in the central area of the landfill is the site of the initial landfilling operations and is visible on 1952 aerial photographs of the site (Reference 20, Appendix A).

The location of these "pits" is consistent with numerous other known iron ore pits in this section of Pennsylvania. They are located close to potential or known fault lines. The iron ore was precipitated out of iron rich groundwater circulating adjacent to fault zones especially in the Antietam Formation and close to the contact with carbonate rock strata where pH changes caused the precipitation of brown hematitic ore (Reference 7, Appendix B).

2.2.4 Hydrogeology

2.2.4.1 General

Hydrogeologic studies at Modern Landfill have been completed to define the nature and extent of leachate migration and to allow design of the groundwater extraction systems. These studies have shown that the underlying groundwater behaves as an unconfined aquifer and that the groundwater flow patterns are typical of an unconfined system with local recharge and discharge areas. In such a system the groundwater surface provides the driving force behind groundwater flow. Variations in the shape of the groundwater surface generate the hydraulic heads necessary to cause groundwater to flow. The groundwater surface in these systems is usually a subdued reflection of the surface topography. Groundwater mounds occur beneath hills and groundwater troughs occur in the valley areas. In areas where the land surface is below the groundwater surface, springs discharge. As the land surface in the vicinity of the landfill generally falls from southwest to northeast, the normal tendency would be for groundwater to flow in this direction. It is considered that the geological structure of the area modifies this flow to such an extent that the dominant flow is roughly east west.

The various hydrogeologic studies have assessed the hydrogeologic parameters (such as hydraulic conductivity and storativity of several of the subsurface materials occurring in the area of the landfill. The Antietam Formation and Harpers Formation bedrock and saprolites derived from these strata have been tested. Only limited knowledge is available regarding the Vintage Formation. The following sections describe the findings of the studies regarding the groundwater surface and the hydrogeologic testing completed to date.

2.2.4.2 Groundwater Surface

A study of water levels in domestic wells in the vicinity of Modern Landfill, completed by AGES (Reference 4, Appendix A) indicated that the groundwater surface about 1,000 feet to the south of the landfill is at an elevation of 700 feet MSL. This groundwater gradually falls to elevation 500 feet MSL, at the north boundary of Modern Landfill (eastern tributary). North of this point, the water surface rises to an elevation of about 550 feet MSL (Frey well). This groundwater surface indicates the potential for a northerly flow of groundwater beneath the landfill.

The configuration of the groundwater surface, beneath the 54 acre landfill, is presently difficult to define since the wells A1, A2, and A3 installed through the landfilled materials have been decommissioned. However, by combining data from winter 1982, when these wells were operational, with current groundwater levels measured in active wells surrounding the landfill, an approximation of the groundwater surface can be prepared. This is presented in

Figure 16. A distinct mound in the water surface is indicated.

It should be noted that the base of the refuse, as probed by wells A1, A2 and A3, is above the groundwater surface. The refuse may be in contact with the groundwater in the old ravine and possibly in the central iron ore pit.

2.2.4.3 Hydrogeologic Testing

In order to define the hydrogeologic parameters of the materials beneath Modern Landfill, several pumping and hydraulic conductivity tests have been conducted. Table 4 presents the locations of these tests and the techniques used for this work. In addition to this, the anisotropy of the hydraulic conductivity of the Harpers Formation bedrock has been defined.

A pumping test was conducted by AGES on the Druck well located just southeast of Modern Landfill within the Harpers Formation and adjacent to a saprolite filled valley. The purpose of the pumping test was to aid in explaining the presence of volatile organics in the Brown well, and to evaluate local transmissivity. Results of the pumping test indicated an elliptical-shaped cone of depression with its major axis N55E. This ellipsoidal axis coincides with the approximate strike of the underlying bedrock. A minimum drawdown of 100 feet was required to maintain a steady discharge of 1 gallon per minute which is indicative of the tight bedrock. As drawdowns increased, well discharge quantities tended to decrease, indicating slow recharge rates to the rock fractures (Reference 9, Appendix A).

Several pumping tests were completed by REWAI between 1975 and 1986. Table 5 presents the range and average transmissivity values derived from these tests.

Monitoring points around the wells indicated that the Harpers Formation hydraulic conductivity in the direction of the major fracture system, i.e. the foliation or northeast - southwest , is between 2 and 10 times greater (average about 5) than the hydraulic conductivity perpendicular to the foliation (References 15 and 17, Appendix A).

The hydraulic conductivity of the bedrock strata has been assessed in the MD and MU series of wells. Table 6 presents the values measured. The range of values for the Antietam Formation is 1.9×10^{-4} cm/sec to 1.6×10^{-6} cm/sec. and for the Harpers Formation 2.4×10^{-5} cm/sec to 4.1×10^{-9} cm/sec.

Vertical flow gradients at the facility have been determined by measurements taken from a series of recently installed cluster wells and from multilevel wells installed in June 1985 (Reference 29, Appendix A). Downward gradients, as high as 0.10 ft/ft., have been observed in the multilevel wells near the east edge of the 54 acre area. Upward gradients on the order of 0.01 ft/ft have been observed in cluster wells located near the eastern tributary. This indicates that discharge of the upper portion of the aquifer is to the streams.

Little information is available regarding the hydrogeologic parameters of the Vintage Formation dolomite. Water level measurements taken at the east and west end of the 21-acre expansion area indicate a 25-foot head difference from east to west across the site. Piezometric pressures measured in the dolomite zone in well clusters W26, C30 and C18 indicate a gradual gradient from east to west beneath the 21-acre expansion area up to the location of C18 then a drop of some10 ft. to an elevation of 500 ft. MSL (the level of the western perimeter stream on this section line). The reason for this abrupt change has not been defined.

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2.2.4.4 Summary

In general, the hydraulic conductivity of fractured rock decreases with depth. The fault zones in the Harpers and Antietam Formations, due to the presence of micaceous and chlorite minerals, form clay-like gouges which may act as aquitards. Adjacent to these fault gouges, the rock is either saprolitically weathered to greater than normal depths or more fractured than the normal rock mass. Hence, these units have a greater potential for transmission of groundwater.

As the rock mass is dissected by a strong northeast southwest cleavage/foliation and the fault zones roughly parallel this trend, groundwater flow will probably be anisotropic within the rock mass, flowing more easily in the northeast or southwest direction for a given hydraulic gradient. This anisotropic drawdown cone, defined during the testing programs described above, is a result of the geologic structure. If gouge filled faults exist beneath the area, these features may further increase the anisotropy of the flow patterns by forming subvertical, northeast - southwest trending aquitards within the rock mass.

The Vintage Formation is a carbonate rock type. Under certain conditions, groundwater flow tends to dissolve this type of rock, opening up fissures and, as evidenced by drillholes and wells in and adjacent to the 21-acre expansion area, forming solution cavities in the dolomite. The flow hydraulics within the Vintage Formation will probably be influenced by these solution cavities. Flow patterns in the Vintage Formation are probably further complicated by the fact that the solution cavities are apparently all infilled with soft clayey soils (Reference 33, Appendix A).

As a consequence of the above, the groundwater flow beneath the landfill, though driven by the hydraulic gradients generated by the shape of the groundwater surface, is complicated by the weatherized fracture systems in the rock mass, the fault structures and the potentially tortuous conduit flow within fractures and infilled solution cavities in the Vintage Formation. Furthermore, the probable regional northeastward groundwater flow direction may well influence the deeper flow patterns.

Modern Landfill is underlain by various geologic materials which have potentially differing hydrogeologic characteristics. These are related to rock type, weathering and fracture state. The following matrix identifies the hydrogeologic units with a potential for differing hydrogeologic properties:

	Formation			
	Kinzers	Vintage	Antietam	Harper
Saprolite	X		X	X
Solutioned dolomite		X		
Weathered Rock	X		X	X
Fractured Rock (adjacent to fault zones)		X	X	X
Relatively Unfractured Rock		X	X	X
Fault Zones	X	X	X	X

Due to the complex geologic structure of the area, it may prove impossible to fully define the hydrogeologic parameters for all the separate hydrogeologic units indicated in the above matrix. To the extent possible additional testing and analysis is required to determine the remaining hydrogeologic parameters such that predictions can be made regarding groundwater flow. This approach along with the data needs are discussed in Sections 2.7.5 and 3.7.

2.3 Preliminary Evaluation of Potential Impacts to Public Health, Welfare and the Environment

Three potential exposure pathways have been identified at Modern Landfill that could result in impacts to public health, welfare and the environment. These exposure pathways include: groundwater, surface water, and air. A fourth pathway, direct contact by the public, adjacent farm residents and livestock has been assessed. Fencing consisting six (6) foot high chain link fence with 3-strand barbed wire is installed along the adjacent Prospect Road. Access along the remaining parameter is controlled by four (4) foot high woven wire fencing. All entrances are controlled by locked gate and security is provided on a 24-hour basis. In light of these access controls and security the direct contact pathway by the unauthorized public does not exist.

Most of the investigations to date have focused on groundwater. There is some limited information on the surface water and air routes of exposure. Section 2.3 describes the existing information regarding these potential impacts. Section 2.7.6 describes the data needed to adequately understand the nature and extent of contamination for these routes of exposure and the data quality objectives for this information.

2.3.1 Groundwater Exposure Pathways

2.3.1.1 Past Studies on Nature and Extent of Contamination

Groundwater quality data has been collected for several years from the various well systems installed at Modern

Landfill. Between January and May 1981, PADER groundwater sampling of wells and springs in the vicinity of Modern Landfill detected volatile organic chemicals. A Preliminary Assessment and Site Investigation (PA/SI) was conducted in 1982 by the EPA Region III Field Inspection Team (FIT) contractor, E & E (Reference 3, Appendix A).

The PA/SI report prepared by E & E noted the presence of organic and inorganic compounds in surface springs at the southwest border of the landfill, in monitoring wells B-1, B-3, B-15, A-1, and A-2 and in the nearby private wells, Frey, Druck, and Peters (see Figure 17). As a result of these findings a Toxicological Impact Assessment was performed by NUS (Reference 19, Appendix A). The NUS report concluded that:

1. Pesticide levels originally reported by the FIT were quantitatively erroneous.

2. High barium and lead levels in the Druck and Frey wells reported in the original FIT were resampled and tested. This testing indicated levels well below those reported in the FIT and substantially below the National Interim Primary Drinking Water Standard of 50 ug/l and concluded that the high barium level was most likely a reporting error.

3. Freon levels in the Peters well were considered non-toxic.

4. Trace levels of insecticides at off-site residential wells were not considered acutely hazardous. The source of these substances was considered to be "not known".

5. The additional lifetime cancer risk for the Druck well with chloroform levels at 50 ug/l would be 26 cases per 100,000 at ingestion levels of 2 liters per day over 70 years. The Druck well water (now decommissioned) was recommended for carbon filtration.

6. The Brown dug well (now closed) was considered severely degraded with several carcinogens.

7. Though some on-site wells contained high levels of iron and manganese, other wells and surface water

samples contained typical levels of these materials which do not threaten water quality.

8. Trace levels of benzene, toluene and cadmium were detected by FIT sampling from the Kreutz Creek tributary. Concern was expressed regarding the possibility of cadmium toxicity to freshwater aquatic life, especially trout.

9. Monitoring wells B-1, B-3, and B-15 showed contamination by benzene, vinyl chloride, Beta-BHC, perchloroethylene (PCE), and trichloroethylene (TCE), chloroform, dichloroethylene, lead, zinc, cadmium, iron, and manganese.

10. Lead (857 ug/l) and zinc (12,160 ug/l) were detected in B-2 and cadmium (580 ug/l) in B-1.

Several investigations were conducted from 1982 through August of 1984 by AGES Corporation and REWAI. In 1986, E & E prepared a draft RAMP and RI/FS Work Plan for Modern Landfill which summarized these investigations (Reference 31, Appendix A). Many of the monitoring wells referenced in these reports have been decommissioned or replaced, as indicated in Section 2.2.2. Locations of decommissioned wells are shown on Figure 11 Results of monitoring well sampling conducted through August of 1984 are summarized below:

1. Elevated concentrations of volatile organics were found in monitoring wells A-1, A-2, and A-3 (total VOC's were 514 ug/l, 2,232 ug/l, and 3,128 ug/l respectively). The A3 well area is the deepest part of the landfill, where previous iron ore exploration supposedly occurred and solid wastes were buried. This area is considered the primary source of contamination which has been detected at the landfill perimeter zones (AGES December 2, 1982 and REWAI May, 1984 References 4-8, and 17, Appendix A).

2. Volatile organic compounds (including chloroform, 1,1-dichloroethane, 1,2-transdichloroethane, 1,1,1-trichloroethane, trichloroethylene, and vinyl chloride) were detected in a number of wells along the western perimeter. These wells included C-1, C-3, C-9, W-7, W-8, W-9, W-13, W-14, W-15, MH-2, MH-3. Total VOC's ranged from 140 ug/l in

W-15 to 1,432 ug/l in W-7 (REWAI August 1984; Reference 17, Appendix A).

3. Elevated levels of iron (up to 380 mg/l in A-1) and manganese (up to 28 mg/l in A-2)were detected in wells A-1, A-2, B-1, B-3, and B-15 and several wells along the western perimeter (REWAI August 1984; Reference 18, Appendix A).

REWAI reviewed the water quality results (post-August 1984) for those wells located in the eastern perimeter of the site (Reference 35, Appendix A). These results indicated that:

1. On the eastern perimeter as a whole, volatile organics are the chemical class that appear to have the widest areal extent, largely due to the extremely low detection level and the natural background levels of zero. Although 18 different priority pollutant volatile organics were detected in eastern perimeter wells, the most common are trichloroethylene, 1,2-transdichloroethylene, 1,1,1-trichloroethane, tetrachloroethylene, methylene chloride, and 1,1-dichloroethane. Two non-priority pollutant volatile organics, trichlorofluoromethane and dichlorodifluoromethane have also been consistently found in the northeastern perimeter wells.

2. No metals other than iron, manganese, and lead are present at significant levels (above EPA Drinking Water Standards) in the eastern perimeter of Modern Landfill.

3. Many of the remaining inorganic parameters indicate elevated levels above normal background within 100 feet of the eastern edge of the landfill. These parameters include chloride, BOD, COD, specific conductance, and others. Beyond this distance from the landfill, the concentrations decrease to levels that are within the range of normal background for the various geologic formations of the eastern perimeter.

4. Nitrate-nitrogen levels monitored in wells B-20 (30 feet deep), W-10 (53 feet deep) and W-11 (53 feet deep) exceeded the EPA Primary Drinking Water Standards.

2.3.1.2 Current Data Nature and Extent of Contamination

The results of Modern Landfill's recent quarterly water quality testing (Fall 1986, Winter 1987, and Spring 1987) are given in Appendix E. The current monitoring system is shown in Figure 12. This system was completed in 1986 along with the eastern perimeter groundwater extraction system. Data collected from the current monitoring network confirms much of the earlier testing regarding the presence of volatile organic compounds in groundwater adjacent to the landfill. However, significantly lower levels of inorganic substances (barium, lead, and cadmium) were detected than those previously reported.

In compliance with PADER, samples are analyzed for 32 volatile organic compounds, metals and other parameters including pesticides, herbicides, and radiological parameters. Selected parameters are summarized in Tables 7 and 8 for the first two sampling periods (fourth quarter 1986, first quarter 1987). Data from the second and third quarters of 1987 have been made available recently. Only a preliminary analysis of this recent information has been completed. Samples were not obtained at certain wells during all sampling periods. This was due to the fact that the non-sampled wells did not produce enough water to be properly developed and/or purged and sampled according to Modern protocol.

Elevated levels of iron and manganese are prevalent in sampled wells throughout Modern Landfill, with the exception of the northernmost section of the landfill. Iron concentrations ranged from below detection limits in a number of wells to 34.5 mg/l in well W-1. The EPA Secondary Drinking Water Standard for iron is 0.3 mg/l. Manganese concentrations also ranged from below detection limits in numerous wells to 9.73 mg/l in well W-1. The Secondary Drinking Water Standard for magnesium is 0.05 mg/l. The presence of iron and manganese is to be expected considering the presence of iron ore deposits in the area and small amounts of iron pyrite in the Antietam and Harpers Formations.

Detectable levels of lead were found in 30 of the wells sampled. However, levels equalled or exceeded the EPA's Primary Drinking Water Standard of 0.05 mg/l in only wells W-35 (0.05 mg/l) and W-23 (0.060 mg/l). This occurred during the fourth quarter 1986 sampling. Levels decreased to below Drinking Water Standards in subsequent sampling. Both of these wells are located along the eastern groundwater extraction system.

Low levels of cadmium at the detection limit (5 ug/l) were found in several wells in the fourth quarter 1986 sampling, with 7.5 ug/l of cadmium detected in well MD104I (Table 1). Levels have been lower in recent sampling with most wells below the method detection limit. Cadmium has not been found at levels as high as previously reported or exceeding the Drinking Water Standard of 10 ug/l, in any of the sampling conducted to this point.

Sixty of the 69 wells sampled had measurable levels of at least one of the volatile organic compounds listed on the Target Compound List (TCL). Figure 18 presents a histogram of frequency (number of wells) in which the indicated volatile organic compounds have been detected (fourth quarter 1986 Sampling Event). Eighteen TCL volatile organic compounds were detected, eleven of which were found in 5 or more wells, as shown in Figure 18. Four of these compounds trichloroethylene, 1,1-dichloroethylene, 1,2-trans-dichloroethylene and vinyl chloride are related in that they are commonly associated with similar manufacturing processes. The last three of these compounds are also degradation products of the first, trichloroethylene. Other compounds which were frequently detected in the wells at

Modern Landfill include 1,1-dichloroethane, 1,2 dichloroethane, 1,1,1-trichloroethane, carbon tetrachloride, and tetrachloroethylene. These compounds are all common decreasing agents and solvents and again, are often associated with similar manufacturing processes. Dichlorodifluoromethane and trichlorofluoromethane are constituents of Freon, a common refrigerant.

The distribution of volatile organic compounds (VOC's)can be grouped into zones based on the occurrence of similar types of compounds. Dividing the area into zones based on the chemicals detected may assist in understanding the nature and extent of contamination. This understanding is necessary to determine the effectiveness of the existing monitoring and remediation system within these zones and to evaluate additional remedial alternatives. Remediation efforts and performance objectives will vary based on risk assessment and Applicable or Relevant and Appropriate Requirements (ARAR's) for specific compounds detected in the various zones. For example, the risk assessment and ARARs may indicate remediation of groundwater is necessary in zones containing vinyl chloride above the MCL of 2 ug/l. However, zones containing higher concentrations of trichlorofluoromethane may not require remediation. These zones are shown on Figure 19 and are discussed below:

1. Zones A & B - Trichlorofluoromethane form a large percentage of the total VOC's, with some dichlorodifluoromethane, tetrachloroethylene, methylene chloride, trichloroethylene, and other VOC's in low concentrations in wells near the northeast corner (MD120, W-59, and W-60A) and northwest perimeter (W-10, W-11, W-12, MD 107-111, and B-20) of the landfill. The Maximum Concentration Level (MCL) for trichloroethylene (5 ug/l) was exceeded in several wells and vinyl chloride (2 ug/l) in one well in these zones.

2. Zone C - In wells along the eastern landfill perimeter near Prospect Road (MD121, MD122I, and MD122S) there are a variety of VOC's; however, 1,2-trans-dichloroethylene, trichlor-ethylene,

methylene chloride, 1,1-dichloroethane, vinyl chloride, and dichlorodifluoromethane occur in the largest concentrations. MCLs were exceeded for benzene (5 ug/l), trichloroethylene (5 ug/l), carbon tetrachloride (5 ug/l), and vinyl chloride (2 ug/l) in this zone.

3. Zone D - Along the eastern tributary a wide variety of VOC's are present. Trichloroethylene and 1,2-trans dichlorethylene occur in the largest concentrations, along with lower amounts of Freon compounds, as well as other VOC's. The MCL for trichloroethylene was exceeded in virtually every well in this zone. Carbon tetrachloride exceeded the MCL in seven wells. In well MD137 located across the tributary stream, both trichloroethylene (38.4 ug/l) and carbon tetrachloride (10.6 ug/l) exceeded the MCLs during the fourth quarter 1986 sampling. Levels have declined in subsequent sampling, possibly as a result of installation of the eastern perimeter groundwater extraction system. The most recent data from 9/15/87, indicates trichloroethylene levels of 5.7 ug/l (MCL = 5 ug/l). No carbon tetrachloride was detected in recent sampling.

4. Zone E - The southern boundary is hydrologically upgradient of the landfill. Low levels of 1,1-dichloroethane, trichloroethylene, and methylene chloride have been detected in wells MU125 and MU102 immediately adjacent to the landfill. In recent sampling no VOC's have been detected in wells further upgradient from the landfill.

5. Zone F - Along the western tributary a wide variety of volatile organic compounds have been detected. The largest concentrations occur for 1,2-trans dichloroethylene, vinyl chloride, trichloroethylene, and 1,1 dichloroethane. The MCLs for trichloroethylene and vinyl chloride was exceeded in most wells in this zone.

6. Zone G - Only trace amounts of methylene chloride (also frequently detected in field and trip blanks) were found in samples from a few wells in the north perimeter area.

Section 2.7.6 defines the data gaps and data quality objectives to fully determine the nature and extent of leachate constituent migration.

2.3.1.3 Factors Influencing Migration

Some of the primary factors that influence movement of groundwater and leachate constituents at Modern Landfill are the chemical properties of the leachate constituents, the history of disposal operations, hydrogeologic properties of the area, orientation of bedrock fractures and other features of the geology, i.e. saprolite zones, fault zones, and the influence of the groundwater extraction system.

The influence of some of these factors is apparent in the spatial distribution of contaminants detected in the monitoring described in Section 2.3.1.1. In order to present the spatial distribution of leachate constituents the area has been divided into the zones discussed above and represented in Figure 19. The distribution of specific compounds may be attributable to some of the factors indicated above. The most important of these factors are probably the history of disposal operations and the hydrogeologic properties associated with the geologic structures.

The distribution of total volatile organics, as shown in Figure 20, and specific conductivity as shown in Figure 21, also indicate several characteristics of the site:

1. Typical leachate constituents (sodium chloride, and other ionized compounds) appear to be in high concentrations in the groundwater, as is shown by the relatively high specific conductivity values.

2. The primary flow paths are east-west, toward the tributary streams, as would be expected based on

hydraulic gradients and dominant bedrock fracture orientation.

3. No leachate constituents appear to be migrating to the north.

4. The relatively high Freon compound concentrations observed in Zones A and B may correlate with disposal history.

5. The groundwater extraction system along the eastern and western perimeters appears to be effectively capturing groundwater containing VOC's. No VOC's have been detected in recent surface water samples. Levels of VOC's have declined significantly in well MD137 located beyond the east tributary (from 188.9 ug/l to 20 ug/l) since the eastern system became operational. Other monitoring wells located across the tributary streams have not detected any VOC's in recent sampling with the exception of low levels of methylene chloride (also present in many field and trip blanks).

The influence of these factors on the movement of groundwater containing leachate constituents are some of the primary items to be addressed further in the proposed field program. Data needed to answer these questions are discussed in Section 2.7.6

2.3.1.4 Nearest Wells and Their Uses

The Hazard Ranking System (HRS) scoring document for Modern Landfill indicated that within a three mile radius of the landfill approximately 819 homes (total population 3,107) are serviced by private wells (Reference 3, Appendix A). As indicated an inventory of the potentially impacted population will be conducted as one of the initial tasks of the remedial investigation.

The nearest private wells to Modern Landfill that are or have been used as drinking water supply wells are shown in Figure 17. These wells have been sampled and analyzed several times by NUS and AGES. These include:

1. The Frey well located north of the landfill across the northern extension of the eastern tributary.

2. The W. Heindel well located across the western tributary.

3. The J. Heindel well located east of the landfill on the other side of Prospect Road.

4. The 3 wells on the former Brown property southeast of the landfill across Prospect Road (no longer used); this property was purchased by Modern.

5. The H. Heindel well located southeast of the landfill.

6. The Druck well located south of the landfill (decommissioned); this property was purchased by Modern and is the location of the present ;landfill entrance.

7. The Peters well located southeast of the landfill.

NUS Corporation sampled the Peters, Frey, and Druck wells in the spring of 1983 and detected low concentrations of certain organic priority pollutants. Trace levels of Freon 11 (trichlorofluoromethane) were found in the Peters wells east of the site. The Frey well, north of the site, showed evidence of insecticides, DDT and lindane. Sampling episodes of the Druck well (non-decommissioned), directly south, indicated trace levels of benzene, chloroform, and methylene chloride (NUS 1983).

E & E in their RI/FS Work Plan (Reference 31, Appendix A), concluded "that both the Peters' and Frey's contamination problems were not the result of the landfill.". Results from a study conducted by AGES (Reference 8 and 10, Appendix A) determined that neither the Frey nor the Peters wells were hydrogeologically connected to Modern landfill, and therefore, their contamination problems could not be associated with the landfill. The depth of the Frey well, 35 feet (base of well at elevation 517 ft. MSL), was determined to be insufficient to induce flow from the landfill across the stream (elevation 500 ft. MSL), which acts as a groundwater discharge area. The Peters well is located in a topographically high area, approximately 2,500 feet southeast of the landfill, and groundwater flow in that area is toward the eastern unnamed tributary. In addition, AGES in their August 1982 report concluded that domestic well cones of depression do not extend beyond 700 feet from the well (Reference 9, Appendix A).

The sampling of three private wells, formerly owned by the Brown family (now closed), detected the presence of numerous priority pollutants. Following the purchase of the Brown property by SCA Services Inc., the use of the Brown wells was discontinued, eliminating the associated pumping influences. Because these southern wells have low water yields, elliptical drawdowns and extensive drawdown magnitudes, and are possibly located close to a faulted, crushed gouge filled rock zone, groundwater reversals may occur. Of the three wells (Brown dug well, Brown old well, Brown new well), the Brown dug well contained the largest concentrations of chlorinated alkane/alkene compounds, including TCE (Reference 19, Appendix A). A pumping test conducted by AGES in December 1982 indicated that the Druck well and the Brown's new well get their water from the bedrock fractures which lie along the strike (northeast - southwest). Therefore, the water quality of the two wells is related. The pumping of the three Brown wells accelerated the migration of the landfill-associated volatile organic compounds (VOC's) into the water-bearing zone that these wells share with the Druck well. The most recent analysis from the Druck well (April 1984) indicated chloroform at less than 10 ug/l as the only volatile organic present Reference 18, Appendix A).

Section 2.7.6 discusses the data gaps defined by the above work and the data quality objectives necessary to allow a risk a rosk assessment and selection of remedial alternatives to be completed.

2.3.2 Surface Water and Sediment Exposure Pathways

2.3.2.1 Nature and Extent of Contamination

Section 1.5 contains a description of surface water in the vicinity of Modern Landfill. The major surface waters of concern are Kreutz Creek and the two unnamed tributaries bordering Modern Landfill. As indicated in the discussion in Section 2.3.1.2, it appears that groundwater containing leachate constituents migrates in the direction of these tributaries. The groundwater extraction systems at Modern Landfill (see Section 1.6) have significantly reduced discharge to the tributaries in the vicinity of the landfill.

Low levels of volatile organic compounds were observed during early investigations in these tributaries. Springs along the western tributary were sampled during the FIT inspection, and total volatile organic concentrations in excess of 400 ppb were observed (Reference 3, Appendix A). However, these levels have been significantly reduced since the FIT inspection, by the currently operating groundwater extraction system. The maximum levels of volatile organics detected in spring samples during this period was 42 ppb at MSP113. No contamination was detected at most surface water sampling points. Methylene chloride, also present in sample blanks, was the only compound detected in the surface water during the most recent sampling events.

Inorganic compounds exceeding USEPA Drinking Water Standards were also reported in early studies in springs and the tributaries. Iron and manganese were detected in the western tributary, (up to 430 ug/l for iron and 250 ug/l for manganese). Secondary drinking water standards for these compounds are 300 ug/l and 50 ug/l respectively. Cadmium was reported at 16 ug/l (MCL = 10 ug/l) from a sample from the eastern tributary. Concern was expressed regarding possible aquatic toxicity due to cadmium (Reference 19,

Appendix A). In recent sampling of the tributaries, lead has been detected at levels of 12-19 ug/l, well below Drinking Water Standards. Cadmium has not been detected in recent sampling (detection limit of 5 ug/l).

In addition to the discharge to the tributaries of groundwater containing leachate constituents, runoff of surface water and sediments containing hazardous constituents potentially could have occurred in the past from the 54-acre landfill. Prior to the groundwater extraction system being operated, (see Section 1.6) an aquatic biological investigation of the western tributary stream was conducted during 1981-1982, by Mr. Robert Schott, Water Pollution Biologist for PADER. Schott concluded that leachate from the landfill was not having any discernible impact on the stream biota. He attributed poor water quality in the creek to siltation caused by cattle on the adjacent Heindel farm. Schott concluded that concentrations of VOC's entering the tributary via springs were either too low or the VOC's volatilized to non-toxic levels (Reference 31, Appendix A). Since that time, levels of total volatile organic compounds detected in the tributaries have decreased by an order of magnitude (400 ug/l to 42 ug/l).

Section 2.7.6. defines the data gaps regarding the nature and extent of leachate migration and the necessary data quality objectives.

2.3.2.2 Surface Water Uses

The tributary streams represent potential exposure pathways primarily due to their potential use as agricultural water supplies. The western tributary stream is reportedly available as a water supply for cattle on the Heindel farm (Reference 31, Appendix A). This is not the case. As a result of perimeter fencing there is no direct access, for livestock, to the tributaries. This cow pathway, therefore, does not exist. If any contamination was reaching the tributary streams, it could potentially reach Kreutz creek where additional uses may include domestic and industrial water supplies, and recreational use. Kreutz Creek is reportedly used for boating, swimming, and fishing (Reference 31, Appendix A). The actual uses of these surface water sources will have to be evaluated to determine the impact of any releases (see Section 2.7.8). As discussed already, Kreutz Creek is not a water supply for Wrightsville as stated by E & E in its RI/FS Work Plan for PADER. Section 2.7.6 discusses the data gaps and data quality objectives of the sampling plan (section 3.8) required to allow assessment of the surface water pathway.

2.3.3 Air Exposure Pathways

Volatilization of hazardous materials and fugitive dust generation are the main release mechanisms for potential air exposures.

Air monitoring performed during the FIT survey in 1982 indicated no significant airborne contamination. Photoionization detector measurements at some groundwater monitoring wells ranged from 1-5 ppm above background; however, no significant readings were obtained during ambient air monitoring (Reference 3, Appendix A). NUS Corporation conducted ambient air monitoring in 1983. No air contaminants above background were detected using an HNU (Reference 20, Appendix A).

A methane gas monitoring and venting system presently exists around the southern, eastern, and western perimeters of the landfill (Figure 7). This system was installed following detection of methane at the former Brown residence located across Yorkana Road. Additional gas wells/vents and gas collection trenches are presently being constructed as part of Modern's on-going remedial activities.

Another potential source of airborne contaminants is the physical/chemical treatment portion of the treatment plant which will release stripped gases from the air stripper during treatment of the leachate and extracted groundwater under the conditions of PADER Air Quality Control Permit No. 67-330-004. Section 2.7.6 discusses these data gaps.

An evaluation of this potential exposure pathway will be conducted during the RI/FS as described in Section 3.

2.4 Preliminary Selection of Indicator Chemicals

The selection of indicator chemicals was the first step in the baseline public health evaluation process. This selection process was performed based on existing data site specific to Modern Landfill. As described in Section 2.3, previous investigations revealed a wide variety of compounds (primarily volatile organics) in groundwater and surface water in and around Modern Landfill. The primary route of exposure identified at this point for Modern Landfill is through groundwater. Since results of early analyses have not been validated and many of the earlier sampling points have been decommissioned, only the most recent data based on current monitoring well locations was used for selection of indicator chemicals. Based on this data, several volatile organic compounds were chosen as indicators.

As discussed in Section 2.3, recent sampling has not found widespread presence of other compounds such as lead and cadmium at levels exceeding Drinking Water Standards as had been reported previously. These compounds will continue to be monitored and, as appropriate, included as indicators, during the RI/FS. Although iron and manganese appear to be widespread, the Secondary Drinking Water Standards for these compounds are based primarily on esthetic effects (taste and staining) and not on health effects. Also their widespread presence probably is due to the iron ore deposits and bedrock located in the area rather than Modern Landfill, as discussed in Section 2.3.1.1.

The initial list of indicator chemicals, developed by following the guidelines as set forth in the "Superfund Public Health Evaluation Manual," are listed in Table 9. These compounds were selected based on site concentration data, chemical toxicity, and environmental fate. Selection of indicator chemicals must take into account various environmental and health related factors, to produce a group of compounds truly representative of the highest risk. The individual components used to determine the high risk chemical indicators for Modern Landfill are discussed in greater detail below.

Analytical data from monitoring wells located in three areas of Modern Landfill were chosen for use in selection of indicator chemicals. These locations are:

1. The western perimeter (wells MD103S, MD104I, W-4, W-5, W-7, and W-13).

2. Wells along Prospect Road on the eastern perimeter (MD121, MD122S, and MD123I).

3. Wells along the eastern tributary stream (MD130S, MD131I, MD132D, MD134S, and MD135I, and W-36 through W-45).

These areas were chosen because they are most representative of locations where a range of compounds was detected and areas where the compounds may impact the environment.

One of the primary factors influencing the mobility of organic chemicals is K_{OC}, the organic carbon partition coefficient, which indicates the tendency of a chemical to sorb to organic carbon in soil. The low K_{OC} values indicate a chemical may leach more rapidly from the source and travel readily through an aquifer. Consequently, K_{oc} values are an important consideration in the ranking of indicator chemicals.

The water solubility of each compound was also considered for the ranking of chemicals. Solubility is an important measure of environmental fate. Compounds with higher solubilities may leach more rapidly from the soil and are mobile in groundwater.

Equally important for selection of indicator chemicals is the toxicity rating given each compound. This rating is based on chemical toxicity and measured concentration. Five compounds receiving a toxicity indicator score greater than 1.1 x 10-E04 were selected.

Finally the persistence or half-life for each compound in surface water was considered (data is generally unavailable for persistence in groundwater).

Selection of indicator chemicals was not based entirely on numerical toxicity ranking as stressed in the EPA guidelines. A qualitative and quantitative evaluation of the analytical data and appropriate environmental and public health parameters was performed. The following five volatile organic compounds were selected as preliminary indicators at Modern Landfill:

1. Benzene
2. Carbon Tetrachloride
3. 1,2 trans-Dichloroethylene
4. Trichloroethylene
5. Vinyl Chloride

All of these compounds are potential carcinogens.

During the RI/FS process, compounds may need to be added or deleted from the list as additional information becomes available. For example, initial screening for additional parameters on the Target Compound List may identify compounds for inclusion. The current list is intended to guide the investigation as to the evaluation of potential migration and exposure routes and the selection of ARARs.

2.5 Identification Of Preliminary Applicable or Relevant and Appropriate Requirements (ARARs)

Included in Table 10 is a preliminary list and assessment of of potential Federal and Commonwealth of Pennsylvania ARARs for Modern Landfill. Potential ARARa specific to Modern Landfill have been determined based on the public health evaluation procedures outlined in the Superfund Interim Guidance Document. This preliminary selection of ARARs was determined from the selection of indicator chemicals as discussed in Sections 2.3.1.1, 2.3.1.2, and 2.4, the assessment of the potential exposure pathways discussed in Section 2.3.2, and the consideration of the probable remedial measures as discussed in Section 2.6.

The route of exposure with the most available information is that of drinking water from groundwater containing leachate constituents. Thus, the preliminary ARARs identified for Modern Landfill are the Maximum Concentration Levels (MCL's) and Maximum Concentration Level Goals (MCLG's) from the Safe Drinking Water Act (42 U.S.C. Sections 300 et seq.). Table 11 lists Drinking Water Standards for the volatile organic compounds identified at Modern and those selected as indicator chemicals along with corresponding MCLs and MCLGs. As indicated in Section 2.3.1.2, MCL's for trichloroethylene, vinyl chloride, benzene and carbon tetrachloride were exceeded in numerous wells at Modern Landfill.

In addition to Drinking Water Standards, Federal Ambient Water Quality Criteria (WQCs) may be applicable to this situation as guidance for potential public health impacts of exposure. These values are based on lifetime ingestion of drinking water and aquatic organisms from a particular source, as well as lifetime ingestion of aquatic organisms alone. Calculations can be made to adjust the criteria to sites with leachate constituents in groundwater sources having the potential for being sources of drinking water. These adjusted WQCs and non-adjusted WQCs are listed in Table 12 for the VOCs and selected indicator chemicals detected at Modern Landfill.

Drinking Water Health Advisories published by the U.S. EPA (DWHAs) are also available as guidance on the impact of certain chemicals being found in drinking water supplies. These values represent concentrations below which adverse health effects are unlikely to be encountered in drinking water. Appropriate health advisories have been compiled for the VOCs and indicator chemicals in Table 13.

Effluent limitations contained in Modern's NPDES permit (permit No. PA0046680) for discharges from the wastewater treatment plant to the western tributary stream at Modern Landfill may also serve as preliminary ARARs for releases or discharges to surface water. These effluent limitations are contained in Table 14.

Monitoring of influent and effluent VOC's required under Air Quality Control Permit No. 67-330-004, and indicative of removal efficiency of the air stripping towers, can also serve as ARAR's.

The specific ARARs for other routes of exposure such as air will be determined based on data collected during the RI/FS. These will likely include OSHA Standards for exposure to workers.

As data becomes available to enable modeling of potential exposure, the baseline public health evaluation for the indicator compounds will be completed. The determination of ARARs is an iterative process. The different ARARs that may apply to a site and its remedial action should be identified and considered at multiple points in the remedial planning process, namely:

1. During scoping of the RI/FS, chemical/specific and location-specific ARARs may be identified on a preliminary basis.

2. During the site characterization phase of the Remedial Investigation when the public health evaluation is conducted to assess risks at a site, the chemical-specific ARARs and advisories and location-specific ARARs are identified more comprehensively and used to help determine the cleanup goals.

3. During development of remedial alternatives in the Feasibility Study, action-specific ARARs are identified for each of the proposed alternatives and considered along with other ARARs and advisories.

4. During detailed analysis of alternatives, all the ARARs and advisories for each alternative are examined as a package to determine what is needed to comply with other laws and be protective of human health and the environment.

5. When an alternative is selected, it must be able to attain all ARARs unless one of the six statutory waivers is invoked.

6. During remedial design, the technical specifications of construction must ensure attainment of ARARs.

This process is consistent with CERCLA (42 U.S.C. 9601 et seq.), as amended by SARA and the Interim Guidelines on Compliance with Applicable or Relevant and Appropriate Requirements" (52 FR No. 166, August 1987).

2.6 Preliminary Assessment of General Response Actions

There are several general response actions that may be applicable to Modern Landfill. These are identified in this section so that the data necessary for evaluating them in the RI/FS can be identified. The general response actions address all the potential impacts identified in Section 2.3. These include impacts to groundwater through leachate generation, to surface water and sediment, and to air.

The general response activities with respect to the conditions at Modern Landfill are:

1. No Action (defined by the baseline condition if no remediation would have been undertaken).
2. Containment of Waste.
3. Pumping, Treatment and Disposal of Extracted Groundwater.
4. Interception, Collection and Treatment.
5 Excavation and Removal of Selected Areas.
6. On-Site Disposal of Excavated Material.
7. Off-Site Disposal of Excavated Material.
8. On-Site Treatment.
9. In-Situ Treatment.
10. Alternative Drinking Water Supplies.

2.6.1 Groundwater

The general response measures to remediate impacts to groundwater at Modern Landfill are: no action, containment, pumping, collection, on-site treatment, in-situ treatment, and alternative drinking water supplies. Combinations of measures are normally utilized to mitigate groundwater impacts. A preliminary review of remedial measures includes:

1. No action - As "actions" have already been taken by Modern to remediate the condition at Modern Landfill the effect of a "no action" response can only be assessed after baseline conditions have been analyzed. Thus the baseline condition is defined as those conditions that existed at the site prior to any remediation taking place. The effectiveness of all other remedial alternatives will be measured against this baseline.

2. Containment - capping with highly impermeable materials to minimize generation of leachate, and construction of barrier walls. Modern's standard procedures for landfill operations include installation of final caps. The southern half of the landfill is currently being capped with a compacted clay in accordance with the Solid Waste Permit No. 100113.

3. Continue Present Pumping Activities - As described previously a considerable amount of remedial response activities have already been conducted at Modern Landfill. These activities have focused on remediating impacts to groundwater and surface water and include various measures that combine containment, pumping, and treatment. The effectiveness of these actions and their effect on baseline conditions will be evaluated.

4. Pumping - Additional groundwater extraction wells possibly on-site and off-site may be necessary. Pumped water would be piped to the existing treatment system.

5. Collection - Subsurface collection interceptor drains.

6. On-Site Treatment - Modifications to the existing treatment system, if necessary.

7. In-Situ Treatment - This would involve in place physical, chemical, or biological treatment or a combination thereof to permanently destroy groundwater contaminants.

8. Alternative Water Supplies - If contaminants associated with Modern Landfill are found above levels of concern in drinking water wells, their removal and replacement with supplies from a clean

source or individual treatment units may be considered.

2.6.2 Surface Water and Sediment

The general response measures to mitigate impacts to surface water and sediments at Modern Landfill have been identified as: pumping, containment, interception and excavation of selected material. In addition, to the extent they would reduce discharges of hazardous constituents, mitigation efforts for groundwater would also mitigate impacts to surface water. Some of the potential remedial measures involved would include:

1. No action - Analysis of baseline conditions; i.e. those conditions that existed at Modern Landfill prior to any remediation taking place.

2. Pumping - Would involve maintenance and monitoring of the effectiveness of existing remediation efforts and possibly installation of additional extraction wells to influence discharge of groundwater to surface water.

3. Containment - Would involve capping, runoff controls such as regrading, landscaping, controlled access and additional sediment collection basins.

4. Excavation of Selected Material - Would involve removal of contaminated sediments, if needed.

5. Interception - Would involve the installation of interceptor box weirs in the streams and spring discharge points as appropriate and conducting intercepted water to the treatment system.

2.6.3 Air Pollution

The general response actions that have been identified for potential air pollution conditions at the Modern Landfill are: No action, containment, collection and treatment. The remedial technologies considered would include:

1. No Action - Based upon baseline conditions; i.e., those conditions that existed at Modern Landfill prior to any remediation taking place.

2. Continued Venting - This would involve maintenance of the current gas venting system with some monitoring.

3. Containment - Would involve capping and/or other dust control measures, along with landfill gas control.

4. Collection/Treatment - Would involve installation of treatment systems to remove hazardous constituents from landfill gases and/or conduction of gases to flares or suitable treatment facility.

2.7 Definition of Data Needs and Data Quality Objectives (DQOs) to Evaluate Potential Impacts and Remedial Actions

2.7.1 General

The detailed review of available data in Section 2.2 and the scoping process described in Section 2.3 - 2.6 have resulted in the identification of data gaps required for site characterization and evaluation of remedial actions. Section 2.7 of this document identifies these data gaps, the uses of the data and the data quality objectives necessary to meet the decision-making requirements for remedial alternatives. The detailed RI/FS Work Plan in Section 3.0 includes activities which will address the data deficiencies. The data requirements for the Modern Landfill RI/FS include a complete understanding of:

1. Regional and local area review.
2. Disposal history/source characterization
3. The structural geology of the site.
4. The hydrogeology of the site.
5. The nature, rate and extent of contamination.
6. The effect and effectiveness of the existing remediation systems.
7. The potential impact from the identified routes of exposure.
8. Data to evaluate remedial response actions.

The data gaps and data quality objectives for these points are discussed in Sections 2.7.2 through 2.7.7.

2.7.2 Local Area and Regional Conditions

In order to analyze conditions at Modern Landfill in context with the local area and regional framework, additional information is required regarding metereology, hydrogeology, geology, and groundwater chemistry (see Section 3.4).

Although an inventory of wells, drill holes and bore holes has been completed for Modern Landfill (Table 3) this must be confirmed as a complete record. Similarily an inventory of streams, springs, and water supply wells in the local area must be compiled. Task 1.2 and 1.3 discuss the work to be completed.

2.7.3 Disposal History/Source Characterization

As described in Section 2.2.1, information regarding the materials disposed of at Modern Landfill has been collected. Unconfirmed information indicates that some aspects of this information may be incorrect, i.e., pesticides reportedly placed in the landfill may have been removed. Consequently, it is considered that further research of available records, and interviews with landfill personnel is required to determine the history of actual types and quantities of waste that have been disposed of at Modern Landfill. The objective of the collection of this data is:

1. To determine whether additional hazardous substances may be present beyond those currently identified.

2. To confirm the presence and probable locations of identified these wastes.

3. To assess the identified wastes potential impact to the environment through the identified routes of exposure, i.e. fully define the nature and source of contaminants.

It is possible that a thorough review of the operating history of Modern Landfill will assist in understanding the distribution of certain compounds detected in the groundwater. The location and age of disposal cells and trenches in relation to the physical characteristics of the geology underlying Modern Landfill may explain some of the groundwater chemistry distribution patterns, assist in defining the hydrogeology, and possibly indicate where remediation efforts need to be focused. Furthermore, it will assist in defining the best indicator chemicals for determining the effects of the groundwater remediation system in different zones around the landfill and screening of other remedial alternatives. Section 3.5 describes the work that will be completed to address this data gap.

2.7.4 Geology

Section 2.2.3 provides a thorough discussion of the known geology at Modern Landfill. This information indicates that:

1. The geology differs considerably from published data regarding the local and regional area (Reference 7, Appendix B).

2. The geology underlying Modern Landfill is far more complex than originally considered.

3. Transport of leachate constituents, via groundwater to the environment, will be controlled by the geologic structures at Modern Landfill.

Fully defining the geology is considered essential since it strongly influences the hydrogeology of the area which, in part, determines the potential impact to the environment. The data gaps which exist in the geologic information associated with the site are:

1. Further definition of the saprolitic weathering profile.

2. Definition of the location and nature of the fault structures which may cross the area to enable the influence of these features on groundwater flow to be determined (such as the fault gouges).

3. Definition of the variation of fracture patterns within the rock mass in the various geologic units to assist in structural interpretation of the site and analysis of the hydrogeology.

4. Further definition of the location, extent, and nature of the Vintage dolomite and Kinzers shale strata.

5. Verification or revision of the current geologic interpretation.

6. Incorporation of the geologic interpretation with the local area/regional geology.

This data will be used to provide a detailed geologic map and geologic cross sections at Modern Landfill and local area and to define the influence of the geology on the hydrogeology.

DQO guidance documents do not specify accuracy levels for geologic mapping/analysis. Drillhole logging will be completed in accordance with the technical specifications discussed in the Quality Assurance Program Plan (QAPP) Appendix F. Section 3.6 defines the geologic studies that will be completed at Modern Landfill.

2.7.5 Hydrogeology

Section 2.2.4 discussed the known hydrogeologic conditions at Modern Landfill. Section 2.1 outlined a matrix of several hydrogeologic units defined by the geologic strata and the weathering and fracture state of those strata.

Whether these units have significantly differing hydrogeologic properties, which may affect the flow of groundwater containing leachate constituents, is not known. However, it may be stated that a groundwater system is adequately understood for the purpose of evaluating environmental/health impacts only when the predictions based on known hydrogeology and source areas of leachate constituents are substantiated with actual field observations. Consequently, the identified data gaps that require adequate definition to explain the hydrogeology of Modern Landfill are:

1. Further definition of the vertical and horizontal magnitude of the driving forces for groundwater flow within the hydrogeologic units (defined in Section 2.2.4.1).

2. Detailed analysis of the vertical and lateral anisotropy of the hydraulic conductivity of all hydrogeologic units defined in section 2.2.4.1.

3. Construction of detailed hydrogeologic plans and cross sections along all landfill and facility perimeters, indicating materials present, their extent and hydrogeologic parameters for the differing units.

Section 3.7 discusses the actual work to be performed.

This data will be used to assist in defining baseline conditions (see Section 2.6), performing the risk assessment of potential impacts of Modern Landfill and selection of remedial alternatives. Guidelines for data quality objectives do not specify accuracy levels for hydrogeologic assessment. Accuracy levels will be commensurate with the testing procedures used. (see Appendix F. Technical Procedures)

2.7.6 Nature and Extent of Contamination

In order to adequately address the requirements of the Risk Assessment and Feasibility Study, sufficient data must be collected to obtain a detailed understanding of the nature and extent of contamination for all routes of exposure described in Section 2.3. Analyses conducted to date have been limited to volatile organic compounds, Primary Drinking Water metals and pesticides, and radium 226 and 228. Analysis has not been conducted for additional compounds on the EPA Contract Laboratory Program (CLP) Target Compounds List (TCL) such as:

1. Base, acid, neutral extractables (BAN compounds).
2. Additional metals.
3. Additional pesticides/PCBs.
4. Screening for specific substances known to have been disposed of at Modern Landfill that are not on the TCL, such as ethylene diamine, thorium, and uranium and molybdenum.

The disposal history review mentioned in Section 2.7.2 may result in the discovery of additional analytes of concern or reduction of specific compounds beyond the TCL. Consequently, in order to define the nature of the leachate constituents in the groundwater at Modern Landfill, additional work is required to fill these data gaps.(see Section 3.8 for details of the Sampling Work Plan).

It is considered that sampling and full TCL analysis of groundwater using EPA CLP Routine Analytical Services (RAS) Level IV methods on 20 wells located at strategic positions around Modern Landfill (see figure 22) and at various depths will determine the nature of the leachate constituents. This program has been defined as Phase 1A as discussed in Section 3.8.1.

Phase 1B of the program as discussed in Section 3.8, will define the extent of the migration of identified leachate constituents, as appropriate, by completing a sampling program on all current wells, and surface sampling points (see Figure 12) at Modern Landfill plus the new sampling wells discussed in the Work Plan. These points will be analyzed for those TCL constituents that are appropriate based upon Phase 1A results, development of key indicator parameters from Phase 1A and historical analytical data and the risks posed by those constituents. At a minimum, VOA's and metals will be analyzed.

Use of this Phase IA and IB data is for site characterization of the nature and extent of leachate constituents. For the indicator compounds identified in Section 2.4 and the ARARs identified in Section 2.5, Analytical Level IV (CLP RAS Methods) are appropriate for site characterization activities. Level IV methods are also appropriate for characterizing the nature and extent of leachate constituents for the additional compounds (BANs, metals, pesticides) mentioned above. The Quality Assurance Program Plan (QAPP), Appendix F, contain the details on sampling procedures, chain of custody, analytical methods, and corresponding QAPP protocols.

No data is available regarding the presence of leachate constituents in the sediments of the unnamed tributaries affected by Modern Landfill, or regarding ambient background levels in the area. Consequently, sediment samples must be taken upstream, adjacent to, and downstream of Modern Landfill to determine its impact on this potential pathway (see Figure 12 for locations).

Analyses of these samples for the same range of constituents, as defined for the Phase IA groundwater sampling event to CLP RAS (Level IV) standards, is considered appropriate. This data and surface water data will be used to define the requirements for further studies of biota and potential remediation of the pathway.

No recent data has been obtained regarding the potential air route of exposure. Initial data collection activities for this route of exposure will be required for health & safety of workers on site and site characterization using field monitoring equipment (Analytical Levels I & II). If airborne substances are detected during field screening, and determined to be a risk, further evaluation of this potential pathway will be necessary.

The Phase 1 Risk Assessment will be based upon the results of the Phase 1A and 1B data and provide directions for subsequent analyses and development of appropriate DQO's.

2.7.7 Effectiveness of the Groundwater Extraction System

Given that leachate constituents have entered the groundwater, it is necessary to determine whether the present groundwater extraction system is effective in removing them by accomplishing the following:

1. Develop a mass balance/water budget for the site and to define the capture range of the wells.

2. Comprehensive analysis must be made of the changes in water quality in all pumping and monitoring wells and surface water in the tributaries as a result of pumping.

3. Since the extraction system has changed the dynamics of groundwater flow and may have altered the natural flow pattern significantly, the changes need to be carefully monitored to differentiate between the natural and induced flow patterns.

4. Further definition of the spatial distribution of leachate constituents is required.

5. An analysis is needed of the existing monitoring network to determine whether any modifications are necessary to properly evaluate the effectiveness of the extraction system.

6. An assessment based on historic data of the pre-pumping groundwater conditions will be required to establish the baseline conditions, i.e. no action, against which all remediation alternatives will be measured.

The data gaps that are defined are thus:

1.- Determination of the potentrometric surface caused by the groundwater extraction system.

2.- Variation of water chemistry with time.

3.- Collection of data on precipitation, evapotranspiration and surface runoff.

4.- Determination of stream flows.

5.- Collection of flow rate measurement data from the treatment plant.

Section 3.10 discusses the work that will be undertaken to allow completion of this work.

2.7.8 Potential Impact From the Identified Routes of Exposure

Data collected to determine the nature and extent of leachate constituents will be used to evaluate the risk posed by Modern Landfill to human health and the environment. Additional data needed to complete this risk assessment include better identification of the population at risk and the groundwater and surface water uses that result in potential exposure to chemicals identified at Modern Landfill.

Based upon the potential uses of Kreutz Creek and access by residents living adjacent to and on the property upon which Modern Landfill is located, potential impacts via exposure to surface water and soil/sediment exposure (ingestion, direct contact and food-chain) must be evaluated. There is no direct access for livestock to the tributaries.

The data regarding groundwater, surface water, air and soil sediment samples will be used to determine the significance of transport routes, exposure pathways and potential health effects from exposure. This information in conjunction with the ARARs will be used to determine the need for immediate or additional long-term remediation as well as the performance goals to evaluate various alternatives.

Impacts from the landfill to biota along and downstream of the western tributary were determined to be non-existent by PADER (see section 2.3.2.1). This conclusion along with the fact that leachate constituent levels in the tributaries have been reduced since that time, this pathway is not considered to be a potential risk. This conclusion will be checked by completing stream amd sediment sampling and analysis as dicussed in Section 3.8. The air pathway has also been defined as a potential risk to human health and the environment.

The data gaps thus defined for this portion of the work plan are:

1. Further determination of the population potentially at risk.

2. Surface water uses.

3. Groundwater uses.

4. Determination of the potential impact to biota if the results of the surface water and sediment sampling programs indicate a potential risk.

5. Determination of the potential impact via the air pathways.

The fieldwork to complete this work is listed in section 3.3.5.

2.7.9 Data to Evaluate Remedial Response Actions

Data collected to determine the geologic and hydrogeologic properties of Modern Landfill baseline condition, the effectiveness of the existing groundwater extraction system, and the nature and extent of contamination through identified routes of exposure will be used to evaluate the potential remedial response actions. Performance goals will be established for evaluating these response actions during the feasibility study. These performance goals will be based on a detailed risk assessment, cost, and their ability and feasibility to achieve ARARs. Analytical Levels I, II, III, and IV will be utilized to evaluate alternatives.

3.0 PHASE I REMEDIAL INVESTIGATION

3.1 General Description

The purpose of the Phase I Remedial Investigation is to conduct a series of tasks involving the collection of data that will characterize existing conditions and allow definition of baseline conditions. This includes defining the full nature and extent of leachate constituents, factors influencing the extent and rate of migration of these constituents, and the effectiveness of existing remedial activities. A risk assessment will be conducted to characterize and assess risks from identified routes of exposure based on modeling the fate and transport of chemicals from Modern Landfill to likely human and environmental receptors. Data quality objectives will be evaluated and refined to ensure that all data necessary for determining environmental and health effects, and evaluating remedial alternatives will be collected.

The tasks conducted during the Phase I RI will be aimed at answering the remaining questions defined by the scoping process (see Section 2.7). The locations of work to be completed at Modern Landfill are shown on Figure 22.

All field work which is done on the site will be performed in accordance with the Quality Assurance Program Plan in Appendix F and the Health and Safety Plan in Appendix G.

Details of the Remedial Investigation are presented by task in the following sections.

3.2 Task 1.1 - Initial Project Meeting

Upon approval of the RI/FS Work Plan by PADER and EPA, Modern will begin solicitation and selection of an RI/FS consultant team to implement the Work Plan. This RI/FS consultant team will consist of qualified members experienced in all required aspects of the RI/FS. Pursuant to the November 4, 1987 COA, the background and experience of the key qualified members of the team will be submitted to PADER and EPA for approval at least 30 days prior to the initiation of work.

After the RI/FS consultant has had an opportunity to review the background information regarding the project, an Initial Project Meeting will be held between Modern and the consultant project team. The objectives of this meeting will be to :

1. Introduce Modern representatives and respective team members.

2. Discuss the overall objectives, approach and schedule of the RI/FS.

3. Obtain and exchange relevant information between Modern and Project team members.

4. Identify significant issues and establish protocols and criteria applicable to the effort.

5. Establish channels of communication and reporting.

Modern shall maintain written minutes of the Initial Project Meeting and shall transmit typed copies to all attendees. The conclusions reached during this meeting will supplement the RI/FS Work Plan and will be forwarded to PADER and EPA for their review and approval.

3.3 Task 1.2 - Monitoring Point Inventory and Site Visit

The existing inventory of environmental monitoring points is essentially complete but will be updated and verified for completeness and accuracy. These monitoring points include Modern Landfill's monitoring wells, groundwater extraction wells, gas vents, as listed in Table 3, springs, seeps, stream sampling locations, and off-site water wells. Off-site wells to be inventoried will include wells of home-owners with a history of water quality concerns, nearby wells considered to be hydraulically connected to the groundwater beneath Modern Landfill and all other wells within 2,500 feet of its boundary.

Appendices C and D provide the presently available data regarding well borings and all other gas vents. The well inventory will include a compilation of the geologic and well construction logs identified. Information for each monitoring well will be tabulated, including depth, diameter, casing type, date installed, open interval, elevation and coordinates, range of water levels and water quality. The majority of this data base has already been compiled. Selected data fields are presented in Table 3.

Information to be collected on private wells will include owner, driller, pumping rate, water level, water use, water quality, existence of any in-line treatment and construction details (provided the original well logs are available). Additionally, information regarding on-site septic systems, on going activities (such as farming, pesticide/herbicide storage, auto repair shops, etc) will be gathered.

3.4 Task 1.3 - Regional and Local Area Information Review

The initial data review presented in this Work Plan will be augmented with a review of available regional information. This regional review will include:

1. Regional geologic and hydrogeologic information from state, federal and university sources.
2. Meteorological, and surface water information from National Oceanic and Atmospheric Agency (NOAA),

National Weather Service (NWS), U.S. Geological Survey (USGS) and other sources.

3. Definition and quantification, to the extent practical, of the groundwater recharge and discharge areas.

4. Definition and quantification, to the extent practical, of the interactions between surface water and groundwater in the region..

5. Definition and quantification of regional surface water and groundwater geochemistry.

6. Definition of current and potential surface water and groundwater resource use in the region.

7. Determination of the patterns and magnitude of water table fluctuation in the region.

This information will allow the site-specific hydrologic and hydrogeologic data to be interpreted in context with the surrounding local area and region.

Task 1.3 will further identify any gaps that may exist in the baseline data at the site scale which is necessary for the RI/FS.

3.5 Task 1.4 - Confirmation of Disposal History

Modern has reviewed PADER and EPA Files, has held limited interviews with site personnel, and has reviewed the existing reports regarding waste disposal and characteristics at Modern Landfill. The preliminary disposal history and waste characterization presented in Section 2.2.1 was prepared from this information. The Phase I RI will include studies to verify and/or complete Modern's understanding of the waste in the landfill. This will involve completing interviews and record searches to determine the accuracy of the various disposal history and activity items listed in section 2.2.1.

3.6 Task 1.5 - Geologic Studies

To address the site geology data gaps defined in Section 2.7.4, additional work is required. This work program will include:

1. Integration of Modern Landfill's geology with the local area (identified in Task 1.3). Field mapping of the area surrounding the study area will be completed. The area will be about 2 miles by 2 miles. Aerial photographs of the area (as available) will be studied and used to provide a photogeological appraisal of the area. Outcrops will be visited and detailed notes made regarding the rock types and fracture systems. Residual soil samples, stream sections and pebble analyses will be used to provide data in areas of poor or no outcrop. On the basis of this work, a local area geologic map will be produced into which Modern Landfill's site geology can be incorporated.

2. To define the location of the thrust fault zone outcrops and saprolitic weathering profiles, throughout Modern Landfill long test trenches will be dug across sites identified by the geologic mapping program. The location of 15 of these are shown on Figure 22. Additional trenches will be dug as required.

3. To define the subsurface nature of the fault zones identified by the test trenching, a series of angled or vertical N size cored holes will be drilled . The number, length, orientation, and location of these holes will be defined after test trenching has been completed. These holes will be packer tested in the hydrogeologic program (see Task 1.6) if detailed analysis of the existing well system does not define the hydraulic parameters of the definable hydrogeologic units.

4. Additional holes will be drilled to further define the location of the Vintage and Kinzers Formation along a north-south section and verify the geology to the north and south of Modern Landfill, if considered necessary. The preliminary locations of the holes, required in points 3 and 4, are shown on Figure 22.

5. The potential exists to use detailed seismic reflection geophysics to define the subsurface extent of the Vintage Formation dolomite. The

advice and recommendation of a geophysicist will be obtained to determine whether the use of this technique or other geophysics technique is feasible.

6. The orientation, spacing and characteristics of the fracture systems dissecting the rock mass, will be defined for each suitable outcrop studied by the geologic mapping exercise described above. Rock core samples taken from previous drillholes and obtained during the coring of drillholes described above will be examined and detailed fracture logs completed. This information will be plotted and used to help define the structural geology of the site and during analysis of the hydrogeology described in Task 1.6.

7. Detailed geologic maps and sections around the perimeter of the site will be drawn up.

3.7 Task 1.6 - Hydrogeologic Investigation

The hydrogeologic investigation as currently conceived will provide data for the definition of lateral and vertical extent of leachate migration, assessment of the effectiveness of the existing groundwater remediation system and determination of baseline conditions.

In order to achieve this, an analysis of the hydrogeologic parameters of the site will be completed. This will include:

1. Determination of the direction and magnitude of the forces driving the groundwater in both the regional and site specific contexts. This will require detailed analysis of the ground water levels and piezometric pressures and surficial water inventory (see Task 1.2). Additional wells will be installed outside the existing perimeter of the monitoring system to define gradients towards the extraction system.

2. Determination of the lateral and vertical variation of the hydraulic conductivity values for the hydrogeologic units at the site. Existing data and the effects of the existing groundwater

extraction system will be thoroughly evaluated to define the hydraulic conductivity values of the materials beneath the site. If necessary packer testing will be completed in all appropriate drillholes installed in Task 1.5 and additional piezometers to define the shape of the potentiometric surface carried by the groundwater extraction system..

3. The hydrogeology of the dolomite zone will be specifically addressed by this work. The techniques to be used during this work are discussed in Appendix F.

4. Simarily, if necessary, pump tests in existing wells, will be carried out to fully define the site characteristics.

5. Hydrogeologic cross sections indicating hydrogeologic units, groundwater levels and potentiometric contours will be developed along all boundaries of the landfill and facility, i.e. north, south, east, and west.

3.8 Task 1.7 - Environmental Sampling

This task involves groundwater, surface water, sediment and air sampling. As shown in Figure 8, there are presently 81 sampling points at Modern Landfill. Sixty-four of these points are groundwater sampling points while 17 are surface water sampling points. In order to further define the nature and extent of contamination, the sampling plan proposed for the Phase I RI will be comprised of two sub phases:

3.8.1 Phase IA Sampling

Twenty existing wells will be sampled to determine the nature of the groundwater chemistry. These wells are indicated on Figure 22. Samples taken from these wells will be tested for the full Target Compound List (TCL) using the CLP RAS techniques. Additionally, testing will be completed for uranium; thorium and molybdenum plus gross alpha, gross beta, Radium 226 and 228. A forward library scan will be completed and reviewed according to RAS techniques. All stream sediments taken during that round of sampling will be analyzed in the same manner. The remaining sampling points will be sampled for Priority Pollutant VOA's groundwater metals, other groundwater conventionals, and PCB's, herbicides, pesticides and radiological parameters gross alpha, gross beta, Radium 226 and 228. This program will aid in identifying additional groundwater consituents not presently detected.

3.8.2 PHASE IB Sampling

As discussed in Task 1.6 additional wells will be installed outside the perimeter of the present monitoring system. The potential locations of these wells are shown on Figure 22. The final depth and position of these wells will be defined by the results of the geologic and hydrogeologic studies, the Phase IA sampling program and the results of the current on-going groundwater monitoring program required by PADER under Solid Waste Permit No. 100113.

All sampling points will be analyzed for those appropriate TCL compounds based upon Phase IA results, development of key indicator parameters from Phase 1A and historical analytical data and the risks posed by those constituents, at a minimum VOA's and metals will be analyzed.

3.8.3 Sediment

Stream sediment sampling locations, one upstream and one downstream location on the east and west tributaries, and one location downstream of the confluence of these tributaries will be analyzed in Phase IA and IB (if appropriate).

This sampling plan will allow for the future monitoring of groundwater, surface water, and sediment (if necessary) to focus on constituents known to exist at Modern Landfill.

To determine the presence of significant gas release from Modern Landfill, air sampling will be completed by a thorough walk over of the site in a grid fashion (50 ft. spacing of traverse lines) using HNU, OVA and methane monitoring equipment, as appropriate, and all gas vents will be monitored as will all drill sites, test trenches and monitoring wells. If significant readings are registered on this equipment portable GC/MS equipment attached to an OVA will be used to characterize the gas releases. Analytic levels I and II are appropriate for this portion of the Work Plan.

3.9 Task 1.8 - Impact From the Identified Routes of Exposure

The identified route of exposure are groundwater, surface water and air. This task will determine the groundwater use in the local area around Modern Landfill. Additionally, a survey will be conducted of surface water uses and biota adjacent to and downstream of Modern Landfill if the results of the surface water sampling or sediment sampling indicate a potential for risk to these receptors. Based upon the results of the air sampling program, potential impacts will be evaluated for this pathway if it is determined that the gas releases form a risk (Task 1.11) to be at levels of risk via the Risk Assessment Task 1.11.

3.10 Task 1.9 - Effectiveness of Groundwater Extraction System

To determine if the groundwater extraction system is functioning as designed and is adequate to deal with the migration of leachate constituents from Modern Landfill, additional field data is required. This work task will focus on:

1. Continued and possibly additional monitoring of the groundwater systems as described above.

2. Development of a detailed mass balance/water budget for the site, via utilization of data on precipitation, evapotranspiration and surface runoff collected in Task 1.3. To determine stream flow in the tributaries, several stream gauges will be installed (see Figure 22).

3. Flow rates from the groundwater extraction systems are required for the NPDES discharge permit associated with the water treatment plant. These measurements would be coordinated with the collection of data in this Task.

Analysis will be made of the following item:

1. Changes in groundwater quality since pumping began.

2. The differences in the groundwater regime since pumping began.

3. The rate of effect of the extraction system on the groundwater quality.

4. The differences caused by the system to the various zones of groundwater quality identified, on a preliminary basis, in Section 2.3.1.2.

5. The influence of teh hydrogeology of teh area on the system.

By combining the hydrogeological data with this assessment of the effect of the extraction system it will be possible to analyze the baseline conditions of Modern Landfill. This in turn will allow determination of the relative effectiveness of the various remedial alternatives.

3.11 Task 1.10 - Data Analyses

All the data collected during the field investigation will be assimilated and the hydrogeologic interpretation presented in previous reports will be updated as necessary. Analyses regarding rates of migration of organic compounds and the potential for capture by the extraction wells of deeply-flowing organic compounds will be performed. All raw data will be tabulated, methods of analysis presented, assumptions discussed and the results presented in the Remedial Investigation Report.

3.12 Task 1.11 - Risk Assessment

A Risk Assessment will be performed as one of the last technical tasks of the Remedial Investigation. This sequencing is necessary since the concentration of leachate constituents and rate of movement through surface water and groundwater is required to model potential exposure levels to the surrounding population and environment. Additionally data gathered associated with the air sampling task, Task 1.7, will be evaluated. A Risk Assessment will be performed as outlined in the EPA Superfund Public Health Evaluation Manual (Reference 3, Appendix B). The Risk Assessment will include:

1. Identification of the potentially impacted population and ecosystems, including biota, farm animals, etc. and selection of indicator compounds.

2. Determination of the potential ranges of levels of exposure of the surrounding population and ecosystems.

3. Translation of the ranges of exposure levels to toxicological impacts, expressed as degree of increased risk of a given negative impact.

4. Comparison of estimated chemical concentrations for the baseline conditions with ARARs and, if necessary, a risk assessment of public health.

5. Development of remediation goals and estimation of risks associated with each remedial alternative.

The Risk Assessment to be performed at Modern Landfill will be based on two scenarios. The first scenario is the typical "no action" alternative. This assessment would quantify the risk of negative impacts if the existing remediation systems had not been installed. This first scenario will provide a baseline condition risk against which the risks resulting from various remediation alternatives can be compared.

The second scenario involves a risk assessment with the existing groundwater extraction and treatment system fully operational.

The reduction in risk of negative impacts to the surrounding population and environment from the baseline condition will be the standard by which the risk reduction of remediation alternatives will be compared.

The determination of target remediation concentrations will be based on applicable or relevant and appropriate chemical concentration standards, i.e., ARARs, (see Section 2.5), or will be based on a risk analysis to develop acceptable doses (ADs) for all pathways of exposure. Determination of ADs would be in accordance with EPA guidance (Reference 6 Appendix B) and SARA.

4.0 PHASE I FEASIBILITY STUDY

4.1 General Description

The Phase I Feasibility Study (FS) will be performed in accordance with the EPA Guidance Document (Reference 2 Appendix B) and SARA. As suggested in the current guidance, the Phase I FS will be conducted concurrently with the Phase I RI. The FS will include the development of alternatives that are appropriate for assessment under CERCLA, SARA and the National Contingency Plan. The degree to which the existing groundwater removal and treatment system is incorporated into the FS will depend upon the system's effectiveness.

4.2 Task 1.12 - Development of Remedial Alternatives

The development of remedial alternatives is the first task of the FS. The first step in this task will be to identify potential remedial measures and their associated containment, treatment, and disposal (i.e. discharge) methodologies. Measures will then be prescreened for suitability as part of alternatives. The various measures will then be assembled into combinations of alternatives. Alternatives will be identified that address each general response action listed in Section 2.6. As required by CERCLA, remedial alternatives will be considered that, to the maximum extent practicable, utilize permanent solutions and alternative technologies. To the extent possible, treatment options will range from alternatives that eliminate the need for long term management at the site to alternatives involving treatment that would reduce toxicity, mobility, and volume as a principal goal. Additionally, at least one remedial alternative will be identified in each of the following categories as required by EPA document "Guidance on Feasibility Studies under CERCLA" June 1985 (Reference 2 Appendix B):

1. Alternatives for treatment, containment, or disposal at an off-site facility.

2. Alternatives that attain applicable or relevant and appropriate Federal and State public health and environmental requirements, (i.e.,ARARS).

3. Alternatives that exceed applicable or relevant and appropriate Federal and State public health and environmental requirements (i.e., ARARS).

4. Alternatives that do not attain applicable or relevant and appropriate Federal public health and environmental requirements (ie., ARARS), but will

reduce the likelihood of present or future threats to public health, welfare, and the environment.

5. Stop action alternative (shut down of the existing remediation system).

In addition, on-site remedial measures will be fully investigated as required by SARA.

Remedial alternatives will be identified that address the operable units: groundwater, surface water, soil/sediment, gas releases, and the waste source. Remedial alternatives may address individual or sets of operable units.

4.3 Task 1.13 - Phase I Remedial Investigation/Feasibility Report

The Draft Phase I RI/FS Report will be prepared following completion of the site investigation, the risk assessment, and the development of remedial alternatives. The report will contain all the information from the data review and the details and results of the field investigation, an analysis of the effectiveness of the current groundwater extraction system, and a range of additional alternatives. The report will also identify additional data gaps if any. The data quality objectives for Phase I activities will be reviewed and modified as necessary for any additional data collection activities.

4.4 Task 1.14 - Review Meeting and Final Report Preparation

Following submittal of the Draft Phase I RI/FS Report, a review meeting will be held between Modern, PADER, EPA and the project consultant team. The objective of the meeting will be to review the Draft RI/FS Report conclusions and recommendations and to reach agreement regarding the scope of the Phase II Feasibility Study and Phase II Remedial

Investigation. In the event that the Report concludes that contamination is bypassing the current groundwater extraction system, the meeting will focus on the types of remedial alternatives to be screened in the Phase II Feasibility Study and if it is possible to integrate the current system in any new systems.

Following the meeting, the final Phase I RI/FS Report will be prepared. It is also anticipated that a public information meeting will be held to provide information regarding the findings of the investigation to any interested parties.

5.0 PHASE II FEASIBILITY STUDY

5.1 Task 2.1 Initial Screening

Once identified, the potential remedial alternatives will be screened to determine which alternatives are considered feasible. This initial screening will use the following criteria:

1. Reliability, effectiveness and technical feasibility of alternatives.
2. Attainment of Federal and State ARARS or other applicable criteria.
3. Potential adverse public health or environmental effects of the remedy.
4. Order-of-magnitude cost estimates for capital costs and operation/maintenance costs in present-worth value.

The screening process will be documented by way of a brief description of the anticipated performance of each remedial alternative with respect to the above criteria. An Initial Screening Report will be prepared which presents the remedial alternatives and an analysis of how all ARARs would impact each potential remedial alternative. This report will be submitted to PADER and EPA for evaluation and comment. Remedial alternatives will be evaluated in detail and the rationale for eliminating the remaining alternatives will be presented. This report will also identify any technical data required to perform the detailed evaluation.

After submittal of the Initial Screening Report, a review meeting will be held between Modern, PADER, EPA and the project consultant team. The objective of this meeting will be to finalize the list of remedial alternatives for detailed evaluation. If additional technical or economic data is necessary to perform the detailed evaluation, the scope of the study work plan would be decided during the meeting.

Further RI/FS activities will not be undertaken until PADER and EPA approve the Initial Screening Report and the additional work tasks identified.

6.0 PHASE II REMEDIAL INVESTIGATIONS

6.1 Task 2.2 - Collect Additional Data

Additional data may be necessary to support the detailed evaluation of the feasible remedial alternatives. This data might include information related to cost, public health risks, environmental impacts and technical literature. In addition further information may be required regarding details of geology, hydrogeology, and extent of contamination. Pilot and/or bench scale treatability studies may also be performed. As identified the Phase I RI/FS such necessary data would be collected, analyzed and summarized in this task.

7.0 PHASE III FEASIBILITY STUDY

7.1 Task 3.1 - Evaluate Feasible Remedial Alternatives

A detailed analysis will be performed for each of the feasible remedial alternatives or groups of alternatives. In conducting this analysis the site specific conditions, nature of the waste and inherent limitations, as well as the ability of each alternative to meet ARARs will be taken into account. The following steps and factors will be included in this analysis:

1. Refine the conceptual design of the alternative and identify the individual components.
2. Prepare the conceptual design drawings to the extent that material quantities can be determined.
3. Define other aspects of the alternative such as transportation, safety issues, regulatory and permitting issues, and storage/disposal capacity availability.
4. Present value and cost sensitivity analysis of capital and operating/maintenance costs will be performed for each remedial alternative for cost effectiveness comparison purposes.
5. List the potentially short and long term adverse public health and/or environmental effects of the alternative.
6. Identify any problems or concerns related to constructibility, reliability or effectiveness of the alternative.
7. Consideration of the long term uncertainties of land disposal.
8. Consideration of the goals and requirements of the Solid Waste Disposal Act.
9. The persistence, toxicity, mobility, and bioaccumulation of contaminants at the site.
10. The potential for future remedial action costs if the remedy fails.

11. The potential threat to human health and the environment from the excavation, transportation, and redisposal or containment of hazardous substances, pollutants, or contaminants.

12. Perform a risk assessment of each alternative and compare to the risks associated with the "no action" alternative and the risks associated with continued operation of the current remedial action including the groundwater extraction system.

To the extent possible, remedial alternatives that use permanent solutions and alternative treatment technologies or resource recovery technologies will be considered. Each of the feasible remedial alternatives will be ranked along with the "no action" and "existing" remedial alternatives.

7.2 Task 3.2 - Prepare Draft Feasibility Study Report

A Draft Feasibility Study Report will be prepared following completion of the technical evaluation and risk assessment of each alternative. The format and outline for the Draft FS Report will be the one presented in "Guidance on Feasibility Studies Under CERCLA", EPA/540/G-85/003, June 1985. The report will present the detailed evaluation information for each alternative. The alternatives will be ranked, but the final remedial alternative will not be recommended. The draft report will be submitted to EPA and PADER for review and approval, with a request for notification of applicable standards. A meeting will be held between Modern, EPA, PADER and the project consultant team, collectively, to review the draft report. Subsequently, a public meeting will be held, followed by a public comment period.

7.3 Task 3.3 - Prepare Final Feasibility Study Report

The Final Feasibility Report will be prepared at the conclusion of the public comment period. The format and outline for the Final FS report will be the same as the Draft. In addition, a Responsiveness Summary will be included at the end, which summarize all comments, received from EPA, PADER and the public on the Draft Report and actions taken in response to those comments if any. The final report will present the recommended remedial alternative. The Final FS Report will be subject to the approval of EPA and PADER.

8.0 PROJECT MANAGEMENT AND TIME SCHEDULE

8.1 Management Structure

Modern will perform the RI/FS outlined in this Work Plan pursuant to the November 4, 1987 COA approved by EPA and entered into between Modern and PADER. EPA is expected to serve in a review and advisory role to PADER. Thus, Modern will provide EPA copies of all information submitted to PADER, following which, PADER will solicit EPA's comments and make copies of these comments available to Modern. All PADER determinations with respect to the RI/FS shall be consistent with comments received from EPA. The COA serves as the legal framework by which the RI/FS is performed.

The RI/FS will be performed by a team of consultants/contractors retained by Modern with assistance from Modern personnel. Modern will have the authority to direct the activities of the RI/FS team within the guidelines of the COA. The RI/FS team structure, including regulatory reviewers, is shown in Figure 23.

Upon receipt of authorization to proceed with this Work Plan, Modern will solocite and obtain the services of a consultant/contractor to complete the Work Plan. Prior to initiating the actual work, the company and key personnel to be involved in the work will be identified to PADER and, to the extent required by the COA, the experience and qualifications of key personnel provided to PADER for approval. Until that time, it will not be possible to identify specific individuals and their responsibilities except for the personnel of the Contract Laboratory, Environmental Testing Certification Corporation (ETC) who will be involved with testing of samples obtained at Modern. Resumes and the organizational chart for ETC are supplied in Appendix F1.

8.2 Time Schedule

The RI/FS time schedule is contingent upon several key events. Modern is, however, committed to proceeding with the RI/FS in an expedient manner. The key events are listed below:

1. PADER and EPA review and approval of this Work Plan by the dates indicated in Section 1.2.
2. Scheduling of the Feasibility Study Report public presentation and the length of the Public Comment Period.
3. Final PADER and EPA approval of the selected remedial alternative.

Based on reasonable assumptions for the scheduling and duration of these key events, the time schedule shown in Figure 24 has been prepared. It should be noted that delays caused by any of the above items or other key project milestones may result in delay of subsequent tasks.

As discussed earlier in this section, it is important to note that this is a phased RI/FS. The only portion of any schedule referenced herein that should be viewed as "firm" is Phase I of the Remedial Investigation and Feasibility Study. The scope of work for subsequent phases of activity will contain an updated schedule which will be submitted to PADER for approval. In this manner, the RI/FS activities will be performed within a workable, PADER-approved schedule.

Well No.	January (gal)	February (gal)	March (gal)	April (gal)	May (gal)	June (gal)	July (gal)	August (gal)	September (gal)	October (gal)	November (gal)	December (gal)	Daily Average (gal)
W-1	34,900	85,107	114,356	64,058	76,562	96,980	31,504	71,193	86,043	46,477	42,489	77,819	2,267
W-3	19,940	23,112	23,867	20,820	19,887	15,202	11,780	10,674	11,980	13,173	12,832	19,716	556
W-4	148,870	167,541	197,233	167,081	175,413	140,796	136,922	121,603	129,284	126,712	117,828	160,561	4,904
W-5	97,380	124,485	128,900	102,894	46,576	73,015	112,605	102,965	74,518	82,906	74,606	95,873	3,060
W-7	216,310	0	50	66,320	351,208	371,064	324,003	202,055	262,959	253,678	218,414	265,013	6,904
W-8	123,340	172,276	404,381	337,315	383,917	257,564	131,147	120,322	85,868	67,678	104,968	243,072	6,663
W-9	107,690	163,380	191,257	168,279	151,759	107,481	84,665	70,156	68,765	70,260	87,804	141,302	3,871
W-10	54,320	131,129	152,434	133,648	136,520	111,455	96,055	88,570	100,194	64,870	86,141	116,618	3,485
W-11	0	123,110	518,890	324,150	375,528	224,627	211,121	210,912	197,924	211,297	195,408	304,001	7,937
W-12	659,080	685,160	744,992	662,823	664,164	579,658	523,687	512,005	531,561	580,176	519,782	653,956	20,047
W-13	182,020	217,840	261,751	246,046	260,876	232,800	197,726	172,659	160,677	160,416	148,919	119,735	6,473
B-20	231,140	292,612	241,056	284,199	284,684	232,257	196,238	206,793	127,551	183,812	214,419	309,006	7,682
Collection Trench	322,955	770,835	568,350	701,480	273,280	131,700	115,240	20,665	3,355	3,019	251,129	522,858	10,096
Total	2,198,945	2,956,587	3,547,517	3,279,113	3,200,374	2,574,599	2,172,693	1,910,622	1,840,679	1,864,474	2,074,739	3,029,530	

TOTAL FOR THE YEAR 30,649,872 gallons

Monthly Average 2,554,156 gallons

Daily Average 83,972 gallons

131557

JOB NO. 863-6020	SCALE N/A	MONTHLY YIELD OF THE WESTERN PERIMETER GROUNDWATER COLLECTION SYSTEM DURING 1986	
DRAWN MRM	DATE 12/5/87		
CHECKED	DWG. NO. 863-6020.25		
Golder Associates		MODE[illegible] AR300487	TABLE 1

Well No.	November* (Gal)	December (Gal)
W-21	7,484	46,977
W-23	128,908	539,815
W-34	233,118	845,769
W-35	19,131	146,585
W-36	167,272	338,290
W-37	12,725	26,408
W-38	15,726	40,623
W-39	8,502	24,873
W-40	33,552	77,330
W-41	44,320	103,249
W-43	130,977	315,350
W-44	161,928	485,992
W-45	65,221	172,409
	1,028,864	3,163,670

TOTAL FOR THE YEAR - 4,192,534 gallons

Daily average - 104,813 gallons

* Pumping began 11/22/86

OB NO. 863-6020	SCALE N/A	MONTHLY YIELD OF THE EASTERN PERIMETER GROUNDWATER COLLECTION SYSTEM DURING 1986	
DRAWN MRM	DATE 12/5/87		
CHECKED	DWG NO. 863-6020.26		
Golder Associates		MODERN LANDFILL	TABLE 2

131557

TABLE 3
LIST OF WELLS, BORINGS AND GAS VENTS

BORING DRILLHOLE WELL OR GAS VENT NO.	APPENDIX LISTING OF LOG	DATE DRILLED	DEPTH	DRILLING METHOD USED	STATUS OF HOLE
A-1	C	/ /	145.0	---	------
A-2	C	/ /	75.0	---	------
A-3	C	11/17/81	61.4	---	------
A-4	C	11/17/81	101.0	---	Decommissioned
A-5	C	07/07/82	54.0	---	Decommissioned
A-6	C	/ /	46.2	---	------
B- 1	C	03/24/86	55.0	air rotary	Decommissioned
B- 1 (S,D)	--	/ /	--	---	------
B- 2	C	/ /	60.0	air rotary	------
B- 3	C	03/29/85	98.0	air rotary	------
B- 3A	C	/ /	220.0	air rotary	------
B- 4	C	05/28/74	30.0	---	------
B- 7	C	05/21/74	21.0	---	------
B- 8	C	05/21/74	25.0	---	------
B- 9	C	05/29/74	35.0	---	------
B-10	C	05/24/74	30.0	---	------
B-11	C	05/20/74	25.0	---	------
B-12	C	05/24/74	51.5	---	------
B-15	--	/ /	--	---	Decommissioned
B-15R	--	/ /	--	---	------
B-16	--	/ /	--	---	------
B-17	--	/ /	--	---	------
B-18	C	/ /	65.0	air rotary	Decommissioned
B-19	--	/ /	--	---	------
B-20	D	/ /	32.0	air rotary	Active
B-21	--	/ /	--	---	------
B-22 (S,D)	--	/ /	--	---	------
B-23 (S,D)	--	/ /	--	---	------
B-25	--	/ /	--	---	------
B-27	--	/ /	--	---	------
B-28	--	/ /	--	---	------
B-29	--	/ /	--	---	------
B-30 (D,I)	--	/ /	--	---	------
B-30 (S)	C	09/15/86	30.0	air rotary	Decommissioned
B-31(S,I,D)	--	/ /	--	---	Decommissioned
C- 1	C	10/11/83	37.0	---	Decommissioned
C- 1A	C	10/13/83	13.1	---	------
C- 2	C	10/14/83	35.0	---	------
C- 2A	C	10/17/83	25.0	---	------
C- 3	C	10/17/83	20.0	---	Decommissioned
C- 4	C	10/11/83	30.0	---	Decommissioned
C- 5	C	10/07/83	38.9	---	Decommissioned
C- 6	C	10/05/83	30.0	---	------
C- 7	C	10/10/83	30.1	---	------
C- 8	C	10/04/83	34.0	---	Decommissioned
C- 9	C	09/29/83	31.4	soilbore/rxcore	Decommissioned

rxcore = rock core drilling

TABLE 3
LIST OF WELLS, BORINGS AND GAS VENTS

BORING DRILLHOLE WELL OR GAS VENT NO.	APPENDIX LISTING OF LOG	DATE DRILLED	DEPTH	DRILLING METHOD USED	STATUS OF HOLE
C-10	C	09/28/83	30.0	soilbore/rxcore	------
C-11	C	09/26/83	30.0	soilbore/rxcore	------
C-12	C	09/22/83	60.0	soilbore,rxcore	------
C-13	C	09/23/83	60.8	soilbore/rxcore	------
C-13A	C	09/26/83	8.9	---	------
C-14	C	10/05/83	57.5	---	Decommissioned
C-15	C	10/06/83	60.0	---	Decommissioned
C-16	C	10/19/83	60.6	---	------
C-16(D)	--	10/20/86	60.6	---	Decommissioned
C-16(S)	--	10/21/83	35.0	---	Decommissioned
C-16A	C	10/19/83	35.0	---	------
C-17	C	10/07/83	43.0	---	Decommissioned
C-18 (D)	C	01/29/85	49.0	soilbore/rxcore	------
C-18 (S)	C	01/29/85	30.0	soil boring	------
C-19 (D)	C	02/06/85	47.0	soilbore/rxcore	------
C-19 (S)	C	01/30/85	34.0	soilbore/rxcore	------
C-20	C	02/02/86	145.0	soilbore/rxcore	Decommissioned
C-21	C	02/10/86	110.0	soilbore/rxcore	------
C-22	C	02/14/86	150.0	soilbore/rxcore	Decommissioned
C-23	C	03/06/86	169.0	soilbore/rxcore	------
C-24	C	03/06/86	289.0	soilbore/rxcore	------
C-28	C	03/07/86	61.5	soilbore/rxcore	------
C-28A	C	03/12/86	72.0	soilbore/rxcore	------
C-29	C	03/14/86	150.0	soilcore/rxbore	Decommissioned
C-30	C	03/11/86	72.0	---	Decommissioned
Druck	C	/ /	170.0	---	Decommissioned
Dug Well	--	/ /	?	---	Decommissioned
E- 1	C	05/22/84	37.0	air track	Decommissioned
E- 2	C	05/22/84	31.0	air track	Decommissioned
E- 3	C	05/22/84	22.0	air track	------
E- 4	C	05/22/84	25.0	air track	------
E- 5	C	05/22/84	32.0	air track	Decommissioned
E- 6	C	05/22/84	39.0	air track	------
E- 7	C	05/22/84	22.0	air track	------
E- 8	C	05/23/84	28.0	air track	Decommissioned
E- 9	C	05/23/84	29.0	air track	Decommissioned
E-10	C	05/23/84	39.0	air track	------
E-11	C	05/23/84	39.0	air track	------
E-12	C	05/24/84	39.0	air track	------
E-13	C	05/24/84	29.0	air track	Decommissioned
E-14	C	05/24/84	33.0	air track	Decommissioned
E-15	C	05/24/84	30.0	air track	Decommissioned
E-16	C	05/24/84	40.0	air track	Decommissioned
E-17	C	06/03/85	30.0	air track	Decommissioned
E-18	C	06/03/85	29.0	air track	Decommissioned
E-19	C	06/03/85	36.0	air track	------

rxcore = rock core drilling

TABLE 3
LIST OF WELLS, BORINGS AND GAS VENTS

BORING DRILLHOLE WELL OR GAS VENT NO.	APPENDIX LISTING OF LOG	DATE DRILLED	DEPTH	DRILLING METHOD USED	STATUS OF HOLE
E-20	C	06/03/85	36.0	air track	------
E-21	C	06/03/85	36.0	air track	------
E-22	C	06/03/85	36.0	air track	------
E-23	C	06/03/85	41.0	air track	------
E-24	C	06/03/85	36.0	air track	------
E-25	C	06/04/85	36.0	air track	------
E-26	C	06/04/85	36.0	air track	Decommissioned
E-27	C	06/04/85	36.0	air track	------
E-28	C	06/04/85	36.0	air track	------
E-29	C	06/06/85	36.0	air track	------
E-30	C	06/05/85	30.0	air track	------
E-31	C	06/05/85	36.0	air track	------
E-32	C	06/05/85	33.0	air track	------
E-33	C	06/05/85	36.0	air track	Decommissioned
E-34	C	06/05/85	24.0	air track	------
E-35	C	06/05/85	42.0	air track	Decommissioned
E-36	C	06/05/85	36.0	air track	Decommissioned
E-37	C	07/30/85	36.0	air track	------
E-38	C	07/30/85	30.0	air track	------
E-39 (D)	C	07/30/85	30.0	air track	------
E-39 (S)	C	07/30/85	12.0	air track	------
E-40	C	03/24/86	42.0	air track	Decommissioned
E-41	C	03/24/86	43.0	air track	Decommissioned
E-42	C	03/24/86	43.0	air track	Decommissioned
E-43	C	03/24/86	42.0	air track	Decommissioned
E-44	C	03/24/86	42.0	air track	Decommissioned
Gas T 1	C	/ /	40.0	---	Active
Gas T 2	C	/ /	76.5	---	Active
Gas T 3	C	/ /	60.5	---	Active
Gas T 4	C	/ /	36.5	---	Active
Gas T 5	C	/ /	11.5	---	Active
Gas T 6	C	/ /	35.0	---	Active
Gas T 7	C	/ /	49.5	---	Active
Gas T 8	--	/ /	--	---	Active
Gas T 9	C	/ /	--	---	Active
Gas T10	--	/ /	--	---	Active
Gas T11	C	/ /	14.0	---	Active
Gas T13	--	/ /	--	---	Active
Gas T14	C	/ /	26.5	---	Active
Gas T15	--	/ /	--	---	Active
Gas T16	--	/ /	--	---	Active
Gas T17	--	/ /	--	---	Active
Gas T18	--	/ /	--	---	Active
Gas T19	--	/ /	--	---	Active
Gas T20	--	/ /	--	---	Active
Gas T21	--	/ /	--	---	Active

TABLE 3
LIST OF WELLS, BORINGS AND GAS VENTS

BORING DRILLHOLE WELL OR GAS VENT NO.	APPENDIX LISTING OF LOG	DATE DRILLED	DEPTH	DRILLING METHOD USED	STATUS OF HOLE
Gas T22	--	/ /	--	---	Active
Gas T23	--	/ /	--	---	Active
Gas T24	--	/ /	--	---	Active
Gas W 1	C	07/17/86	29.0	36"bucket auger	Active
Gas W 2	C	07/17/86	42.0	36"bucket auger	Active
Gas W 3	C	07/17/86	65.0	36"bucket auger	Active
Gas W 4	C	07/18/86	44.0	36"bucket auger	Active
Gas W 5	C	07/17/86	29.5	36"bucket auger	Active
Gas W 6	C	07/17/86	36.0	36"bucket auger	Active
Gas W 7	C	07/17/86	41.0	36"bucket auger	Active
Gas W 8	C	07/16/86	30.5	36"bucket auger	Active
Gas W 9	C	07/15/86	23.0	36"bucket auger	Active
Gas W10	C	07/15/86	23.5	36"bucket auger	Active
Gas W11	C	07/14/86	48.0	36"bucket auger	Active
Gas W12	C	07/15/86	30.0	36"bucket auger	Active
Gas W13	C	07/15/86	12.0	36"bucket auger	Active
Gas W14	C	07/19/86	10.0	36"bucket auger	Active
GasMW- 1	C	/ /	42.1		Decommissioned
GasMW- 2	C	/ /	42.8		Decommissioned
GasMW- 3	C	/ /	41.0		Decommissioned
GasMW- 4	C	/ /	44.1		Decommissioned
GasMW- 5	C	/ /	44.6		Decommissioned
GasMW- 6	C	/ /	44.5		Decommissioned
GasMW- 7	C	/ /	42.0		Decommissioned
GasMW- 8	C	/ /	42.0		Decommissioned
GasMW- 9	C	/ /	43.0		Decommissioned
GasMW-10	C	/ /	42.4		Decommissioned
GasMW-11	C	/ /	42.0		Decommissioned
GasMW-12	C	/ /	44.9		Decommissioned
GasMW-13	C	/ /	42.5		Decommissioned
GasMW-14	C	/ /	39.0		Decommissioned
GasMW-15	C	/ /	43.5		Decommissioned
GasMW-16	C	/ /	44.2		Decommissioned
GasMW-17	C	/ /	43.0		Decommissioned
GasMW-18	C	/ /	42.7		Decommissioned
GasMW-19	C	/ /	42.0		Decommissioned
GasMW-20	C	/ /	42.3		Decommissioned
GasMW-21	C	/ /	43.8		Decommissioned
GasMW-22	C	/ /	42.5		Decommissioned
GasMW-23	C	/ /	41.7		Decommissioned
GasMW-24	C	/ /	42.0		Decommissioned
GasMW-25	C	/ /	42.8		Decommissioned
GasMW-26	C	/ /	--		Decommissioned
GasMW-27	C	/ /	42.4		Decommissioned
GasMW-28	C	/ /	41.0		Decommissioned
GasMW-29	C	/ /	42.4		Decommissioned

TABLE 3
LIST OF WELLS, BORINGS AND GAS VENTS

BORING DRILLHOLE WELL OR GAS VENT NO.	APPENDIX LISTING OF LOG	DATE DRILLED	DEPTH	DRILLING METHOD USED	STATUS OF HOLE
GasMW-30	C	/ /	42.9		Decommissioned
GasMW-31	C	/ /	42.7		Decommissioned
GasMW-32	C	/ /	42.5		Decommissioned
GasMW-33	C	/ /	42.6		Decommissioned
GasMW-34	C	/ /	41.8		Decommissioned
GasMW-35	C	/ /	38.9		Decommissioned
GasMW-36	C	/ /	--		No Record
GasMW-37	C	/ /	40.4		Decommissioned
GasMW-38	C	/ /	39.6		Decommissioned
GasMW-39	C	/ /	42.4		Decommissioned
GasMW-40	C	/ /	41.9		Decommissioned
GasMW-41	C	/ /	40.9		Decommissioned
GasMW-42	C	/ /	42.6		Decommissioned
GasMW-43	C	/ /	51.2		Decommissioned
GasMW-44	C	/ /	45.5		Decommissioned
GasMW-45	C	/ /	37.1		Decommissioned
GasMW-46	C	/ /	39.6		Decommissioned
GasMW-47	C	/ /	38.2		Decommissioned
GasMW-48	C	/ /	39.1		Decommissioned
GasMW-49	C	/ /	44.7		Decommissioned
GasMW-50	C	/ /	43.2		Decommissioned
GasMW-51	C	/ /	41.4		Decommissioned
GasMW-52	C	/ /	40.1		Decommissioned
GasMW-53	C	/ /	35.4?		Decommissioned
GasMW-54	C	/ /	41.0		Decommissioned
GasMW-55	C	/ /	41.1		Decommissioned
GasMW-56	C	/ /	41.5		Decommissioned
GasMW-57	C	/ /	41.1		Decommissioned
GasMW-58	C	/ /	33.5?		Decommissioned
GasMW-59	C	/ /	40.4		Decommissioned
GasMW-60	C	/ /	42.4		Decommissioned
HC-31	C	04/01/86	64.1	HSauger,wireline	-------
HC-32	C	04/04/86	149.0	HSauger,wireline	------
HC-33	C	04/09/86	148.0	HSauger,wireline	------
HC-34	C	04/04/86	100.0	dr.case/rollbit	------
HC-35	C	04/04/86	47.0	rollerbit,core	------
MD103S	D	01/08/87	32.4	air rotary	Active
MD104I	D	09/04/86	130.7	air rotary	Active
MD105D	D	10/03/86	231.5	air rotary	Active
MD106	D	09/19/86	84.4	air rotary	Active
MD107S	D	01/07/87	31.9	air rotary	Active
MD108I	D	09/04/86	129.7	air rotary	Active
MD109D	D	09/09/86	234.6	air rotary	Active
MD110	D	09/30/86	55.2	air rotary	Active
MD111	D	09/16/86	53.0	air rotary	Active
MD112S	D	08/19/86	65.0	air rotary	Active

TABLE 3
LIST OF WELLS, BORINGS AND GAS VENTS

BORING DRILLHOLE WELL OR GAS VENT NO.	APPENDIX LISTING OF LOG	DATE DRILLED	DEPTH	DRILLING METHOD USED	STATUS OF HOLE
MD113D	D	08/18/86	159.2	air rotary	Active
MD114S	D	08/18/86	68.0	air rotary	Active
MD115D	D	08/15/86	168.2	air rotary	Active
MD116S	D	08/20/86	57.1	air rotary	Active
MD117D	D	08/19/86	153.0	air rotary	Active
MD118	D	01/19/86	75.0	air rotary	Active
MD119	D	08/24/86	77.5	air rotary	Active
MD120	D	02/25/87	75.0	air rotary	Active
MD121	D	08/23/86	89.1	air rotary	Active
MD122S	D	08/23/86	70.0	air rotary	Active
MD123I	D	08/28/86	183.5	air rotary	Active
MD124D	D	09/17/86	281.7	air rotary	Active
MD130S	D	07/18/85	30.0	air rotary	Active
MD131I	D	09/10/86	133.5	air rotary	Active
MD132D	D	09/15/86	229.7	air rotary	Active
MD133	D	09/18/86	95.1	air rotary	Active
MD134S	D	09/10/86	30.0	air rotary	Active
MD135I	D	09/09/86	132.7	air rotary	Active
MD136D	D	09/12/86	232.2	air rotary	Active
MD137	D	09/20/86	95.0	air rotary	Active
MD138	D	08/25/86	75.4	air rotary	Active
MU101	D	01/08/87	82.8	air rotary	Active
MU102	D	08/15/86	70.0	air rotary	Active
MU102A	D	12/29/86	100.0	air rotary	Active
MU125	D	09/29/86	83.0	air rotary	Active
MU127	D	09/16/86	102.2	air rotary	Active
MU128	D	08/23/85	75.0	air rotary	Active
P- 1	--	/ /	--	--	Decommissioned
P- 2	--	/ /	--	--	Decommissioned
P- 3	--	/ /	--	--	Decommissioned
P- 4	--	/ /	--	--	Decommissioned
P- 5	--	/ /	--	--	Decommissioned
P- 6	--	/ /	--	--	--
P- 7	--	/ /	--	--	Decommissioned
P- 8 (S,D)	--	/ /	--	--	Decommissioned
P- 9	--	/ /	--	--	Decommissioned
P-10	--	/ /	--	--	Decommissioned
P-11	--	/ /	--	--	Decommissioned
P-12 (S,D)	--	/ /	--	--	Decommissioned
P-13	--	/ /	--	--	--
P-14	--	/ /	--	--	Decommissioned
P-15	--	/ /	--	--	--
P-16	--	/ /	--	--	--
P-17	--	/ /	--	--	Decommissioned
P-18	--	/ /	--	--	Decommissioned
PR-1	--	/ /	--	--	Decommissioned

TABLE 3
LIST OF WELLS, BORINGS AND GAS VENTS

BORING DRILLHOLE WELL OR GAS VENT NO.	APPENDIX LISTING OF LOG	DATE DRILLED	DEPTH	DRILLING METHOD USED	STATUS OF HOLE
PR-2	--	/ /	--	---	Decommissioned
PR-3	--	/ /	--	---	Decommissioned
W- 1	D	03/01/84	45.0	air rotary	Active
W- 2	C	03/01/84	73.0	air rotary	Decommissioned
W- 3	D	03/02/84	49.0	air rotary	Active
W- 4	D	06/08/84	48.0	air rotary	Active
W- 5	D	06/11/84	54.0	air rotary	Active
W- 6	C	06/11/84	98.0	air rotary	Decommissioned
W- 7	D	06/13/84	97.0	air rotary	Active
W- 8	D	06/21/84	51.0	air rotary	Active
W- 9	D	06/18/84	98.0	air rotary	Active
W-10	D	06/19/84	53.0	air rotary	Active
W-11	D	06/15/84	51.0	air rotary	Active
W-12	D	06/15/84	50.0	air rotary	Active
W-13	D	07/09/84	98.0	air rotary	Active
W-14	C	07/10/84	123.0	air rotary	Decommissioned
W-15	C	07/11/84	200.0	air rotary	Decommissioned
W-16	C	02/07/85	175.0	air rotary	Decommissioned
W-17	C	02/08/85	125.0	air rotary	Decommissioned
W-18	C	01/24/85	172.0	air rotary	Decommissioned
W-19	C	01/25/85	147.0	air rotary	Decommissioned
W-20	C	01/24/85	147.0	air rotary	Decommissioned
W-21	D	02/05/85	97.0	air rotary	Active
W-22	C	02/06/85	75.0	air rotary	------
W-23	D	01/28/85	72.0	air rotary	Active
W-24	C	01/30/85	72.0	air rotary	------
W-25	C	01/29/85	48.0	air rotary	------
W-26	C	06/11/85	200.0	air rotary	Decommissioned
W-26 (D)	C	03/13/86	268.0	air rot./rxcore	Decommissioned
W-26 (I)	C	08/12/85	148.0	air rotary	Decommissioned
W-26 (S)	C	06/11/85	48.0	air rotary	Decommissioned
W-27	C	06/14/85	201.0	air rotary	------
W-27 (D)	C	08/05/85	230.0	air rotary	Decommissioned
W-27 (I)	C	07/24/85	130.0	air rotary	Decommissioned
W-27 (S)	C	07/24/85	30.0	air rotary	------
W-28	C	06/13/85	297.0	air rotary	Decommissioned
W-28 (D)	C	08/16/85	280.0	air rotary	Decommissioned
W-28 (I)	C	08/05/85	180.0	air rotary	Decommissioned
W-28 (S)	C	07/26/85	70.0	air rotary	------
W-29	C	06/12/85	200.0	air rotary	Decommissioned
W-29 (D)	C	07/25/85	230.0	air rotary	Decommissioned
W-29 (I)	C	07/10/85	130.0	air rotary	Decommissioned
W-29 (S)	C	07/18/85	30.0	air rotary	------
W-31	D	12/04/86	85.0	air rotary	Active
W-32	D	12/05/86	75.0	air rotary	Active
W-34	D	12/20/85	80.0	air rotary	Active

rxcore = rock core drilling

TABLE 3
LIST OF WELLS, BORINGS AND GAS VENTS

BORING DRILLHOLE WELL OR GAS VENT NO.	APPENDIX LISTING OF LOG	DATE DRILLED	DEPTH	DRILLING METHOD USED	STATUS OF HOLE
W-35	D	11/21/85	75.0	air rotary	Active
W-36	D	11/21/85	75.0	air rotary	Active
W-37	D	06/24/85	75.0	air rotary	Active
W-38	D	11/27/85	75.0	air rotary	Active
W-39	D	12/16/85	75.0	air rotary	Active
W-40	D	12/18/85	75.0	air rotary	Active
W-41	D	12/19/85	75.0	air rotary	Active
W-43	D	01/02/86	75.0	air rotary	Active
W-44	D	06/24/85	75.0	air rotary	Active
W-45	D	12/31/85	75.0	air rotary	Active
W-52	C	01/19/86	75.0	air rotary	------
W-53	C	08/23/85	75.0	air rotary	------
W-54	C	06/26/85	50.0	air rotary	Decommissioned
W-55	C	06/13/85	73.0	air rotary	Decommissioned
W-56	C	12/30/85	85.0	air rotary	Decommissioned
W-57	C	01/19/85	62.0	---	Decommissioned
W-58	D	12/05/86	85.0	air rotary	Active
W-59	D	12/08/86	90.0	air rotary	Active
W-60	C	01/16/87	85.0	cable tool	------
W-60A	D	12/19/86	100.0	air rotary	Active
W-61	C	06/25/85	200.0	air rotary	Decommissioned
W-62	D	08/18/86	75.0	air rotary	Active
W-63	D	08/19/86	75.0	air rotary	Active
W-64	D	08/19/86	75.0	air rotary	Active
new well	--	/ /	--	---	Decommissioned
old well	--	/ /	--	---	Decommissioned

TABLE 4

HYDRAULIC CONDUCTIVITY AND PUMP TESTING METHODS

Well/Borehole #'s	Location	Date	Type of Test Performed
W-23, W-18 W-21	Eastern Perimeter	5/85	4 hr Step drawdown pump test and 24 hour constant rate pump test
W-44, W-37 W-26(S)	Eastern Perimeter	10/85	24 hr pump test
E-5, E-6, E-7, E-8 W-14	Western Perimeter	8/84	Slug test
E-1, E-2	Western Perimeter	8/84	Falling head test
W-4, W-5, W-7 W-8, W-9, W-10 W-11, W-12, W-13	Western Perimeter	8/84	4 hr Step drawdown pump test and 24 hr constant rate pump test
W-15	Western Perimeter	8/84	Rising head test
B-18, W-21, W-23 W-31, W-32, W-34 W-35, W-36, W-37 W-38, W-39, W-40 W-41, W-43, W-44 W-45, W-58, W-59 W-60	Eastern Perimeter	4/87	4 hr Step drawdown pump test and 24 hr. constant rate pump test
Well 1, Well 3 B-20	Western Perimeter	5/84	4 hr Step drawdown and constant rate pump test.
All MU and MD series wells except, MU102, MU102A, MD118 and MD122(S)	Sitewide	9/86 - 10/86	Rising head test

TABLE 5

TRANSMISSIVITY OF DIFFERENT ROCK STRATA

FORMATION	ROCK TYPE	NO. SAMPLE	TRANSMISSIVITY RANGE gpd/ft2	TRANSMISSIVITY AVERAGE gpd/ft2
HARPERS	SAPROLITE/PHYLLITE	5	140-1740	838.2
HARPERS	PHYLLITE	13	100-2119	1293.7
ANTIETAM	PHYLLITE	2	1703-2600	2151.5
ANTIETAM	SANDSTONE	1	278	278
ANTIETAM	QUARTZITE	1	6700	6700
VINTAGE	DOLOMITE	3	2112-7542	4684.6
VINTAGE/ ANTIETAM	DOLOMITE/SANDSTONE	1	2600	2600

TABLE 6
HYDRAULIC CONDUCTIVITY VALUES

WELL NUMBER	HYDRAULIC CONDUCTIVITY cms/sec.	BEDROCK FORMATION
MD103S	2.4×10^{-5}	Harpers Formation
MD105D	2.6×10^{-7}	Harpers Formation
MD106	3.1×10^{-6}	Harpers Formation
MD108I	1.1×10^{-5}	Antietam Formation
MD109D	2.1×10^{-6}	Antietam Formation
MD112S	1.9×10^{-4}	Antietam Formation
MD113D	1.6×10^{-6}	Antietam Formation
MD115D	7.7×10^{-6}	Antietam Formation
MD116S	8.0×10^{-5}	Antietam Formation
MD117D	6.5×10^{-6}	Antietam Formation
MD119	4.6×10^{-5}	Antietam Formation
MD120	1.9×10^{-5}	Harpers Formation
MD123I	5.3×10^{-8}	Harpers Formation
MD124D	4.1×10^{-9}	Harpers Formation
MD131I	9.9×10^{-7}	Harpers Formation
MD132D	3.3×10^{-7}	Harpers Formation
MD133	1.7×10^{-7}	Harpers Formation
MD135I	2.4×10^{-5}	Harpers Formation
MD136D	1.9×10^{-8}	Harpers Formation
MD137	9.9×10^{-6}	Antietam Formation
MD138	1.7×10^{-6}	Antietam Formation
MU125	2.3×10^{-7}	Harpers Formation
MU128	6.8×10^{-5}	Harpers Formation

REFER TO APPENDIX D

NOTE: HYDRAULIC CONDUCTIVITY DETERMINED BY RISING HEAD TESTS.

TABLE 7

HAZARDOUS SUBSTANCE LIST PARAMETERS
4th Quarter, 1986

VOLATILE ORGANICS		MW101	MW102	MD103S	MD104I	MD106	MD107	MD108I	MD109D	MD110	MD111	MD112S	MD113D	MD114S	MD115D	MD116S	MD117D	MD118
Methylene Chloride		21.9	57.6	-	8.64	-	-	205	-	-	-	-	4.6	-	5.2	-	-	6.23
1.1 Dichloroethane		-	16.4	-	22.3	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2 Dichloroethane		-	4.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene		-	6.87	104	147	-	-	-	-	-	-	-	-	-	2.16	-	-	-
1.2 Transdichloroethylene		-	8.05	7.13	1480	-	-	-	-	-	-	-	-	-	3.45	-	-	-
1.1.1 Trichloroethane		-	-	6.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene		-	-	-	52.7	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride		-	-	-	347	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene		-	-	-	7.86	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane		-	-	-	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane		-	-	-	-	-	12.2	-	-	-	51.8	-	-	-	-	-	-	-
Toluene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1 Dichloroethylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1.2 Trichloroethane		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acrolein		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acrylonitrile		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis(Chloromethyl)ether		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorodibromomethane		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloroethylvinyl ether		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobromomethane		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2 Dichloropropane		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl bromide		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl chloride		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1.2.2-Tetrachloroethane		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL VOA'S		21.9	93.76	117.7	2078.4	0	12.2	205	0	0	51.8	0	4.6	0	10.81	0	0	6.23
SPECIFIC CONDUCTIVITY (uM/cm)		584	342	396	1790	130	341	224	235	266	365	268	267	119	292	345	234	247
GROUNDWATER METALS																		
Arsenic		<2	<2	3.5	<2	<2	<2	8.1	<2	<2	3.4	<2	<2	<2	<2	<2	<2	<2
Barium		38	60	180	100	<25	280	150	160	150	220	300	140	160	45	350	150	300
Cadmium		<5	5	<5	7.5	<5	<5	<5	5	5	<5	<5	<5	<5	5	<5	<5	<5
Chromium		<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
Lead		10	18	12	35	<10	<10	<10	25	12	<10	<10	<10	15	<10	<10	<10	22
Mercury		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium		<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Silver		<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5
Sodium		46000	11000	5000	140000	5400	17000	9800	6100	15000	16000	26000	9000	7500	13000	22000	14000	8300
INITIAL BACKGROUND PARAMETERS																		
2,4,5-TP (Silvex)		<9.6	<9.1	<11	<9.4	<10.4	<14.2	<10	<12	<12	<10	<12	<11.1	<10	<9.3	<11.3	<10.4	<10
2,4-D		<96	<91	<106	<94	<104	<142	<100	<119	<119	<100	<116	<111	<104	<92.6	<113	1.4	<100
Ammonia (mg/l)		<0.05	<0.05	<0.05	0.15	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endrine		<0.1	<0.1	<.097	<0.1	<0.1	<0.1	<0.1	<0.1	<0.09	<0.1	<0.09	<0.1	<0.1	<0.1	<0.1	<0.09	<0.1
Lindane		<0.2	<0.2	<1.9	<0.2	<2.0	<2.0	<2.3	<1.7	<1.7	<1.9	<1.8	<2.0	<1.9	<2.0	<2.0	<1.7	<2.0
Methoxychlor		<5.2	<5.4	<50	<5.1	<49	<50	<58	<43	<43	<4.8	<45	<50	<48	<50	<49	<58	<51
Radium 226	(pCi/l)	1.2	0.8	0.4	1	<0.8	<0.8	<0.4	2.3	<0.7	0.9	1.2	1.3	<0.7	1.3	0.5	NT	1.3
	+/-	0.3	0.3	0.3	0	-	-	-	0.4	-	0.3	0.5	0.3	-	0.3	0.3	NT	0.3
Radium 228	(pCi/l)	2	2.4	<1.6	2.6	<2.6	<2.9	<1.6	<1.6	2	<1.9	<1.8	<1.6	<1.5	1.7	<1.8	NT	<1.7
	+/-	1	1.2	-	1	-	-	-	-	1.1	-	-	-	-	1.1	-	NT	-
Toxaphene		<2.6	<2.7	<2.4	<2.6	<2.3	<2.5	<2.9	[illegible]	<2.2	<2.4	<2.3	<2.5	<2.5	<2.5	<2.4	<2.2	<2.7

"-" Not Detected, "NT" Not Tested, All con[illegible]rations in ug/l except where noted

TABLE 7 (CONT)
HAZARDOUS SUBSTANCE LIST PARAMETERS
4TH QUARTER, 1986

VOLATILE ORGANICS	MD119	MD121	MD122S	MD123I	MD128	MD129	MD130S	MD131I	MD132D	MD133	MD134S	MD135I	MD137	MD138	820	W-1	W-3
Methylene Chloride	-	-	280	73.9	4	-	3.83	-	2.99	12.4	5.2	-	17.7	-	11.9	13.4	4.95
1.1 Dichloroethane	-	47.4	104	23.2	-	-	21	-	-	-	15.4	10.6	8.15	-	13.7	11.6	18.9
1.2 Dichloroethane	-	6.44	13.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	-	-	342	161	-	3.9	67.5	-	3.69	-	68.9	52.3	38.4	11.2	26.8	-	47.2
1.2 Transdichloroethylene	-	21.4	631	146	-	-	24	-	-	-	84.9	48.4	38.8	8.24	36.8	1.7	48.4
1.1.1 Trichloroethane	-	-	33	24.5	-	-	12.1	-	-	-	19	10.8	7.78	-	21.3	-	3.97
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	-	16.4	30.4	-	-	-	-	-	-	-	-	-	-	-	-	-	18.4
Benzene	-	11.8	20.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	-	-	22.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	-	-	33	36.8	-	-	-	-	-	-	27.2	12.6	10.6	-	-	-	-
Chloroform	-	-	5.13	-	-	-	-	-	-	-	-	2.06	-	-	-	-	-
Dichlorodifluoromethane	-	-	51.8	13.9	-	-	-	-	-	-	31.8	24.7	34.5	-	59.6	-	-
Tetrachloroethylene	-	-	12.8	-	-	11.2	14	-	-	-	12.1	7.8	9.13	-	9.85	-	11.4
Trichlorofluoromethane	-	-	31	-	-	-	-	-	-	-	30.1	20.4	23.8	13.8	327	-	-
Toluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1 Dichloroethylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.6
1.1.2 Trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acrolein	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acrylonitrile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis(Chloromethyl)ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorodibromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloroethylvinyl ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2 Dichloropropane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl bromide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1.2.2-Tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL VOA'S	0	103.44	1610.7	479.3	4	15.1	142.43	0	6.68	12.4	294.6	189.66	188.86	33.24	506.95	26.7	163.82
SPECIFIC CONDUCTIVTIY (um/cm)	241	1077	303	551	254	163	245	232	180	178	239	283	393	274	152	194	1300
GROUNDWATER METALS																	
Arsenic	2.9	4.1	2.9	4	<2	<2	<2	<2	2	<2	<2	5.9	<2	<2	<2	<2	<2
Barium	50	140	40	490	150	38	70	75	110	<25	50	30	62	60	160	62	250
Cadmium	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5	5	<5	<5	<5	5
Chromium	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
Lead	<10	<10	<10	12	<10	<10	<10	15	15	12	19	10	15	15	<10	<10	<10
Mercury	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Silver	<7.5	<7.5	<7.5	<7.5	<7.5	10	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	22	<7.5	<7.5
Sodium	7600	51000	17000	98000	12000	6200	6400	7600	16000	5600	8700	12000	9400	9600	5900	9700	150000
INITIAL BACKGROUND PARAMETERS																	
2.4.5-TP (Silvem)	<12	<10	<10	NT	<12	<13	<10	<10	<10	<11.9	<11	<10	<10	<9.4	<8.6	<10	<10.6
2.4-D	<116	<100	<104	NT	<123	<128	<100	<100	<100	<119	<111	<100	<100	<94	<86	<100	<106
Ammonia (mg/l)	<0.05	0.85	<0.05	NT	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	0.09	0.13	0.22	4.1
Endrine	<0.09	<0.1	<0.1	NT	<0.17	<0.1	<0.1	<0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.09	<0.11	<0.1
Lindane	<1.8	<1.9	<0.2	NT	<1.8	<1.6	<0.2	<0.22	<0.2	<2.2	<1.9	<2.0	<2.0	<0.2	<1.9	<0.21	<0.19
Methoxychlor	<65	<47	<4.9	NT	<50	<41	<5.1	<5.4	<50	<56	<50	<50	<49	<5.2	<47	<5.3	<4.6
Radium 226 (pCi/l)	0.9	1.7	0.8	NT	1.6	1.1	1.1	1.5	4.7	<0.4	1.5	2.8	0.6	<0.4	1.3	2.3	1.5
+/-	0.3	0.3	0.3	NT	0.4	0.4	0.3	0.4	0.8	-	0.4	0.4	0.3	-	0.5	0.5	0.5
Radium 228 (pCi/l)	<1.8	2.9	<1.4	NT	1.9	1.6	<2.0	2.3	<2.5	1.8	1.7	1.7	<1.5	<1.4	1.4	1.4	2.3
+/-	-	0.3	-	NT	1.1	1.1	1.1	1.1	-	1.1	1	1	-	-	1	1	1.1
Toxaphene	<2.3	<2.4	<2.4	NT	<2.2	<2.1	<2.6	<2.7	<2.5	<2.8	<2.3	<2.5	<2.5	<2.6	<2.4	<2.7	<2.3

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TABLE 7 (CONT)
HAZARDOUS SUBSTANCE LIST PARAMETERS
4TH QUARTER, 1986

VOLATILE ORGANICS	W-4	W-5	W-7	W-8	W-9	W-10	W-11	W-12	W-13	W-21	W-23	W-34	W-35	W-36	W-37	W-38	W-39
Methylene Chloride	21.7	-	77.3	-	-	5.9	23.3	22.1	14.2	-	-	-	-	17.8	14.5	-	-
1.1 Dichloroethane	64.3	5.26	188	-	6.9	10.3	9.69	-	11.2	-	-	-	-	29.3	32.6	12.5	13.3
1.2 Dichloroethane	2.81	-	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	56.4	14.8	158	-	87.9	15.7	90.6	16.3	98	12.5	10.8	5.61	7.19	110	142	44	77.1
1.2 Transdichloroethylene	125	906	120	-	134	26.1	24.3	3.39	196	8.98	5.1	-	-	38.5	39.7	15.8	22.4
1.1.1 Trichloroethane	63.6	-	134	-	-	18.1	47.2	13.5	-	-	-	-	-	22.4	25.6	10.8	17.9
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	15.8	93.3	23.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	6.78	-	-	-	-	-	-	-	-	-	-	-	4.59	-	-
Chloroethane	-	-	32.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	-	-	6.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	-	-	115	-	12.3	-	136	39.5	-	-	-	-	-	89.4	-	-	-
Tetrachloroethylene	-	-	8.45	-	-	4.36	19.2	5.61	-	4.28	9.51	8.65	8.56	29.3	23	8.28	8.77
Trichlorofluoromethane	11	-	19	-	-	79.1	1500	141	-	-	-	-	-	35.4	19.2	15.2	14.2
Toluene	-	-	9.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1 Dichloroethylene	15.7	-	40	-	-	-	3.85	-	3.36	-	-	-	-	-	5.83	-	-
1.1.2 Trichloroethane	-	-	-	-	7.43	-	-	-	-	-	-	-	-	-	-	-	-
Acrolein	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acrylonitrile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis(Chloromethyl)ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorodibromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloroethylvinyl ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2 Dichloropropane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl bromide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1.2.2-Tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL VOA'S	376.31	1019.3	947.44	0	248.53	159.56	1854.1	241.4	322.76	25.76	25.41	14.26	15.75	372.1	307.02	106.58	153.67
SPECIFIC CONDUCTIVITY (uM/cM)	193	254	171	121	397	298	404	253	683	315	151	116	98	167	194	251	208
GROUNDWATER METALS																	
Arsenic	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2.7	<2
Barium	55	<25	45	45	280	50	200	220	180	100	<25	48	32	<25	<25	<25	58
Cadmium	<5	<5	5	<5	<5	5	5	<5	<5	5	<5	5	5	<5	<5	<5	<5
Chromium	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	8	8
Lead	<10	<10	<10	20	<10	<10	<10	<10	<10	12	60	20	50	25	28	<10	21
Mercury	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	<2	<2	<2	3.4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Silver	<7.5	<7.5	10	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5
Sodium	12000	34000	12000	8100	22000	14000	15000	8800	65000	10000	7300	4600	4000	6100	5500	5800	4300
INITIAL BACKGROUND PARAMETERS																	
2.4.5-TP (Silvex)	<12	<9.3	<9.1	<9.2	<10	NT	<11.1	<10.9	<8.8	<9.3	<9.8	<11	<9.6	<11	<10	<11	<11
2.4-D	<122	<93	<91	<91	<100	NT	<111	<109	<88	<92.6	<98	<109	<96	<111	<104	<114	<111
Ammonia (mg/l)	<0.05	<0.05	0.31	0.7	<0.05	<0.05	<0.05	<0.05	1.3	0.17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.15
Endrin	<0.1	<0.1	<0.12	<0.11	<0.09	NT	<0.1	<0.1	<0.09	<0.1	<0.1	<0.09	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane	<0.19	<0.21	<0.24	<0.22	<1.9	NT	<1.9	<0.19	<1.9	<2.4	<2.0	<1.9	<2.1	<1.9	<2.0	<1.9	<1.8
Methoxychlor	<4.8	<5.2	<6.0	<5.4	<46	NT	<4.7	<4.6	<46	<61	<49	<47	<52	<47	<49	<46	<44
Radium 226 (pCi/l)	0.6	1.7	1.2	<0.8	2.7	1.9	1.6	<0.7	1.2	1.5	1.6	0.9	1.6	1.8	1.4	<0.5	2.4
+/-	0.4	0.6	0.6	-	0.7	0.5	1	-	0.4	0.3	0.4	0.4	0.4	0.4	0.4	-	0.7
Radium 228 (pCi/l)	<1.6	<1.5	2.4	<2.2	<1.9	2.1	<2.4	<1.8	2.1	<1.8	<1.6	<1.6	<1.7	<1.7	<1.8	<1.8	<2.8
+/-	-	-	1.3	-	-	1	-	1.1	1	-	-	-	-	-	-	-	-
Toxaphene	<2.4	<2.6	<3.0	<2.7	<2.3	NT	<2.4	<2.3	<2.3	<3.1	<2.5	<2.4	<2.6	<2.4	<2.5	<2.3	<2.2

TABLE 7 (CONT)
HAZARDOUS SUBSTANCE LIST PARAMETERS
4TH QUARTER, 1986

VOLATILE ORGANICS	W-40	W-41	W-43	W-44	W-45	MS108	MS109	MSP110	MS111	MS112	MSP113	MS114
Methylene Chloride	4.63	15.6	35.4	-	6.59	86.6	-	-	-	9.2	-	-
1.1 Dichloroethane	-	25.3	25.1	15.4	9.58	-	-	-	-	-	8.62	-
1.2 Dichloroethane	9.35	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	65	165	133	64.9	34	-	-	-	-	-	10.3	-
1.2 Transdichloroethylene	32.4	84.9	105	79.3	37.1	-	-	-	-	-	8.72	-
1.1.1 Trichloroethane	14.2	33.2	28.2	12.1	14	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	-	8.48	29.8	24.3	16.1	-	-	-	-	-	-	-
Chloroform	-	-	-	5.62	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	-	66.8	53.8	42.4	-	-	-	-	-	-	-	-
Tetrachloroethylene	7.28	14	15.5	9.95	9.52	-	-	-	-	-	15	-
Trichlorofluoromethane	23.2	47.5	41.1	30.9	28.9	-	-	-	-	-	-	-
Toluene	-	-	-	-	-	-	-	-	-	-	-	-
1.1 Dichloroethylene	-	7.77	6.1	-	-	-	-	-	-	-	-	-
1.1.2 Trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-
Acrolein	-	-	-	-	-	-	-	-	-	-	-	-
Acrylonitrile	-	-	-	-	-	-	-	-	-	-	-	-
bis(Chloromethyl)ether	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	-	-	-	-	-	-	-	-	-	-	-	-
Chlorodibromomethane	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloroethylvinyl ether	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobromomethane	-	-	-	-	-	-	-	-	-	-	-	-
1.2 Dichloropropane	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-
Methyl bromide	-	-	-	-	-	-	-	-	-	-	-	-
Methyl chloride	-	-	-	-	-	-	-	-	-	-	-	-
1.1.2.2-Tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL VOA'S	156.06	468.55	473	284.87	155.79	86.6	0	0	0	9.2	42.64	0
SPECIFIC CONDUCTIVTIY (um/cm)	197	170	195	257	301	171	227	245	213	168	125	168
GROUNDWATER METALS												
Arsenic	<2	<2	2.4	<2	<2	2	3.4	2.4	<2.0	<2.0	<2.0	<2.0
Barium	<25	50	72	55	72	40	45	150	50	45	50	42
Cadmium	<5	<5	<5	5	<5	<5	<5	<5	<5	<5	<5	<5
Chromium	<8	<8	<8	<8	<8	<8	<8	<8	<8	8	<8	<8
Lead	10	15	18	35	12	12	<10	<10	19	18	<10	18
Mercury	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Silver	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5
Sodium	4900	4400	4700	7400	12000	8600	11000	21000	8900	7700	6500	11000
INITIAL BACKGROUND PARAMETERS												
2.4.5-TP (Silvex)	<11	<11	<11	<9.8	<9.4	<10	<9.4	<10	<11	<11	<12	<11
2.4-D	<114	<109	<111	<98	<94.3	<100	<94	<100	<112	<112	<122	<115
Ammonia (mg/l)	<0.05	0.15	0.06	<0.05	<0.05	0.14	0.24	<0.05	0.23	0.16	<0.05	0.09
Endrine	<0.09	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.093	<0.095	<0.091	<0.091
Lindane	<1.8	<1.9	<0.2	<2.1	<2.0	<1.9	<2.1	<2.4	<1.9	<1.9	<1.8	<1.8
Methoxychlor	<45	<47	<4.5	<52	<50	<4.8	<5.2	<59	<74	<50	<62	<50
Radium 226 (pCi/l)	0.9	<0.5	0.8	<0.5	1.2	<0.4	<0.4	<0.8	0.8	<0.4	<0.4	<0.4
+/-	0.4	-	0.3	-	0.3	-	-	-	0.2	-	-	-
Radium 228 (pCi/l)	<1.7	<1.9	1.7	<1.9	<1.1	<1.5	<2.3	<2.5	<1.9	<1.8	<2.3	<1.7
+/-	-	-	1	-	-	-	-	-	-	-	-	-
Toxaphene	<2.3	<2.4	<2.2	<2.6	<2.5	<2.4	<2.6	<3.0	<2.3	<2.4	<2.3	<2.3

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TABLE 8
HAZARDOUS SUBSTANCE LIST PARAMETERS
FIRST QUARTER, 1987

VOLATILE ORGANICS	MW101	MW102A	MD103S	MD104I	MD106	MD107S	MD108I	MD109D	MD110	MD111	MD112S	MD113D	MD114S	MD115D	MD116S	MD117D	MD118
Methylene Chloride	NT	17.9	NT	NT	-	-	4.18	-	3.47	3.25	NT	NT	NT	NT	NT	NT	NT
1.1 Dichloroethane	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
1.2 Dichloroethane	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Trichloroethylene	NT	-	NT	NT	-	6.42	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
1.2 Transdichloroethylene	NT	-	NT	NT	-	3.04	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
1.1.1 Trichloroethane	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Chlorobenzene	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Vinyl Chloride	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Benzene	NT	-	NT	NT		-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Chlorothane	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Carbon Tetrachloride	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Chloroform	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Dichlorodifluoromethane	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Tetrachloroethylene	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Trichlorofluoromethane	NT	-	NT	NT	-	-	-	-	-	28	NT	NT	NT	NT	NT	NT	NT
Toluene	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
1.1 Dichloroethylene	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
1.1.2 Trichloroethane	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Acrolein	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Acrylonitrile	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
bis(Chloromethyl)ether	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Bromoform	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Chlorodibromomethane	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
2-Chloroethylvinyl ether	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Dichlorobromomethane	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
1.2 Dichloropropane	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Ethylbenzene	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Methyl bromide	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
Methyl chloride	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
1.1.2.2-Tetrachloroethane	NT	-	NT	NT	-	-	-	-	-	-	NT	NT	NT	NT	NT	NT	NT
TOTAL VOA'S	NT	17.9	NT	NT	0	9.46	4.18	0	3.47	31.25	NT	NT	NT	NT	NT	NT	NT
SPECIFIC CONDUCTIVTIY (um/cm)	NT	214	NT	NT	139	266	218	191	236	355	NT	NT	NT	NT	NT	NT	NT
GROUNDWATER METALS																	
Arsenic	NT	<10	NT	NT	<10	<10	<10	<10	<10	<10	NT	NT	NT	NT	NT	NT	NT
Barium	NT	46	NT	NT	11	140	120	140	120	180	NT	NT	NT	NT	NT	NT	NT
Cadmium	NT	<3.1	NT	NT	<3.1	<3.5	<3.5	<3.2	<3.2	<3.2	NT	NT	NT	NT	NT	NT	NT
Chromium	NT	<17	NT	NT	<17	<17	<17	<23	<23	<23	NT	NT	NT	NT	NT	NT	NT
Lead	NT	<5.0	NT	NT	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	NT	NT	NT	NT	NT	NT	NT
Mercury	NT	<0.22	NT	NT	<0.22	<0.19	<0.19	<0.22	<0.22	<0.22	NT	NT	NT	NT	NT	NT	NT
Selenium	NT	<5.0	NT	NT	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	NT	NT	NT	NT	NT	NT	NT
Silver	NT	<12	NT	NT	<12	<12	<12	<11	<11	<11	NT	NT	NT	NT	NT	NT	NT
Sodium	NT	16000	NT	NT	6700	15000	9900	7900	13000	8400	NT	NT	NT	NT	NT	NT	NT

INITIAL BACKGROUND PARAMETERS (For wells not previously sampled)

2.4.4-TP (Silvex)	NT
2.4-D	NT
Ammonia (mg/l)	0.42
Endrine	<0.1
Lindane	<0.41

TABLE 8 (CONT)
HAZARDOUS SUBSTANCE LIST PARAMETERS
FIRST QUARTER, 1987

	MD119	MD120	MD121	MD122S	MD123I	MU125	MU127	MD128	MD130S	MD131I	MD132D	MD133	MD134S	MD135I	MD136	MD137	MD138
VOLATILE ORGANICS																	
Methylene Chloride	NT	180	NT	NT	NT	20.2	28.5	-	NT	NT	NT	-	NT	19.8	NT	-	NT
1.1 Dichloroethane	NT	-	NT	NT	NT	6.67	-	-	NT	NT	NT	-	NT	11.3	NT	-	NT
1.2 Dichloroethane	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Trichloroethylene	NT	15.5	NT	NT	NT	13.2	-	-	NT	NT	NT	-	NT	58.7	NT	17	NT
1.2 Transdichloroethylene	NT	-	NT	NT	NT	4.51	-	-	NT	NT	NT	-	NT	56.8	NT	19.9	NT
1.1.1 Trichloroethane	NT	12.5	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	11.3	NT	-	NT
Chlorobenzene	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Vinyl Chloride	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Benzene	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Chlorothane	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Carbon Tetrachloride	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	12.1	NT	3.56	NT
Chloroform	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Dichlorodifluoromethane	NT	12.1	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Tetrachloroethylene	NT	27	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	6.4	NT	-	NT
Trichlorofluoromethane	NT	222	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	14.9	NT	-	NT
Toluene	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
1.1 Dichloroethylene	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	3.25	NT	-	NT
1.1.2 Trichloroethane	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Acrolein	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Acrylonitrile	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
bis(Chloromethyl)ether	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Bromoform	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Chlorodibromomethane	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
2-Chloroethylvinyl ether	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Dichlorobromomethane	NT	14.8	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
1.2 Dichloropropane	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Ethylbenzene	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Methyl bromide	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
Methyl chloride	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
1.1.2.2-Tetrachloroethane	NT	-	NT	NT	NT	-	-	-	NT	NT	NT	-	NT	-	NT	-	NT
TOTAL VOA'S	NT	483.9	NT	NT	NT	44.58	28.5	-	NT	NT	NT	0	NT	194.55	NT	40.48	NT
SPECIFIC CONDUCTIVTIY (uM/cM)	NT	304	NT	NT	NT	786	386	-	NT	NT	NT	164	NT	262	NT	379	NT
GROUNDWATER METALS																	
Arsenic	NT	<10	NT	NT	NT	<10	<10	NT	NT	NT	NT	<10	NT	<10	NT	<10	NT
Barium	NT	160	NT	NT	NT	100	140	NT	NT	NT	NT	3.8	NT	21	NT	3.7	NT
Cadmium	NT	<3.7	NT	NT	NT	<3.7	<2.5	NT	NT	NT	NT	<3.5	NT	<3.1	NT	<3.5	NT
Chromium	NT	<26	NT	NT	NT	26	<12	NT	NT	NT	NT	<17	NT	<17	NT	<17	NT
Lead	NT	<5.0	NT	NT	NT	<5.0	<5.0	NT	NT	NT	NT	<5.0	NT	<5.0	NT	<5.0	NT
Mercury	NT	<0.21	NT	NT	NT	<0.21	<0.22	NT	NT	NT	NT	<0.19	NT	<0.22	NT	<0.19	NT
Selenium	NT	<5.0	NT	NT	NT	<5.0	<5.0	NT	NT	NT	NT	<5.0	NT	<5.0	NT	<5.0	NT
Silver	NT	<18	NT	NT	NT	<18	<11	NT	NT	NT	NT	<12	NT	<12	NT	<12	NT
Sodium	NT	11400	NT	NT	NT	32500	18000	NT	NT	NT	NT	6800	NT	9200	NT	6800	NT
INITIAL BACKGROUND PARAMETERS																	
2.4.4-TP (Silvex)		<0.93				<1.1	<1.2					<0.94		<12		<1.0	
2.4-D		<9.3				<11	<12					<9.4		<120		<10	
Ammonia (mg/l)		0.08				0.1	0.92					<0.05		<0.05		<0.05	
Endrine		<0.1				<0.096	<0.089					<0.1		<0.094		<0.09	
Lindane		<0.41				<0.38	<0.36					<0.43		<0.38		<0.38	
Methoxychlor		<10				<9.6	<8.9					<11		<9.4		<9.4	
Radium 226 (pCi/l)		<0.4				0.8	1.4					<0.4		0.5		0.9	
+/-		-				0.4	0.5					-		0.3		0.4	
Radium 228 (pCi/l)		2.2				2.3	1.6					<1.9		<1.7		<2	
+/-		1.3				1.3	0.9					-		-		-	
Toxaphene		<2.6				<2.4	<2.2					<2.7		<2.4		<2.4	

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TABLE 8 (CONT)
HAZARDOUS SUBSTANCE LIST PARAMETERS
FIRST QUARTER, 1987

	B20	W-1	W-3	W-4	W-5	W-7	W-8	W-9	W-10	W-11	W-12	W-13	W-21	W-23	W-31	W-32	W-34	W-35
VOLATILE ORGANICS																		
Methylene Chloride	38.4	-	-	18.8	25.1	28	-	-	11	40.6	76	4.39	-	3.42	30.7	11.8	3.59	4.22
1.1 Dichloroethane	20.3	24.8	14.1	43.8	52.5	110	9.23	7.76	27.7	-	-	-	-	-	-	-	5.24	7.00
1.2 Dichloroethane	-	-	-	3.07	-	-	-	-	-	9.11	11.1	8.57	-	-	-	-	-	-
Trichloroethylene	36.5	-	35.7	26.6	32.9	91.6	-	49.2	43	91.1	13.8	62.6	12.2	11.1	6.07	11.3	9.68	9.85
1.2 Transdichloroethylene	51.3	-	36.5	46.8	56.4	68.7	-	152	84.7	21.4	-	160	12.1	6.47		-	6.6	9.9
1.1.1 Trichloroethane	24.6	-	-	29.6	36.6	82	-	-	18.8	53.6	16.6	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-
Vinyl Chloride	-	-	14.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	4.52	-	-	-	-	-	-	-	-	-	-	-	-
Chlorothane	-	28.2	-	-	-	20.9	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	-	-	-	-	-	10.2	-	-	-	28.8	-	-	-	-	-	-	-	-
Tetrachloroethylene	8.02	-	9.96	-	-	5.61	-	9.37	-	17.6	7.61	-	4.17	9.57	5.34	8.94	10.3	12.9
Trichlorofluoromethane	133	-	-	-	-	-	-	-	-	564	85.5	-	-	-	-	-	-	-
Toluene	7.19	-	-	11.6	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1 Dichloroethylene	-	-	8.03	6.59	9.13	23.3	-	-	5.79	-	-	-	-	-	-	-	-	-
1.1.2 Trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acrolein	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acrylonitrile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis(Chloromethyl)ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorodibromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloroethylvinyl ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2 Dichloropropane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl bromide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1.2.2-Tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL VOA'S	319.41	53	118.69	186.66	226.03	444.83	9.23	218.33	200.99	826.21	210.61	235.56	28.47	30.56	42.11	31.84	35.41	43.93
SPECIFIC CONDUCTIVITY (uM/cm)	288	303	1095	200	197	167	184	295	314	277	172	860	359.5	135	152	159	105	115
GROUNDWATER METALS																		
Arsenic	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Barium	78	100	66	38	33	364	64	23	278	64	170	30	150	32	180	66	27	20
Cadmium	<3.1	<3.2	<3.2	<3.2	<3.2	<3.9	<3.2	<3.2	<3.9	<3.2	<3.1	<3.2	<3.9	<3.1	<3.9	<3.9	<3.1	<3.1
Chromium	<19	<23	<23	<23	<23	<19	<23	<23	<19	<23	<16	<23	<19	19	<19	<19	<19	<19
Lead	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<5.0	16	<5.0	<5.0	26	11
Mercury	<0.21	<0.22	<0.22	<0.22	<0.22	<0.21	<0.22	<0.22	<0.21	<0.22	<0.220	<0.22	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Selenium	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Silver	<11	<11	<11	<11	<11	<4.8	<11	<11	<124.8	<11	<15	<11	<48	<11	<4.8	<4.8	<11	<11
Sodium	21000	15000	47000	14000	13000	12000	11000	12000	14000	16000	8910	73000	12000	8100	8600	9000	5700	6200
INITIAL BACKGROUND PARAMETERS																		
2.4.5-TP (Silvex)									<0.89						<1.0	<1.0		
2.4-D									<8.9						<10	<10		
Ammonia (mg/l)									0.19						<0.05	<0.05		
Endrine									<0.09						<0.1	<0.098		
Lindane									<0.36						<0.40	<0.39		
Methoxychlor									<9.0						<10	<9.8		
Radium 226 (pCi/l)									NT						0.5	<0.3		
+/-									NT						0.3	-		
Radium 228 (pCi/l)									NT						<1.6	2.4		
+/-									NT						-	1.3		
Toxaphene									<2.2						<2.5	<2.5		

TABLE 8 (CONT)
HAZARDOUS SUBSTANCE LIST PARAMETERS
FIRST QUARTER, 1987

VOLATILE ORGANICS	W-36	W-37	W-38	W-39	W-40	W-41	W-43	W-44	W-45	W-58	W-59	W-60	W-62	W-63	W-64	W-65	W-67
Methylene Chloride	64.1	14.3	3.85	5.76	14.1	5.4	5.3	3.2	3.1	15.2	12.5	10.9	11.7	27	7	9.72	10.5
1.1 Dichloroethane	36.9	9.92	9.17	15.3	12.7	9.97	13.6	8.39	4.94	-	-	-	-	31.6	19.3	-	-
1.2 Dichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	165	37.5	47.9	113	74.1	66.6	60	35.6	23	17.8	-	-	15.2	-	-	-	-
1.2 Transdichloroethylene	54.5	10.9	16.8	46.6	48	45.6	89	41.8	22.5	13.9	3.93	-	20.3	-	-	-	-
1.1.1 Trichloroethane	26.2	7.44	10.3	28	17.6	13.8	9.46	8.8	5.93	-	-	7.27	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	4.62	4.89	-	-	12.6	-	-	-	-	-	-	-	-	-	-	-	-
Chlorothane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17.3	-	-
Carbon Tetrachloride	-	-	-	-	-	6.9	27.6	10.8	5.94	-	-	-	-	-	-	-	-
Chloroform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	12.1	-	-	16.7	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	29	7.54	6.23	10.8	5.39	5.66	7.63	7.03	4.71	-	-	-	-	-	-	-	-
Trichlorofluoromethane	21.9	-	-	23.1	15.7	12.6	11.3	14.2	-	-	-	96.5	-	-	-	-	-
Toluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1 Dichloroethylene	8.59	-	-	6.89	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1.2 Trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acrolein	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acrylonitrile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis(Chloromethyl)ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorodibromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloroethylvinyl ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorobromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2 Dichloropropane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl bromide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1.2.2-Tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL VOA'S	422.91	92.49	94.25	266.15	200.19	166.63	223.89	129.82	70.12	46.9	16.43	114.67	47.2	58.6	43.6	9.72	10.5
SPECIFIC CONDUCTIVTIY (uM/cM)	170	199	228	171	198	202	207	253	271	285	292	287	282	220	201	146	142
GROUNDWATER METALS																	
Arsenic	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Barium	21	14	26	30	25	31	34	33	50	252	160	326	41	140	110	140	87
Cadmium	<3.1	<3.1	<3.1	<3.9	<3.1	<3.1	<3.9	<3.9	<3.9	<3.9	<3.9	<3.1	<3.9	<3.9	<3.9	<2.4	<1.5
Chromium	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<16	<19	<19	<19	<23	<11
Lead	8.8	<5.0	<5.0	<5.0	<5.0	<5.0	19	<5.0	6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Mercury	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.19	<0.21	<0.21	<0.21	<0.21	<0.24
Selenium	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Silver	<11	<11	<11	<4.8	<11	<11	<4.8	<4.8	<4.8	<4.8	<4.8	<15	<4.8	<4.8	<4.8	<13	<13
Sodium	8300	7300	6900	6100	6900	6300	7200	9500	11000	11000	11000	13800	22000	9800	12000	11000	7600
INITIAL BACKGROUND PARAMETERS																	
2.4.4-TP (Silvex)										<1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.1	<0.85
2.4-D										<11	<10	<10	<10	<10	<9.8	<11	<6.5
Ammonia (mg/l)										<0.05	0.05	0.06	0.17	0.45	0.23	NT	0.6
Endrine										<0.1	<0.096	<1.0	<0.1	<0.098	<0.1	<0.096	<0.093
Lindane										<0.41	<0.38	<0.40	<0.40	<0.39	<0.40	<0.38	<0.37
Methoxychlor										<10	<9.6	<10	<10	<9.8	<10	<9.6	<9.3
Radium 226 (pCi/l)										0.7	<0.3	0.4	<0.3	<0.4	<0.4	NT	0.4
+/-										0.5	-	0.3	-	-	-	NT	0.2
Radium 228 (pCi/l)										2.9	<1.6	<1.8	<1.7	<1.7	<1.8	NT	<1.6
+/-										1.5	-	-	-	-	-	NT	-
Toxaphene										<2.6	<2.4	<2.5	<2.5	<2.5	<2.5	<2.4	<2.3

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TABLE 8 (CONT)
HAZARDOUS SUBSTANCE LIST PARAMETERS
FIRST QUARTER, 1987

VOLATILE ORGANICS	MSP101	MSP102	MS103	MS104	MS106	MS108	MS109	MSP110	MS111	MS112	MSP113	MS115	MS116
Methylene Chloride	-	-	-	-	4.9	-	-	-	20.3	7.57	DRY	-	34.4
1.1 Dichloroethane	-	7.71	-	-	-	-	-	-	-	-		-	-
1.2 Dichloroethane	-	-	-	-	-	-	-	-	-	-		-	-
Trichloroethylene	-	5.54	-	-	-	-	-	-	-	-		-	-
1.2 Transdichloroethylene	-	-	-	-	-	-	-	-	-	-		-	-
1.1.1 Trichloroethane	-	-	-	-	-	-	-	-	-	-		-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-		-	-
Vinyl Chloride	-	-	-	-	-	-	-	-	-	-		-	-
Benzene	-	-	-	-	-	-	-	-	-	-		-	-
Chlorothane	-	-	-	-	-	-	-	-	-	-		-	-
Carbon Tetrachloride	-	-	-	-	-	-	-	-	-	-		-	-
Chloroform	-	-	-	-	-	-	-	-	-	-		-	-
Dichlorodifluoromethane	-	-	-	-	-	-	-	-	-	-		-	-
Tetrachloroethylene	-	-	-	-	-	-	-	-	-	-		-	-
Trichlorofluoromethane	-	-	-	-	-	-	-	-	-	-		-	-
Toluene	-	-	-	-	-	-	-	-	-	-		-	-
1.1 Dichloroethylene	-	-	-	-	-	-	-	-	-	-		-	-
1.1.2 Trichloroethane	-	-	-	-	-	-	-	-	-	-		-	-
Acrolein	-	-	-	-	-	-	-	-	-	-		-	-
Acrylonitrile	-	-	-	-	-	-	-	-	-	-		-	-
bis(Chloromethyl)ether	-	-	-	-	-	-	-	-	-	-		-	-
Bromoform	-	-	-	-	-	-	-	-	-	-		-	-
Chlorodibromomethane	-	-	-	-	-	-	-	-	-	-		-	-
2-Chloroethylvinyl ether	-	-	-	-	-	-	-	-	-	-		-	-
Dichlorobromomethane	-	-	-	-	-	-	-	-	-	-		-	-
1.2 Dichloropropane	-	-	-	-	-	-	-	-	-	-		-	-
Ethylbenzene	-	-	-	-	-	-	-	-	-	-		-	-
Methyl bromide	-	-	-	-	-	-	-	-	-	-		-	-
Methyl chloride	-	-	-	-	-	-	-	-	-	-		-	-
1.1.2.2-Tetrachloroethane	-	-	-	-	-	-	-	-	-	-		-	-
TOTAL VOA'S	0	13.25	0	0	4.9	0	0	0	20.3	7.57		0	34.4
SPECIFIC CONDUCTIVITY (um/cm)	130	212	132	136	157	257	164	281	80	195		262	113
GROUNDWATER METALS													
Arsenic	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10		<10	<10
Barium	27	33	20	25	23	33	51	110	54	73		54	32
Cadmium	<3.2	<3.2	<3.2	<3.2	<3.5	<3.9	<3.1	<3.1	<3.9	<3.1		<3.1	<3.9
Chromium	<23	<23	<23	<23	<17	<19	<17	<19	<19	<19		<19	<19
Lead	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	11		<5.0	<5.0
Mercury	<0.22	<0.22	<0.22	<0.22	<0.19	<0.21	<0.22	<0.21	<0.21	<0.21		<0.21	<0.21
Selenium	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0		<5.0	<5.0
Silver	<11	<11	<11	<11	12	<4.8	<12	<11	<4.8	<11		<11	<4.8
Sodium	7600	7200	6400	6700	4900	41400	13000	14000	8900	11000		15000	6100
INITIAL BACKGROUND PARAMETERS													
2.4.4-TP (Silvex)	<1.1	<1.1	<0.98	<1.0	<1.0							<1.1	<0.96
2.4-D	<11	<11	<9.8	<10	<10							<11	<9.6
Ammonia (mg/l)	0.09	<0.05	<0.05	<0.05	0.22							<0.05	0.07
Endrine	<0.1	<0.1	<0.1	<0.1	<0.09							<0.1	<0.1
Lindane	<0.39	<0.48	<0.39	<0.40	<0.38							<0.40	<0.38
Methoxychlor	<10	<11.0	<10.0	<10.0	<9.4							<10.0	<9.6
Radium 226 (pCi/l)	-	0.5	0.6	0.5	0.1							<0.3	<0.3
+/-	-	0.4	0.4	0.4	0.03							-	-
Radium 228 (pCi/l)	-	<1.8	<1.9	<1.9	<1.8							<1.8	<1.6
+/-		-	-									-	-
Toxaphene	<2.5	<2.7	<2.5	<2.5	<2.4							<2.5	<2.4

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TABLE 9

PARAMETERS FOR INDICATOR CHEMICALS

COMPOUND	KOC (ml/g)	WATER SOLUBILITY (mg/l)	HALF-LIFE (days)	TOXICITY Indicator Score 2
* Carbon Tetrachloride	110	7.57 x 10+E02	0.3-300	7.7 x 10-E03
* 1.2 trans-Dichlorethylene	59	6.3 x 10+E03	1-6	1.3 x 10-E02
* Benzene	83	1.75 x 10+E03	1-6	1.1 x 10-E04
* Trichloroethylene	126	1.1 x 10+E03	1-90	9.7 x 10-E02
* Vinyl Chloride	57	2.67 x 10+E03	1-5	8.1 x 10-E04
Chloroform	31	8.2 x 10+E03	0.3 - 30	2.0 x 10-E04
1,1 Dichloroethylene	30	5.5 x 10+E03	1-6	6.7 x 10-E04
Methylene Chloride	8.8	2.4 x 10+E04	1.2-5.8	4.3 x 10-E05
1,1,1 Trichloroethane	152	1.5 x 10+E03	0.14 - 7.0	1.3 x 10-E05

Notes:
1. Half life in surface water - No data available on persistance in groundwater

2. Indicator score calculated from formula ISi:=Ci:.Ti
   Where IS: = Indicator score for compound;
   Ci; = representative concentration of compound: at selected monitoring wells
   based on monitoring data in Table 3 and 4 (units in mg/l for water)
   Ti; = toxicity constant for chemical; (units are inverse of concentration unit - (mg/l)-Eol)

3. * Selected Indicator Chemicals

TABLE 10

PRELIMINARY IDENTIFICATION OF
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS[1]

Requirement	Applicable	Relevant and Appropriate	To Be Considered	Rationale
Water				
1. Safe Drinking Water Act		X		MCLs may be relevant and appropriate.
a. Maximum Contaminant Levels			X	SARA Section 121 (d) (2) (A) (ii) To be considered.
b. Maximum Contaminant Level Goals (MCLGs)				
2. Health Advisories, EPA Office of Drinking Water			X	Previous investigations have identified presence of chemicals for which health advisories are listed.
3. Clean Water Act (PL92-500)				
a. Federal water quality criteria (FWQC)			X	Current remedial actions provide groundwater remediation and discharge to surface waters. These criteria will be considered. New guidance being formulated.
b. NPDES (PADER permit #0046680)	X			Current remedial actions include discharge to surface waters.
4. EPA's Groundwater Protection Strategy			X	Classification of groundwater use and conditions at site to be considered and potential impacts to public health and environment.
5. Pennsylvania Pollutant Discharge Elimination System (PPDES) Rules, PA Code Title 25, Chapter 92	X			Current remedial actions include discharge to surface waters. NDPES Permit # 0046680.

Footnote

[1]This table identifies, on a preliminary basis, the Federal and State (PADER) Applicable or Relevant and Appropriate Requirements (ARAR's) for consideration as part of the scoping of the RI/FS in this Work Plan. The identification of ARAR's is an iterative process and would be refined at various points in the RI/FS process depending upon site conditions, specific chemicals at the site, proposed remedial actions, feasibility of attaining the ARAR's through the remedial actions, and selection and design of the remedial action. This process is consistent with CERCLA, as amended. 42 U.S.C. 9601 et. seq. and the "Interim Guidance on Compliance with Applicable or Relevant and Appropriate Requirements" (52 FR No. 166, August 27, 1987).

TABLE 10 (cont.)

PRELIMINARY IDENTIFICATION OF
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS[1]

	Requirement	Applicable	Relevant and Appropriate	To Be Considered	Rationale
6.	Pennsylvania Water Quality Standards, PA Code Title 25, Chapter 93	X			Current remedial actions include discharge to surface waters. NPDES. Permit #0046680.
7.	Pennsylvania Wastewater Treatment Requirements, PA Code Title 25, Chapter 95	X			Current remedial actions include discharge to surface waters. NPDES Permit #0046680.
8.	Pennsylvania Industrial Wastes Regulations, PA Code Title 25 Chapter 97	X			Current remedial actions include discharge to surface waters. NPDES Permit #0046680.
9.	Pennsylvania Special Water Pollution Regulations, PA Code Title 25, Chapter 101	X			Currently applicable for permitted solid waste disposal facility. Pennsylvania Solid Waste Permit #100113.
10.	Pennsylvania Stormwater Management Act of October 4, 1987, Act No. 167			X	Remedial actions may require storm-water management systems.
11.	Pennsylvania Erosion Control Regulations, PA Code Title 25. Chapter 102	X			Soil Disturbances due to current remedial actions require erosion and sedimentation control measures.
12.	Pennsylvania Dam Safety and Encroachment Act (32 P.S. 693.1 et.seq.)	X			Current remedial actions include encroachment to surface waters. Water Obstruction and Encroachment Permit #E67-203.
13.	Pennsylvania Clean Streams Law, PA Code Title 35, Chapter 5				Current remedial actions include discharges to surface water NPDES Permit #0046680.

TABLE 10

PRELIMINARY IDENTIFICATION OF
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS[1]

Requirement	Applicable	Relevant and Appropriate	To Be Considered	Rationale
14. Clean Air Act (42 USC 7401)				
a. National Ambient Air Quality Standards (NAAQS) for six criterial pollutants (40 CFR Part 50)			X	Emissions associated with remedial actions may include criteria pollutants.
b. Public health and basis to list pollutants as hazardous under Section 112 of the Clean Air Act			X	Emissions associated with remedial actions may include criteria pollutants.
c. Air Permit #67-330-004	X			Current remedial alternatives include discharge to air AQC Permit No. 67-330-004.
15. Pennsylvania Air Pollution Control Regulations, PA Code Title 25, Chapters 121 through	X			Current remedial alternatives include discharge to air AQC Permit No. 67-330-004.
Hazardous Solid Waste				
16. Hazardous Waste Requirements (The HSWA to RCRA Subtitle C)		X		Standards may be relevant and appropriate to site depending upon scope of remedial actions (e.g. minimum technological requirements.
17. Pennsylvania Solid Waste Disposal Regulations, PA Code Title 25, Chapter 75		X		Standards for generation, transported treatment and disposal of hazardous wastes. Depends upon scope of remedial actions.
18. Pennsylvania Hazardous Substances Transportation Regulations PA Code Title 13 (Flammable Liquids and Flammable Solids) and Title 15 (Oxidizing Materials, Positions, and Corrosive Liquids)			X	Should remedial actions include include offsite transportation of of hazardous substances.

TABLE 10 (cont.)

PRELIMINARY IDENTIFICATION OF
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS[1]

	Requirement	Applicable	Relevant and Appropriate	To Be Considered	Rationale
19.	Pennsylvania Solid Waste Management Act (Act 97) July 1980		X		Act requiring promulgation of standards for generation, transportation, treatment storage and disposal of municipal, residual and hazardous wastes.
Miscellaneous					
20.	Toxic Substance Control Act (15 U.S.C. 2601)				
	a. PCB Requirements (40 CFR 761)			X	Should remedial actions involve disposal or treatment of PCB's.
	b. TSCA health data, chemical advisories, and Compliance Program policy			X	Considered in the public evaluation.
21.	OSHA Requirements (29 CFR, Parts 1910, 1926, and 1904)	X			Required for workers engaged in onsite remedial activities.
22.	Executive Order 11990 (Protection of Wetlands)			X	Should wetland resources be affected by remedial actions.
23.	Federal Floodplain Executive Order 11988			X	Should floodplains be impacted by remedial actions.
24.	DOT Rules for Hazardous Materials Transport (49 CFR, Parts 107, 171.1-171.500)			X	Should remedial alternatives include offsite transport of materials.
25.	Endangered Species Act of 1973 (16 USC 1531)			X	Should endangered or threatened species be impacted.

TABLE 10 (cont.)

PRELIMINARY IDENTIFICATION OF
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS[1]

	Requirement	Applicable	Relevant and Appropriate	To Be Considered	Rationale
26.	Fish and Wildlife Coordination Act (15 USC 661)			X	Should remedial alternatives affect wetlands and protected habitats.
27.	Fish and Wildlife Improvement Act of 1978 (16 USC 742)			X	Should actions affect wetlands and protected habitats.
28.	Fish and Wildlife Conservation Act of 1980 (16 USC 2901)			X	Should remedial actions affect wetlands and protected habitats.
29.	Pennsylvania Rare and Endangered Species Regulations			X	Should remedial actions affect rare and endangered species.

TABLE 11

DRINKING WATER
STANDARDS FOR VOLATILE ORGANIC COMPOUNDS

COMPOUND	MCL (mg/l)	MCLG (mg/l)
1,1 DICHLOROETHANE	-	-
1,2 DICHLOROETHANE	-	0
1,1 DICHLOROETHYLENE	-	0.007
*1,2 trans DICHLOROETHYLENE	-	-
1,1,1 TRICHLOROETHANE	-	0.2
1,1,2 TRICHLOROETHANE	-	-
*BENZENE	.005	0
*CARBON TETRACHLORIDE	.005	0
CHLOROBENZENE	-	-
CHLOROETHANE	-	-
CHLOROFORM	0.1	-
DICHLORODIFLUORMETHANE	-	-
METHYLENE CHLORIDE	-	-
TETRACHLOROETHYLENE	-	-
TOLUENE	-	-
*TRICHLOROETHYLENE	.005	0
TRICHLOROFLUOROMETHANE	-	-
*VINYL CHLORIDE	.002	0

Notes:
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
- = Not Available
* Selected Indicator Chemicals

TABLE 12

AMBIENT WATER QUALITY CRITERIA FOR
VOLATILE ORGANIC COMPOUNDS

COMPOUND	WQC Aquatic Organisms and Drinking Water	WQC Adjusted for Drinking Water Only
1,1 DICHLOROETHANE	NA	NA
1,2 DICHLOROETHANE	0;(0.94 ug/l)	0;(0.94 ug/l)
1,1 DICHLOROETHYLENE	0;(33 ng/l)	0;(33 ng/l)
*1,2 trans DICHLOROETHYLENE	NA	NA
1,1,1 TRICHLOROETHANE	18.4 mg/l	19 mg/l
1,1,2 TRICHLOROETHANE	0;(0.6 ug/l)	0;(0.6 ug/l)
*BENZENE	0;(0.66 ug/l)	0;(0.67 ug/l)
*CARBON TETRACHLORIDE	0;(0.4 ug/l)	0;(0.42 ug/l)
CHLOROBENZENE	488 ug/l	488 ug/l
CHLOROETHANE	NA	NA
CHLOROFORM	0;(0.19 ug/l)	0;(0.19 ug/l)
DICHLORODIFLUORMETHANE	NA	NA
METHYLENE CHLORIDE	NA	NA
TETRACHLOROETHYLENE	0;(0.8 ug/l)	0;(0.88 ug/l)
TOLUENE	14.3 mg/l	15 mg/l
*TRICHLOROETHYLENE	0;(2.7 ug/l)	0;(2.8 ug/l)
TRICHLOROFLUOROMETHANE	NA	NA
*VINYL CHLORIDE	0;(2.0 ug/l)	0;(2.0 ug/l)

Notes:
NA = Not Available
WQC = Ambient Water Quality Criteria
* *Concentrations in parentheses*
  correspond to midpoint of risk range
  (1x10-6) for potential carcinogens only
* *Selected Indicator Chemicals*

TABLE 13

HEALTH ADVISORIES FOR VOLATILE ORGANIC COMPOUNDS

COMPOUND	ONE DAY (ug/l) 10 kg	TEN DAY (ug/l) 10 kg	LONGER-TERM (ug/l) 10 kg	LONGER-TERM (ug/l) 70 kg	LIFETIME (ug/l) 70 kg	REFERENCE CONCENTRATION for POTENTIAL CARCINOGENS (ug/l); 70 kg
1,1 DICHLOROETHANE	NA	NA	NA	NA	NA	NA
1,2 DICHLOROETHANE	740	740	740	2600	NA	0.95
1,1 DICHLOROETHYLENE	1000	1000	1000	3500	NA	0.24
*1,2 trans DICHLOROETHYLENE	2/20	1000	1000	3500	350	NA
1,1,1 TRICHLOROETHANE	140000	35000	35000	125000	1000	22000
1,1,2 TRICHLOROETHANE	NA	NA	NA	NA	NA	NA
*BENZENE	233	NA	NA	NA	NA	0.35
*CARBON TETRACHLORIDE	4000	160	71	250	NA	0.3
CHLOROBENZENE	1800	1800	9000	30000	3150	NA
CHLOROETHANE	NA	NA	NA	NA	NA	NA
CHLOROFORM	NA	NA	NA	NA	NA	NA
DICHLORODIFLUORMETHANE	NA	NA	NA	NA	NA	NA
METHYLENE CHLORIDE	NA	NA	NA	NA	NA	NA
TETRACHLOROETHYLENE	NA	34000	1940	6800	NA	0.7
TOLUENE	18000	6000	NA	NA	10800	NA
*TRICHLOROETHYLENE	NA	NA	NA	NA	NA	2.8
TRICHLOROFLUOROMETHANE	NA	NA	NA	NA	NA	NA
*VINYL CHLORIDE	2600	2600	13	46	NA	NA

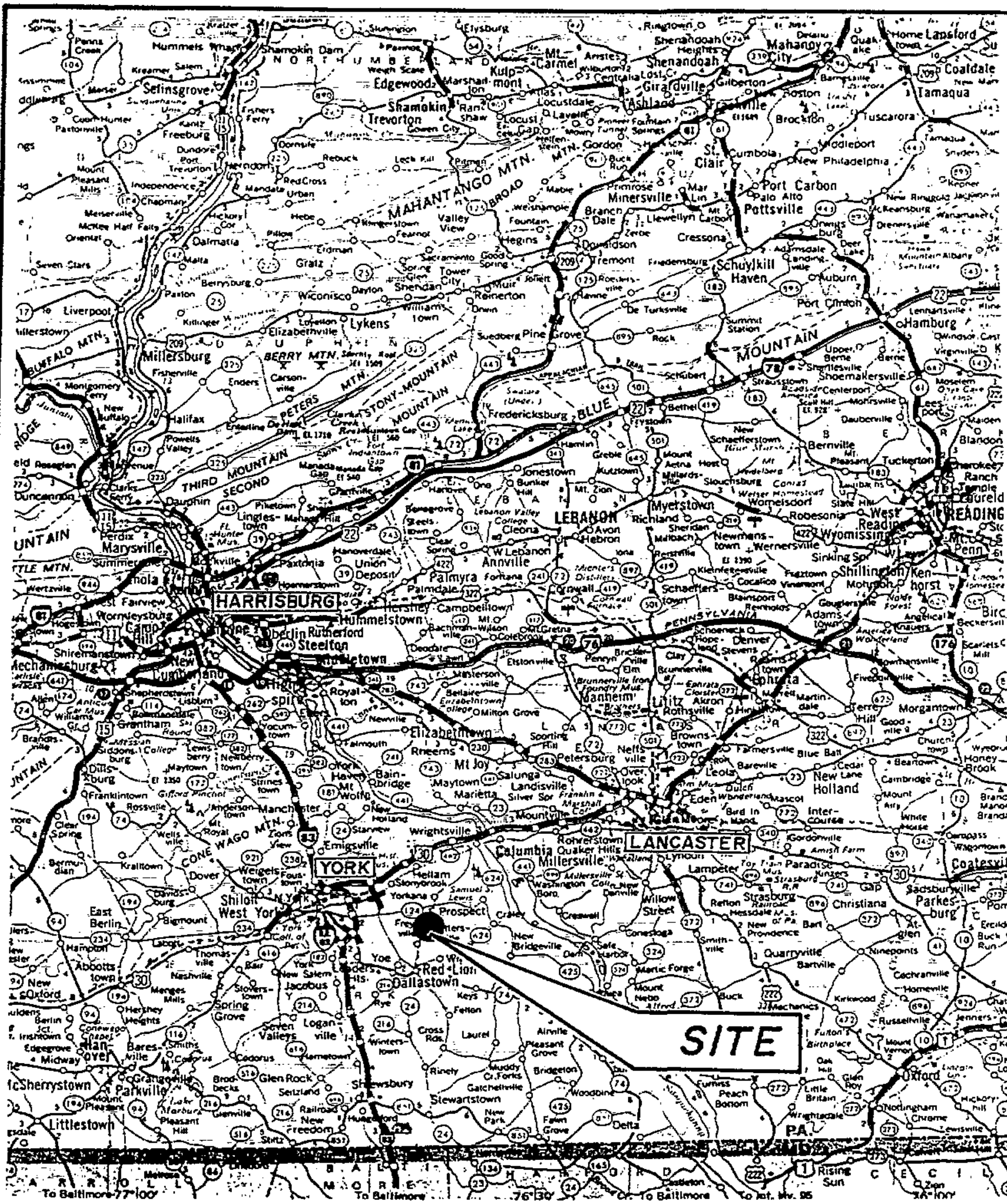
Notes:
NA = Not Available
* = Concentrations correspond to potential carcinogenic risk of 1x10-6
::
* Selected indicator chemicals

TABLE 14

EFFLUENT LIMITS MODERN NPDES
PERMIT NO. PA0046680

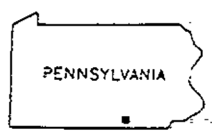
Parameter	Average Monthly (mg/l)	Maximum Daily (mg/l)	Instanteous Maximum (mg/l)
5-Day BOD	10		20
Suspended Solids	10		20
Ammonia Nitrogen			
(5/1 to 10/31)	1		4
(11/1 to 4/30)	3		12
Total Phosphorus			
as P	2		
Dissolved Oxygen	5.0 mg/l at all times	--	--
pH	6.0 to 9.0		
Iron	1.9	3.8	4.8
Managese	1.2	2.4	3.0
Zinc	0.038	0.075	0.10
Copper	0.09	0.18	0.22
Lead	0.038	0.075	0.10
Nickel	0.25	0.5	0.63
1,2 Trans-Dichloroethylene	0.088	0.17	
Trichloroethylene	0.039	0.078	
1,1 Dichloroethylene	0.0007	0.0014	
Methylene Chloride	0.06	0.12	
Carbon Tetrachloride	0.0034	0.0068	
Tetrachloroethylene	0.008	0.016	

AE 20440A-8

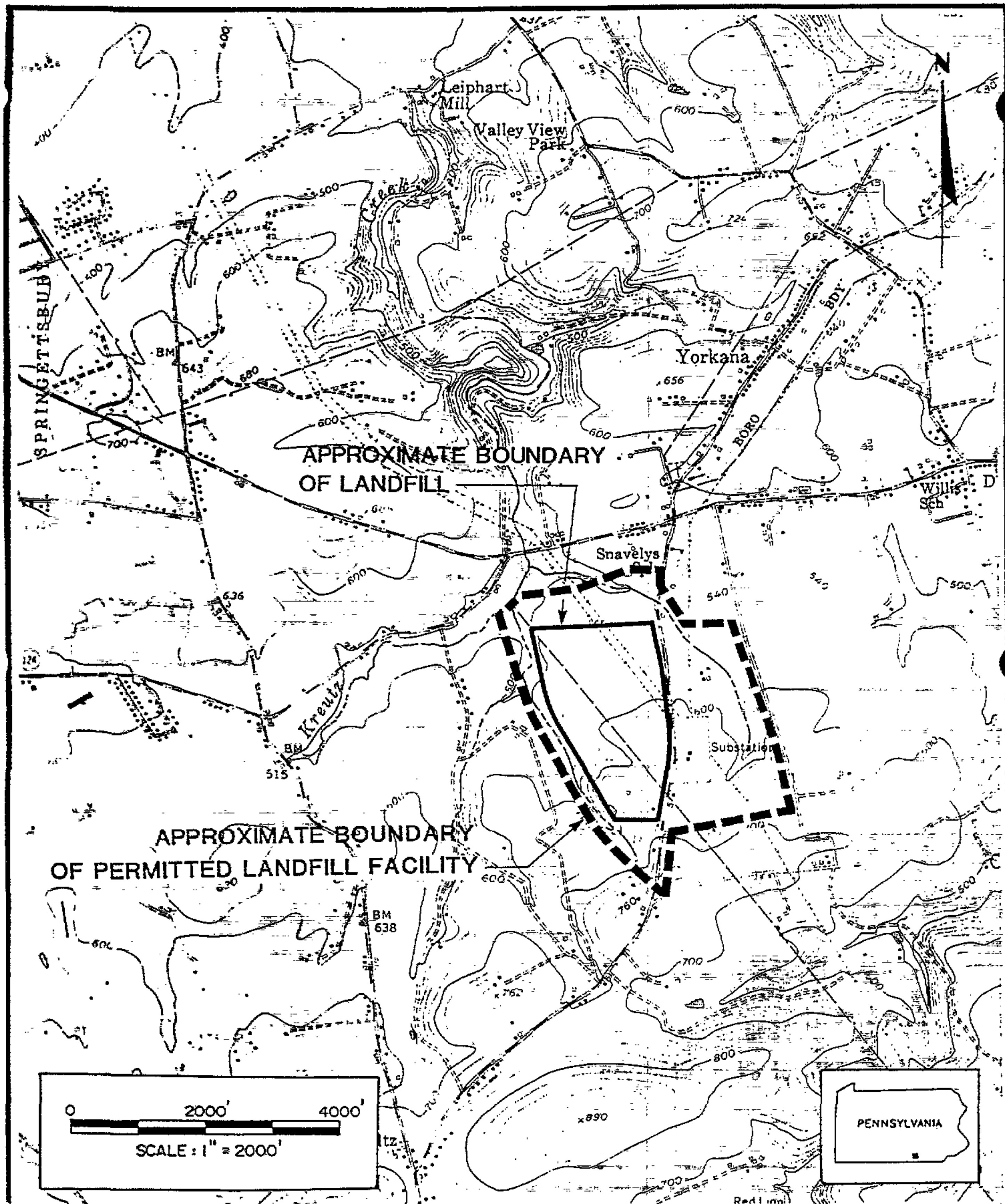


Scale: One inch: approximately 10.5 miles

miles: 0 5 10 15 20 25
inches: 0 1 2



JOB NO. 863-6020	SCALE AS SHOWN	SITE VICINITY PLAN		
DRAWN EAM	DATE 11/10/87			
CHECKED JEB	DWG NO 863-6020.1			
Golder Associates		MODERN LA AR300519	FIGURE 1	

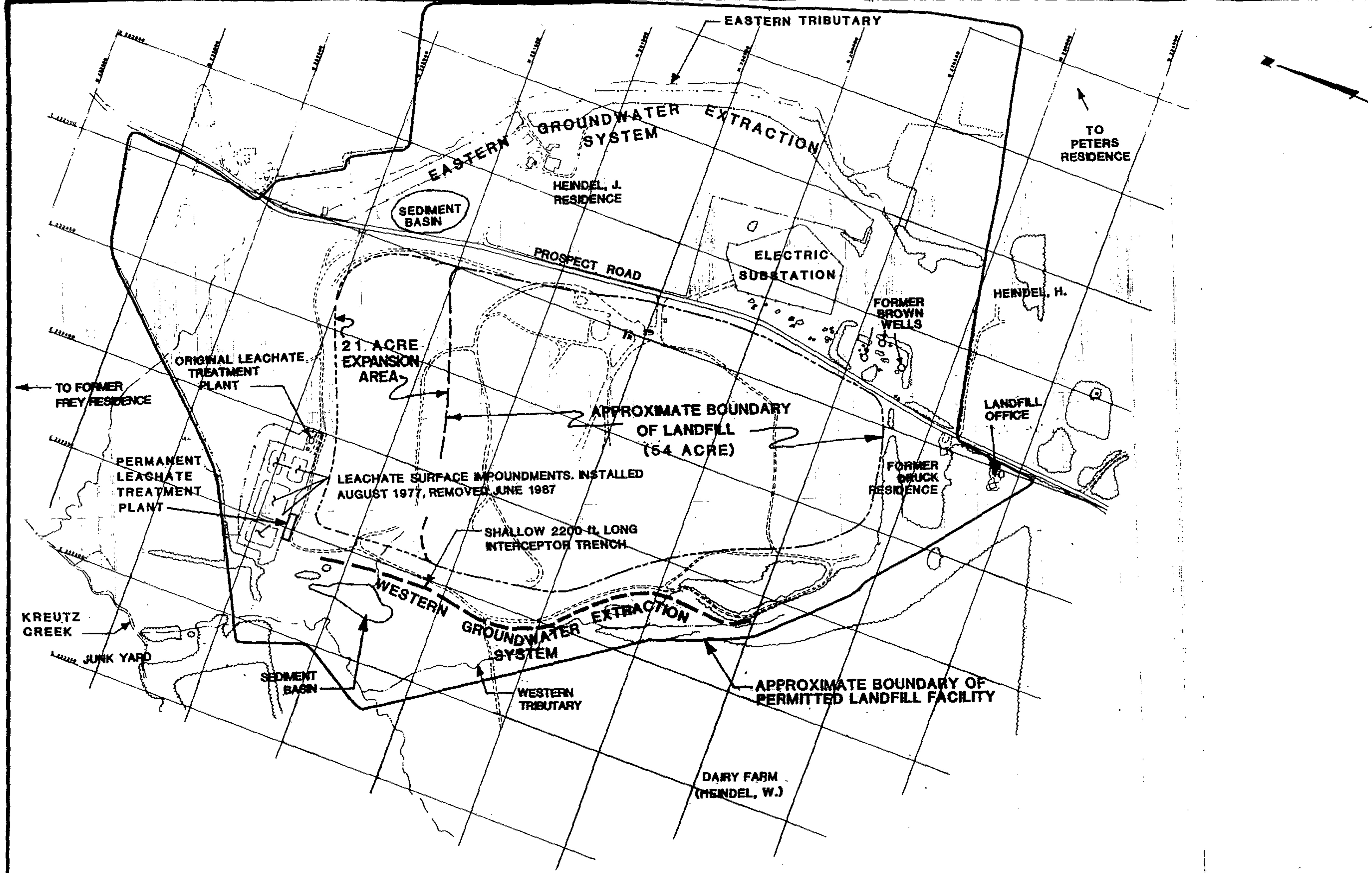


JOB NO. 863-6020	SCALE AS SHOWN	MODERN LANDFILL FACILITY LOCATION PLAN	
DRAWN MRM	DATE 11/9/87		
CHECKED RCK	DWG NO 863-6020.2		
Golder Associates		MODERN LANDFILL	FIGURE 2

AR300520

131567

A F 20440C-D

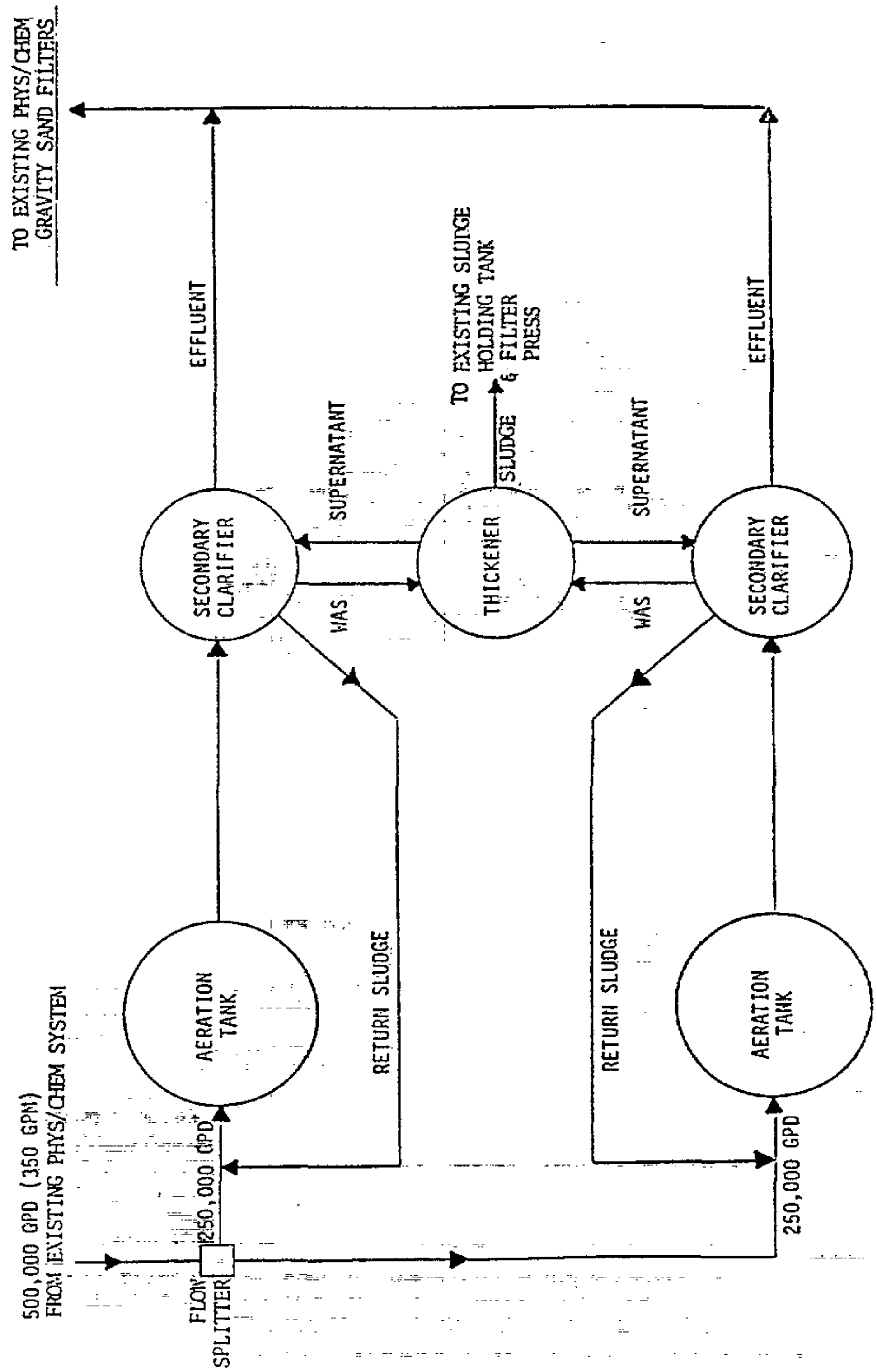


JOB NO.	863-6020	SCALE	1" = 500'
DRAWN	EAM	DATE	11/10/87
CHECKED	RCOK	DWG. NO.	863-6020.3
Golder Associates			

FACILITY LAYOUT

MODERN LANDFILL — FIGURE 3

AR300523

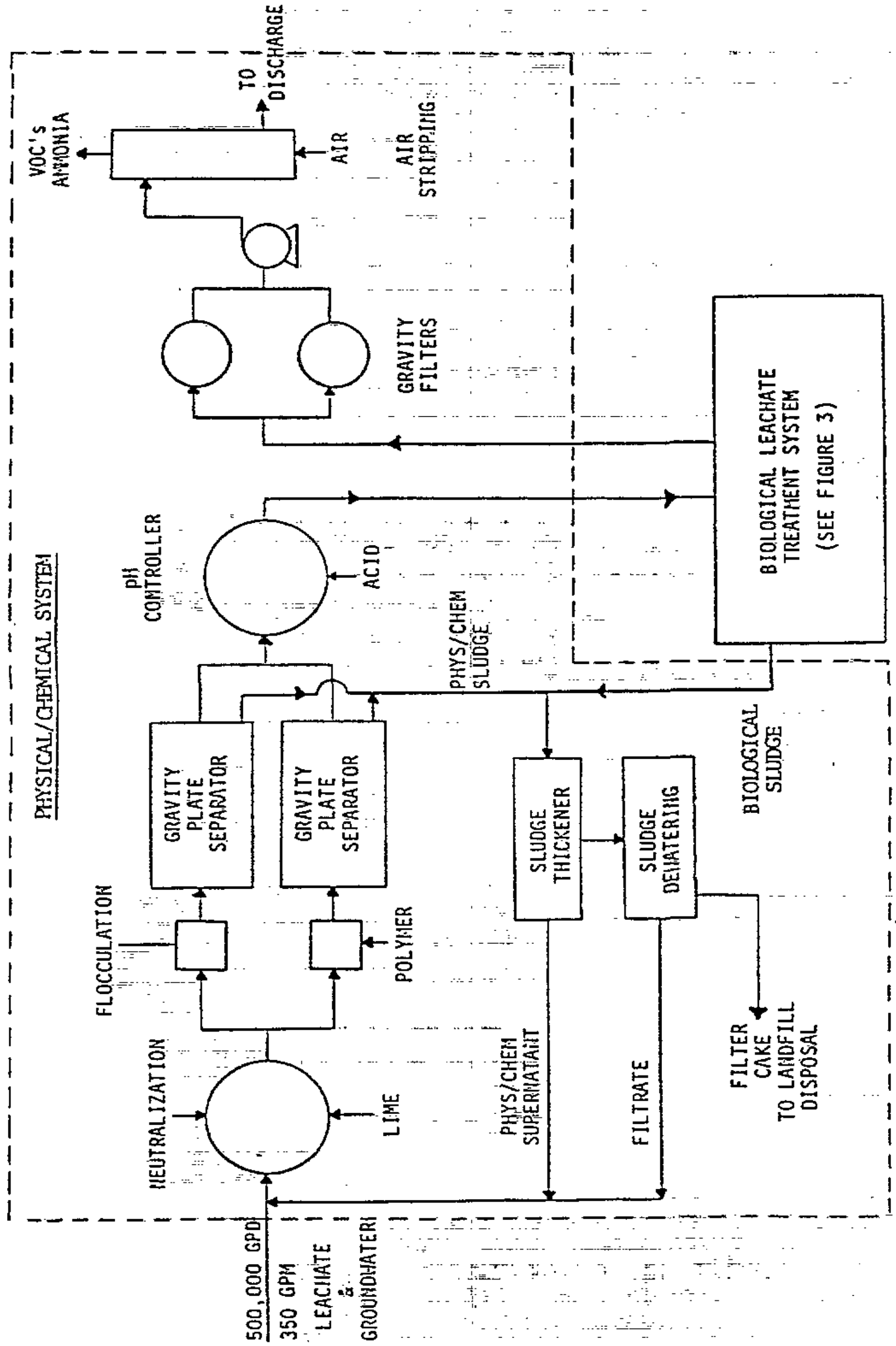


REFERENCE: REXNORD ENVIRONMENTAL MANAGEMENT

JOB NO.	863-6020	SCALE	N/A	PROPOSED BIOLOGICAL TREATMENT SYSTEM
DRAWN	MRM	DATE	12/2/87	
CHECKED	RCF/K	DWG. NO.	863-6020.6	
Golder Associates				MODERN LANDFILL — FIGURE 6

131557

AR300522

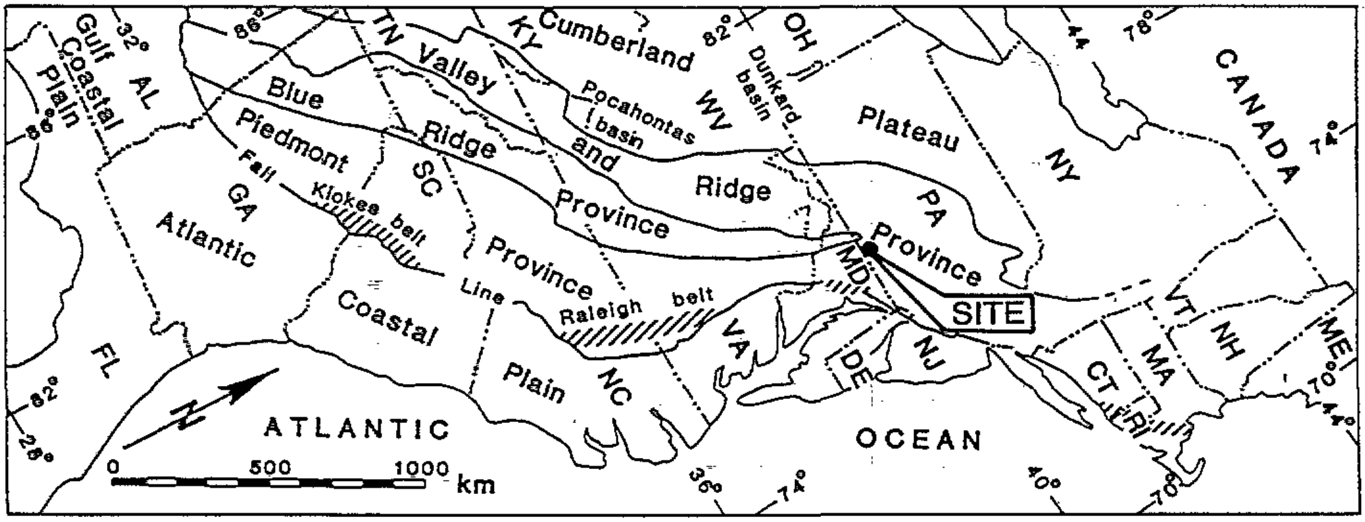


REFERENCE: REXNORD ENVIRONMENTAL MANAGEMENT

JOB NO. 863-6020	SCALE N/A	ULTIMATE COMBINED PHYSICAL/CHEMICAL AND BIOLOGICAL TREATMENT SYSTEM	
DRAWN MRM	DATE 12/2/87		
CHECKED RCFK	DWG NO. 863-6020.7		
Golder Associates		MODERN LANDFILL	FIGURE 7

131557

AR300523



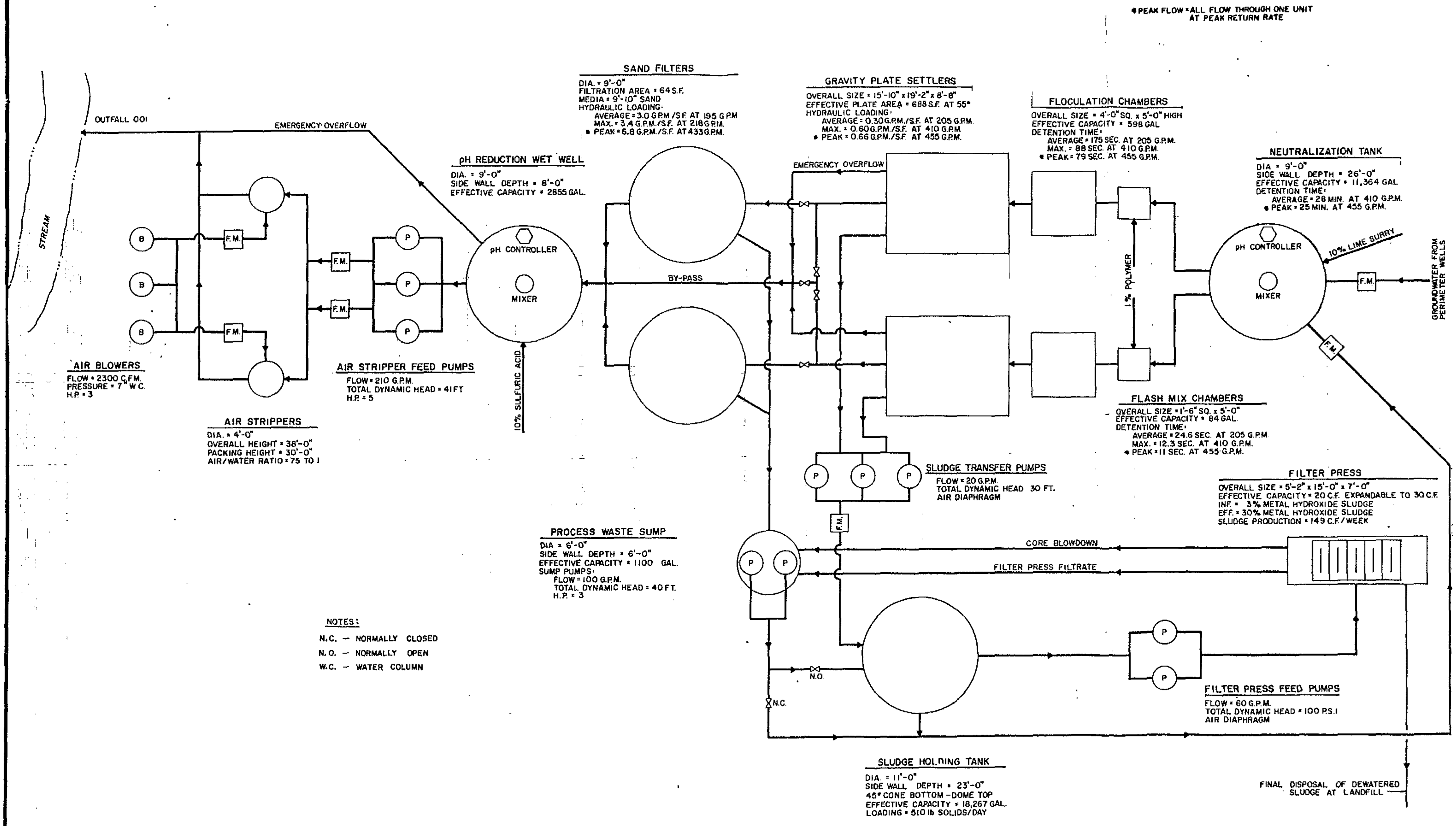
JOB NO. 863-6020	SCALE AS SHOWN
DRAWN MRM	DATE 11/8/87
CHECKED KCFK	DWG NO. 863-6020.8

Golder Associates

GEOLOGIC PROVINCES IN EASTERN NORTH AMERICA

AR300524

FIGURE 8



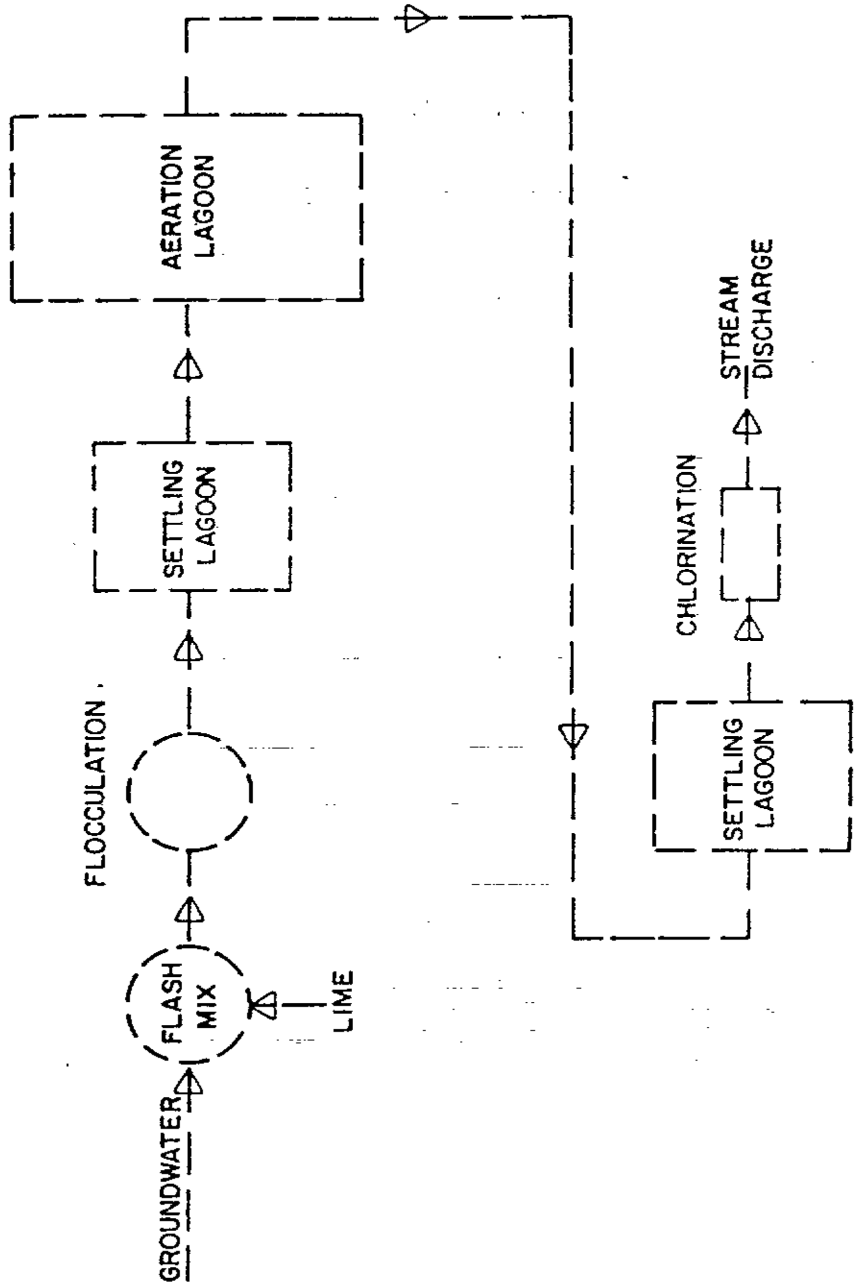
JOB NO. 863-6020	SCALE N/A	PROCESS FLOW SCHEMATIC
DRAWN EAM	DATE 12/7/87	
CHECKED RCFK	DWG. NO. 863-6020.5	
Golder Associates		MODERN LANDFILL — FIGURE 5

REFERENCE: BUCHART-HART, INC., DATED, NOV'85

AR300525

131557

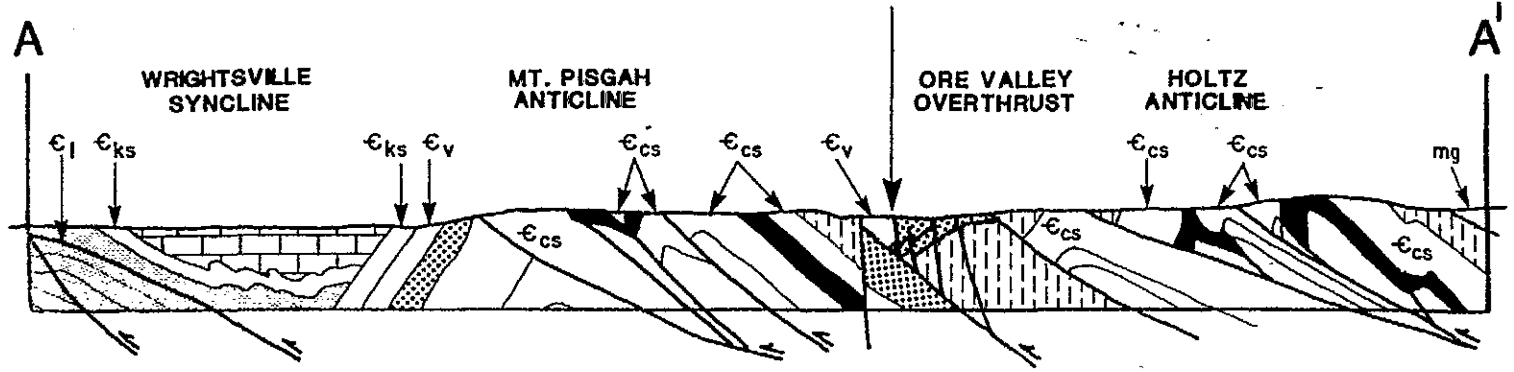
REFERENCE: BUCHART-HORN, INC.



JOB NO. 863-6020	SCALE N/A	ORIGINAL GROUNDWATER TREATMENT SYSTEM 1977-1986		
DRAWN MRM	DATE 12/2/87			
CHECKED RCFK	DWG. NO. 863-6020.4			
Golder Associates		MODERN LANDFILL	FIGURE	4

AR300526

131557



LEGEND

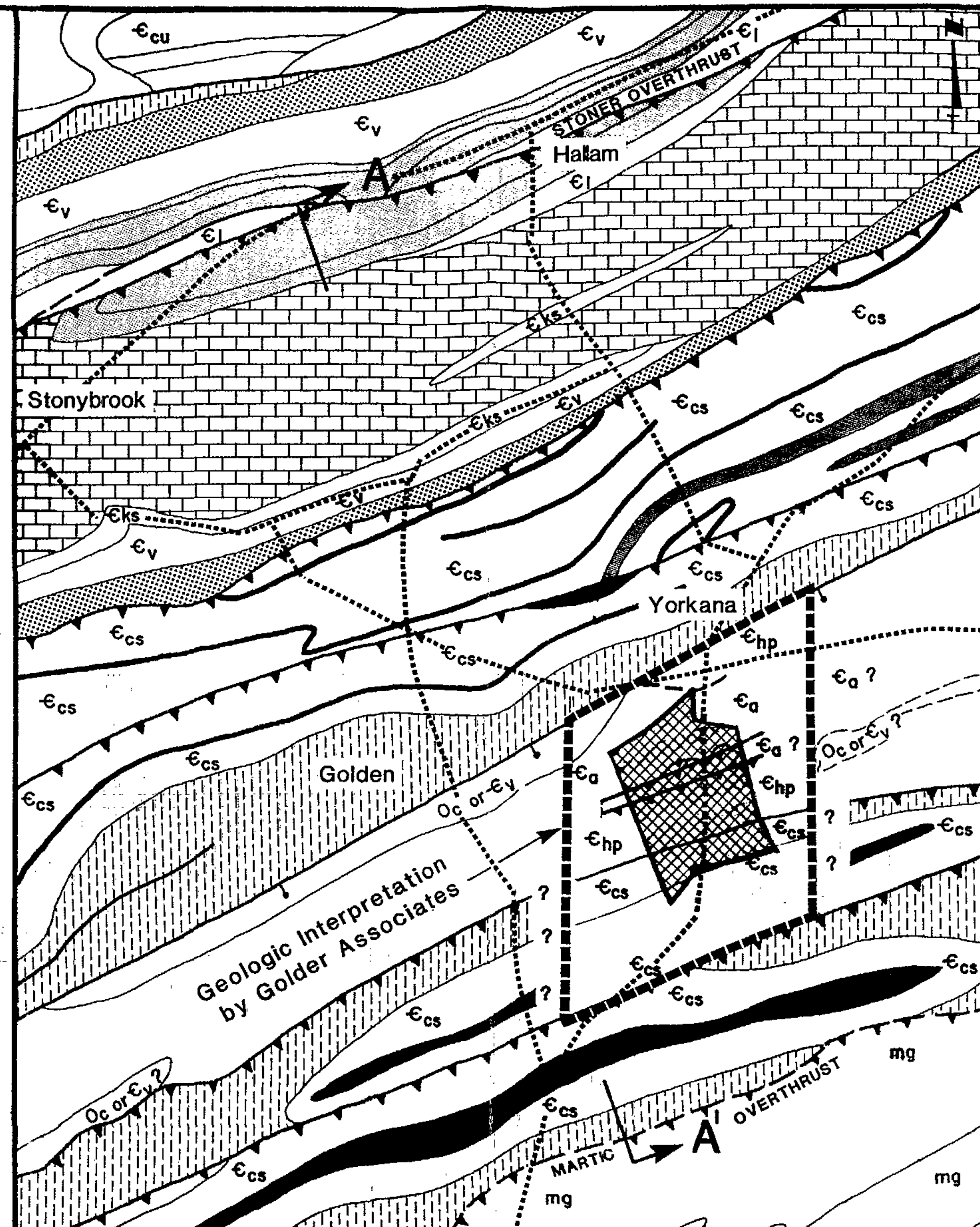
	Formation	Symbol	Thickness(ft.)	Character
Lower Ordovician	Conestoga Formation	Oc	300–1,000	Limestone, argillaceous in places, thin- and thick-bedded with thin partings of graphitic shale.
Lower Cambrian	Ledger Formation	Ꞓl	1,200±	Massive granular gray dolomite; chert horizon occurs near top of formation.
	Kinzers Formation	Ꞓku Ꞓks	160– 400	Upper member—earthy limestone containing dark argillaceous layers; middle member—limestone of variable composition; lower member—dark shale with earthy limestone.
	Vintage Formation	Ꞓv	500– 800	Upper part of formation is primarily pure fine-grained limestone, finely banded or mottled by wavy dark layers. Lower part of formation is chiefly a blue knotty dolomite.
	Antietam Formation	Ꞓa	100– 200	Fine- to medium-grained phyllitic quartzite.
	Harpers Formation	Ꞓhp	800–1,000	Dark-gray quartzose phyllite; contains beds of dense green ferruginous quartzite and magnetite-bearing gray quartzite.
	Chickies Formation	Ꞓcq Ꞓch Ꞓcs	400– 900	Massive, prominently bedded, white vitreous quartzite north of the Stoner overthrust. Black shiny slate with numerous thin plates and thicker zones of quartzite south of the Stoner overthrust. A basal conglomerate member made up of quartzose conglomerate, feldspathic quartzite, and interbedded black slate is present north and south of the Stoner overthrust.
Precambrian	Metabasalt	mg	(?)	Grayish-green to bluish-gray hornblende schist, blotched with green epidote.
	Volcanic slate	mg	(?)	Blue and dark-purple sparkling sericite slate, in part amygdaloidal and containing dust-like particles of hematite.
	Metarhyolite	mg	(?)	Fine-grained hard dense metarhyolite with or without phenocrysts of feldspar and quartz.

APPROXIMATE BOUNDARY OF PERMITTED LANDFILL FACILITY

PROBABLE OR POSSIBLE

ROAD

0 3000 6000
SCALE IN FEET



JOB NO.	863-6020	SCALE	AS SHOWN
DRAWN	MRM	DATE	12/7/87
CHECKED	RCF/K	DWG. NO.	863-6020.9

Golder Associates

REGIONAL GEOLOGY AND GEOLOGIC SECTION

MODERN LANDFILL

FIGURE 9

AR300527

EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 115230
PAGE # 300528

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME MODERN SANITATION

OPERABLE UNIT OU 1

ADMINISTRATIVE RECORDS- SECTION III **VOLUME** A

REPORT OR DOCUMENT TITLE Remedial Investigation/ Feasibility Study (RI/FS) Work Plan - Vol. 1 - Part 1 of 3

DATE OF DOCUMENT 12/1/87

DESCRIPTON OF IMAGERY History of Landfill Development

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized MAP

EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 115230
PAGE # 300529

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME MODERN SANITATION

OPERABLE UNIT OU1

ADMINISTRATIVE RECORDS- SECTION III **VOLUME** A

REPORT OR DOCUMENT TITLE Remedial Investigation/ Feasibility Study (RI/FS) Work Plan - Vol. 1 - Part 1 of 3

DATE OF DOCUMENT 12/1/87

DESCRIPTON OF IMAGERY Decommisioned, Abandoned and Inactive wells, Test Pits

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized Map

EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 115230
PAGE # AR300530

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME Modern Sanitation

OPERABLE UNIT OU1

ADMINISTRATIVE RECORDS- SECTION III VOLUME A

REPORT OR DOCUMENT TITLE Remedial Investigation/ Feasibility study Work Plan - Volume I - Part 1 of 3

DATE OF DOCUMENT 1 December 1987

DESCRIPTON OF IMAGERY Active monitoring points

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized map.

EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 115230
PAGE # 300531

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME Modern Sanitation

OPERABLE UNIT 00

ADMINISTRATIVE RECORDS- SECTION ____ VOLUME III A

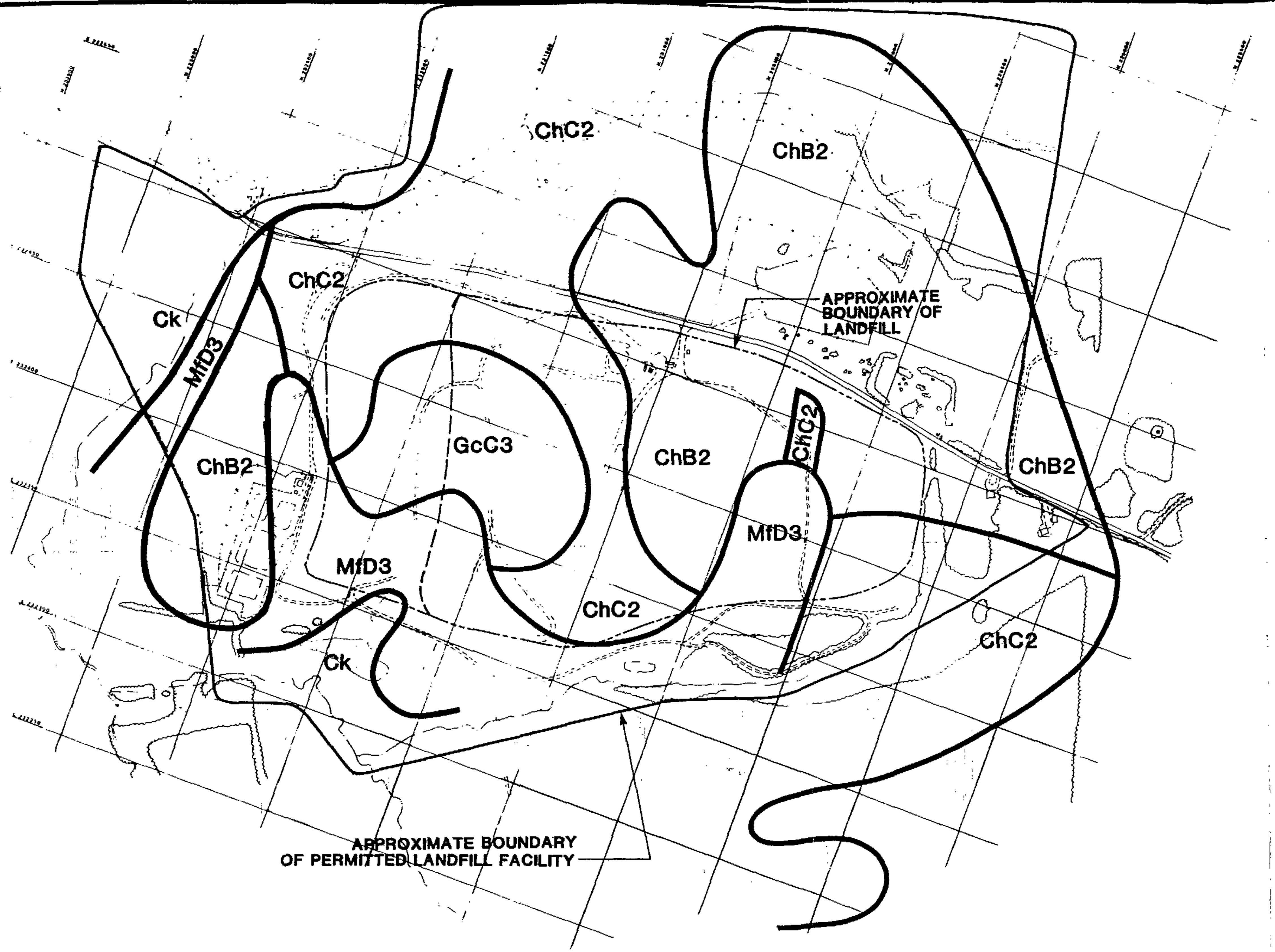
REPORT OR DOCUMENT TITLE Remedial Investigation/Feasibility Study Work Plan - Vol 1 Part 1 of 3

DATE OF DOCUMENT 12/1/87

DESCRIPTON OF IMAGERY Geologic Map and Section

NUMBER AND TYPE OF IMAGERY ITEM(S) 1, Oversized Map

A F 20440C-D



LEGEND:

SYMBOL	DESCRIPTION	SLOPE
Ch C2	Chester silt loam	8% – 25%
Ch B2	Chester silt loam	3% – 8%
Gc C3	Glenelg channery silt loam	8% – 15%
Mf D3	Manor channery loam	15% – 25%

JOB NO.	863-6020	SCALE	1" = 500'
DRAWN	MRM	DATE	12/6/87
CHECKED	RCFK	DWG. NO.	863-6020.14

Golder Associates

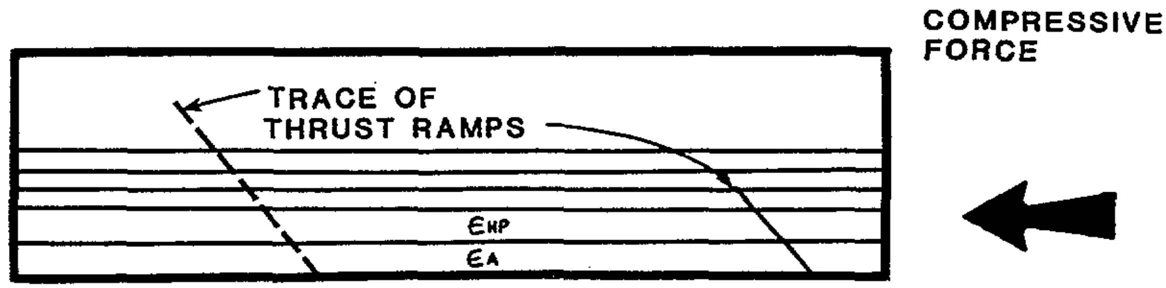
AGRICULTURAL SOILS

MODERN LANDFILL

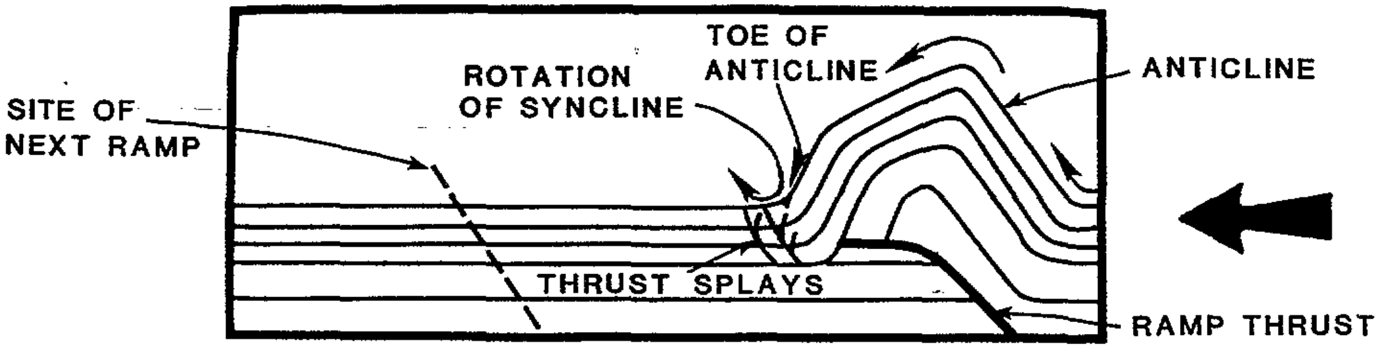
FIGURE 14

AR300532

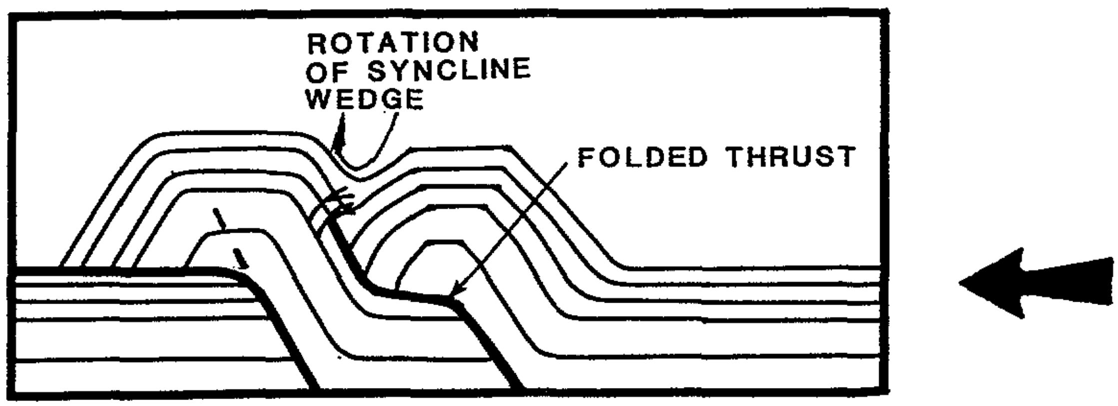
AF 20440A-B



1. Deposition and Lithification



2. Development of Thrust Fault and Ramp Anticline



3. Rotation of Synclinal Wedge

REFERENCES

ELLIOT, D. AND BOYER, S. (1982) THRUST SYSTEMS AMER. ASSOC. PETRO. GEOL., V. 66 P1196-1230

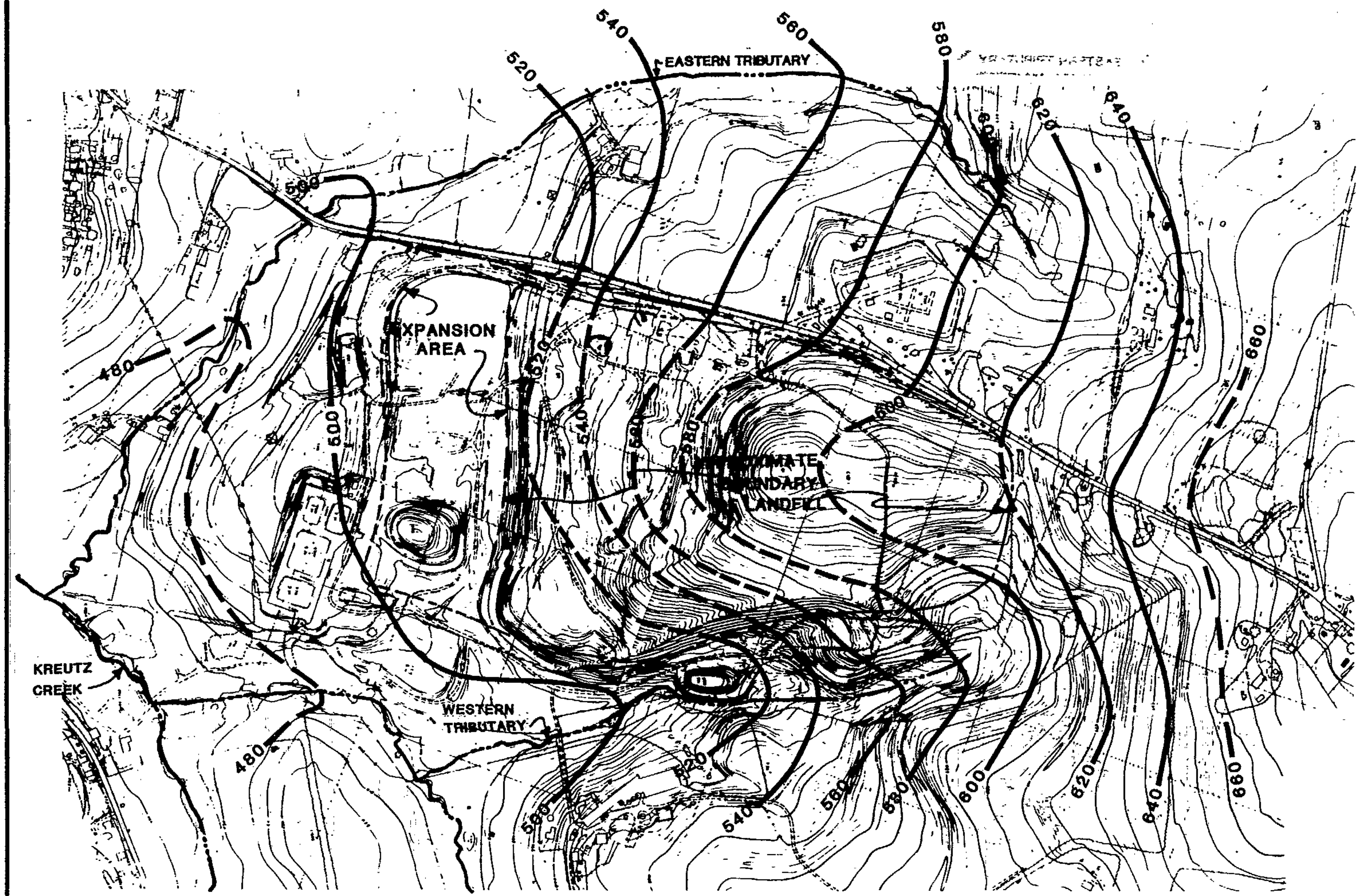
MITRA, S. (1987) REGIONAL VARIATIONS IN DEFORMATION MECHANISMS AND STRUCTURAL STYLES IN THE CENTRAL APPALACHIAN OROGENIC BELT. GEOL. SOC. AMER., V. 98 P569-590

RAMSEY, J.G. AND HUBER, M.T. (1987) THE TECHNICS OF MODERN STRUCTURAL GEOLOGY. V. 2, FOLDS AND FRACTURES ACADEMIC PRESS, LONDON. PP505-559

JOB NO.	863-6020	SCALE	NTS	SCHEMATIC DEVELOPMENT OF RAMPED ANTICLINES
DRAWN	CSC	DATE	11/9/87	
CHECKED	KLCK	DWG. NO.	863-6020.15	
Golder Associates				MODERN LANDFILL — FIGURE 15

AR300533

A F 20440C-D



LEGEND

—— 620 —— GROUNDWATER ELEVATION CONTOURS (FT.-MSL)

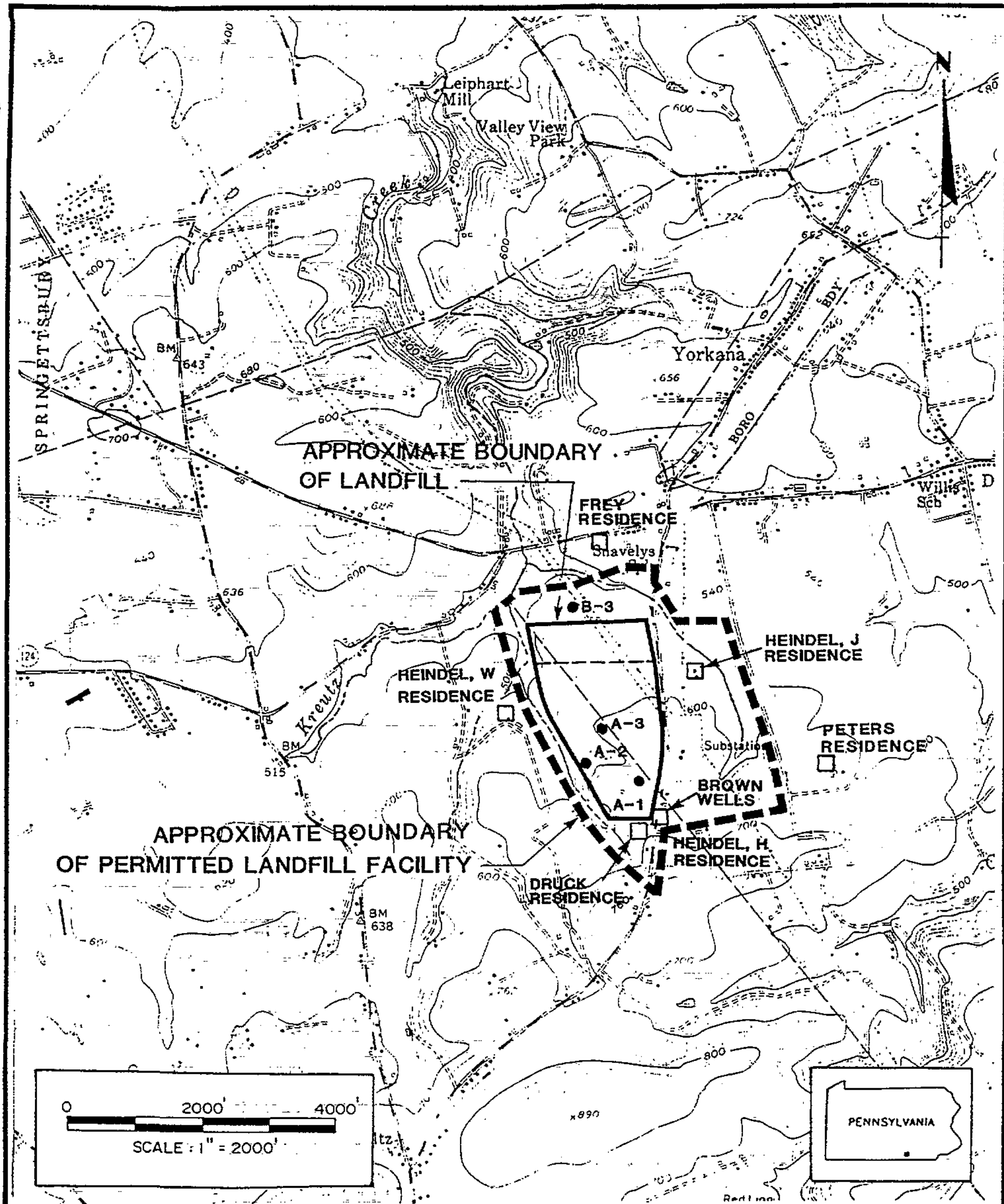
— — 660 — — INFERRED GROUNDWATER CONTOURS (FT.-MSL)

NOTE: MEASUREMENTS TAKEN NOVEMBER & DECEMBER 1986.

CONTOURS BENEATH LANDFILL BASED ON SEPT. '81 - FEB. '82 WELLS A1, A2 & A3.

JOB NO. 863-6020	SCALE 1" = 500'	GROUNDWATER POTENTIOMETRIC SURFACE CONTOURS		
DRAWN EAM	DATE 11/10/87			
CHECKED RCEK	DWG. NO. 863-6020.16			
Golder Associates		MODERN LANDFILL	FIGURE	16

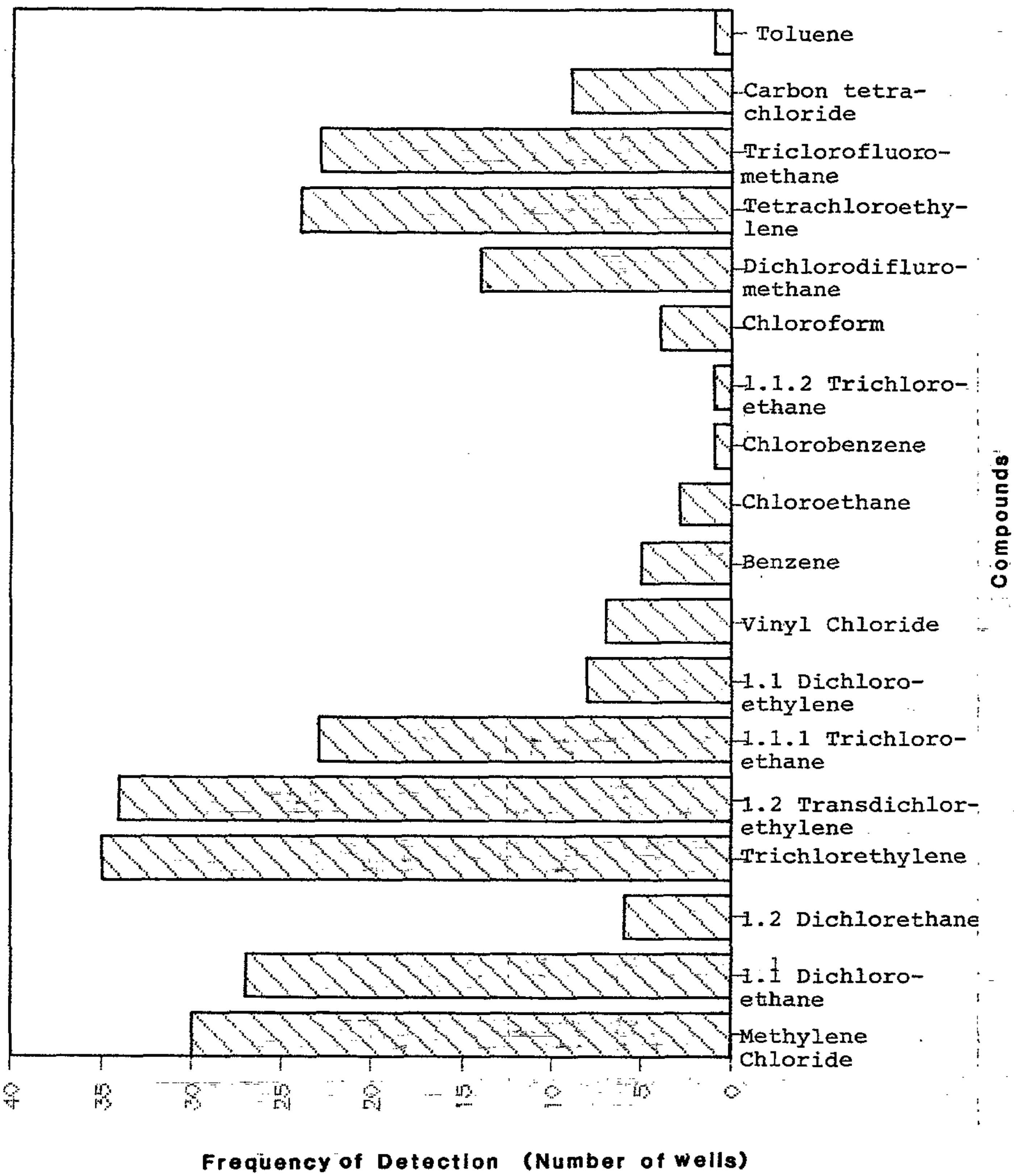
AR300534



JOB NO. 863-6020	SCALE AS SHOWN	LOCATION OF DETECTION POINTS FOR FIT REPORT 1982	
DRAWN MRM	DATE 11/9/87		
CHECKED KCFK	DWG NO 863-6020.17		
Golder Associates		MODERN LANDFILL	FIGURE 17

131557

AR300535



NOTE:
FROM 4th QUARTER, 1986 DATA

JOB NO. 863-6020	SCALE N/A	FREQUENCY OF COMPOUND DETECTION
DRAWN APTM	DATE 11/11/87	
CHECKED RCAK	DWG. NO. 863-6020.18	
Golder Associates		MODERN LA AR300536 18

131557

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SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 115230
PAGE # AR300537

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME Modern Sanitation

OPERABLE UNIT 01

ADMINISTRATIVE RECORDS- SECTION III VOLUME A

REPORT OR DOCUMENT TITLE Remedial Investigation/ Feasibility Study Work Plan

DATE OF DOCUMENT 12/1/87

DESCRIPTON OF IMAGERY Characterization of Groundwater (Figure 19)

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 Oversized map

EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 115230
PAGE # AR300538

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME Modern Sanitation

OPERABLE UNIT 01

ADMINISTRATIVE RECORDS- SECTION III VOLUME A

REPORT OR DOCUMENT TITLE Remedial Investigation/ Feasibility Study Work Plan

DATE OF DOCUMENT 12/1/87

DESCRIPTON OF IMAGERY Total Volatile Organics Distribution Map 4th Quarter 1986 (Figure 20)

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized map

EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 115230
PAGE # AR300539

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME Modern Sanitation

OPERABLE UNIT 01

ADMINISTRATIVE RECORDS- SECTION III VOLUME A

REPORT OR DOCUMENT TITLE Remedial Investigation/Feasibility Study - Work Plan

DATE OF DOCUMENT 12/1/87

DESCRIPTON OF IMAGERY Specific Conductivity Distribution Map 4th Quarter 1986 (Figure 21)

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized map

EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 115230
PAGE # AR300540

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME Modern Sanitation

OPERABLE UNIT 01

ADMINISTRATIVE RECORDS- SECTION III VOLUME A

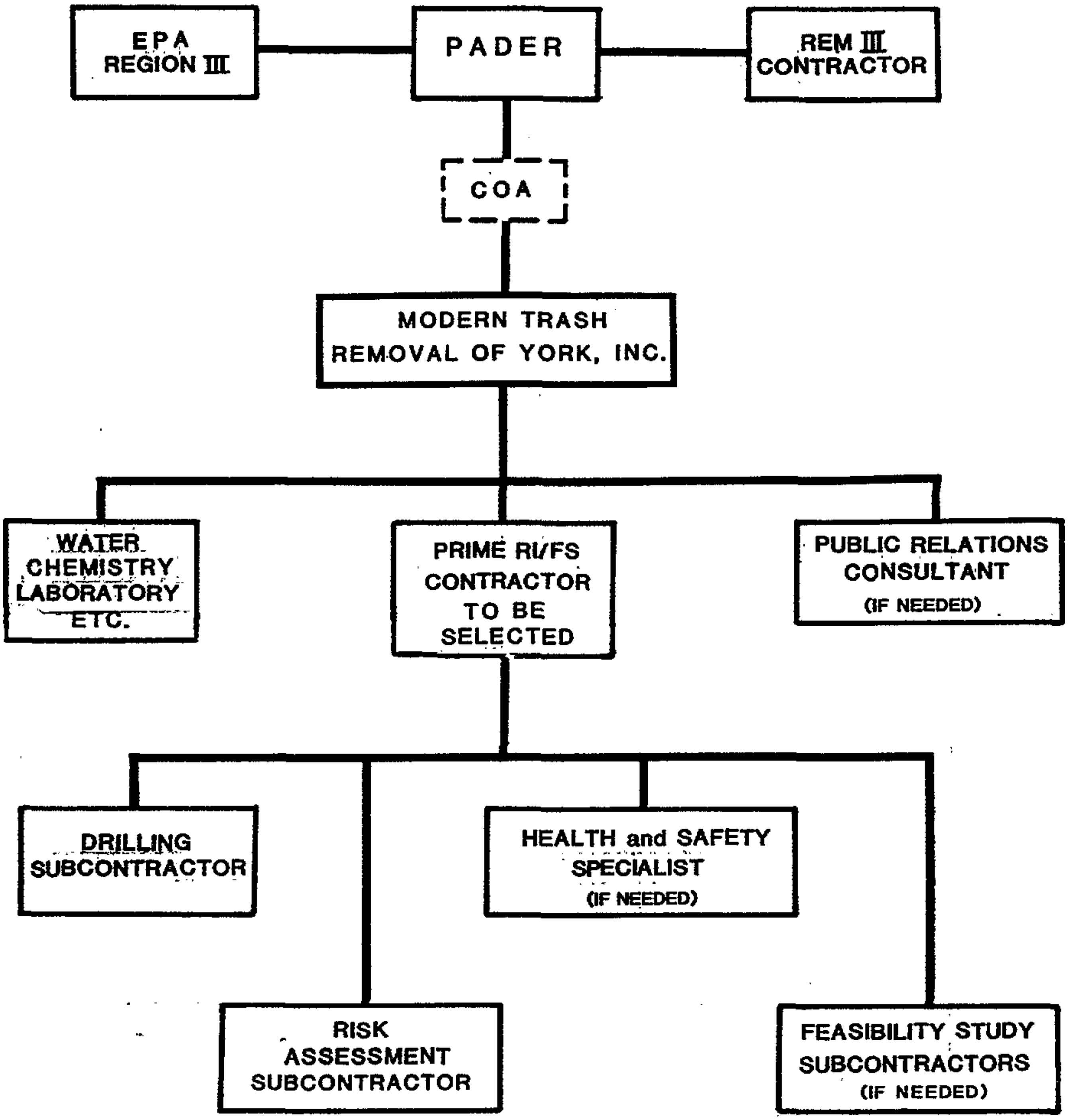
REPORT OR DOCUMENT TITLE Remedial Investigation

DATE OF DOCUMENT 12/1/87

DESCRIPTON OF IMAGERY Proposed Field Investigation (Figure 22)

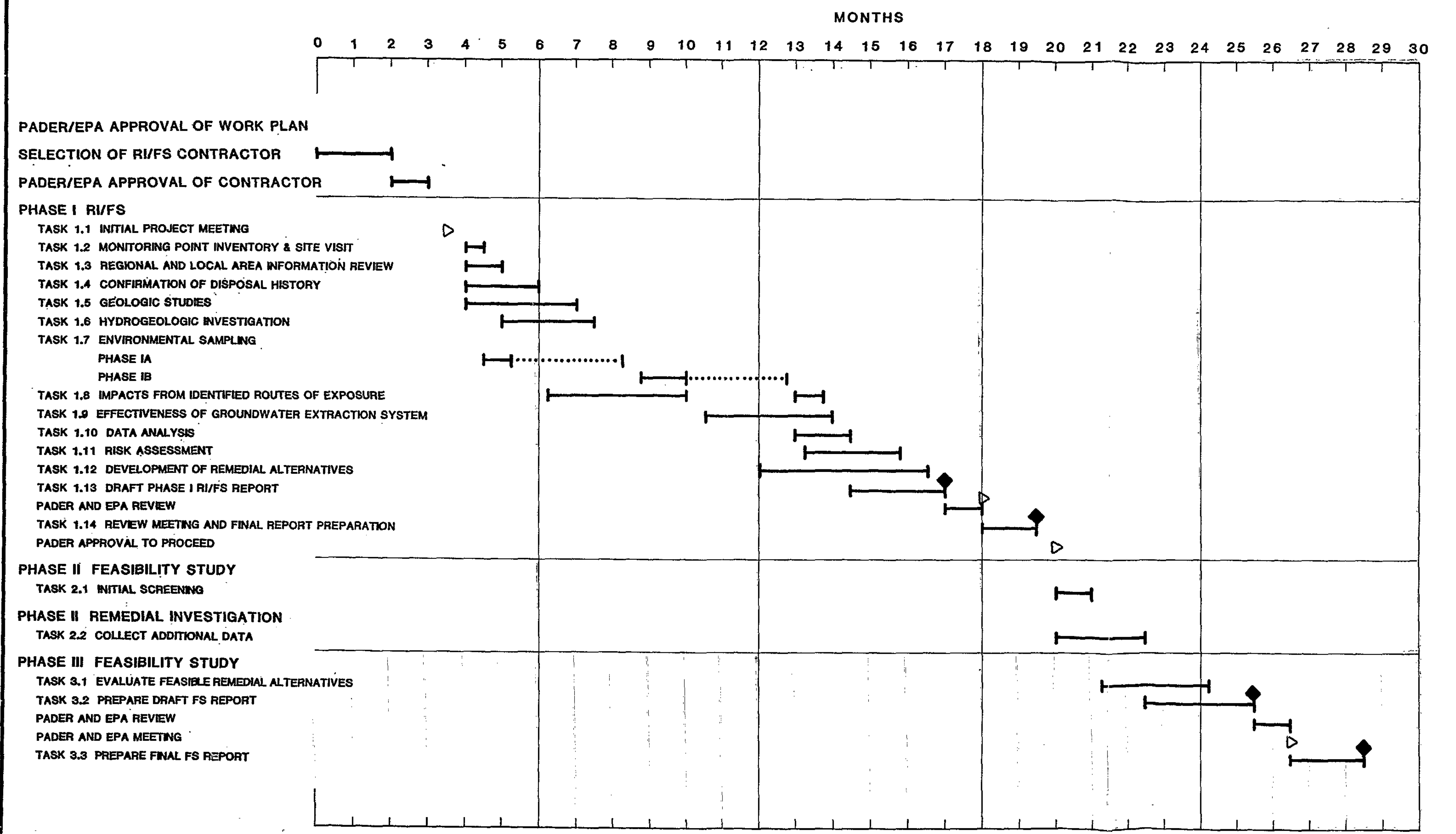
NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized map

A# 20440A-B



JOB NO. 863-6020	SCALE N/A	RI / FS MANAGEMENT STRUCTURE
DRAWN EAM	DATE 11/10/87	
CHECKED JEB	DWG. NO. 863-6020.23	
Golder Associates		MODERN LANDFILL — FIGURE 23

AR300541



LEGEND:

- |—| WORK ITEM DURATION
- |·····| CHEMICAL ANALYSIS
- ◆ SUBMIT WRITTEN DOCUMENTATION
- ▷ MEETING

JOB NO.	863-6020	SCALE	N/A
DRAWN	MRM	DATE	12/9/87
CHECKED	KCK	DWG. NO.	863-6020.24

Golder Associates

RI/FS TIME SCHEDULE

MODERN LANDFILL

FIGURE 24

AR300542

APPENDIX A

MODERN REPORTS

1. REWAI, 1975. The Feasibility of Utilizing Shallow Pumping Wells as a Primary Leachate Recovery System for the Modern Landfill.

2. William E. Sacra and Associates, 1976. Erosion and Sediment Control Plan for Modern Trash Removal of York, Inc., Sanitary Landfill and Construction of an Industrial Waste Treatment Facility.

3. E & E, 1982 (October). Preliminary Assessment and Site Inspection Report.

4. AGES, 1982. Hydrogeologic Study, Modern Sanitary Landfill.

5. AGES, 1982. Hydrogeologic Study, Appendix 1 and 2, Modern Sanitary Landfill.

6. AGES, 1982. Hydrogeologic Study, Installation of Observation Wells A-5 and A-6 and Extension of Wells A-1 and A-2.

7. AGES, 1982. Report of Laboratory Analysis of Selected Sampling Points Collected June 23, 1982 at the Modern Sanitary Landfill.

8. AGES, 1982. Treatability Study, Groundwater Wells A-1 and A-2, Modern Sanitary Landfill.

9. AGES, 1982. Long Term Pump Test, Druck Residential Well, Modern Sanitary Landfill.

10. AGES, 1982. Hydrogeologic Assessment of Frey Residence, York County, Pa.

11. AGES, 1983. Western Interceptor Study, Modern Sanitary Landfill.

12. AGES, 1983 (Aug.). Analytical Report for Modern Sanitary Landfill.

13. AGES, 1983 (Nov.). Analytical Report for Modern Sanitary Landfill.

14. AGES, 1984 (Feb.). Analytical Report for Modern Landfill.

15. REWAI, 1984. Modern Landfill, York, PA., Phase I Investigation of Leachate Collection Alternatives in the Western Perimeter Area.

16. AGES, 1984 (March). Analytical Report of Modern Landfill.

17. REWAI, 1984. Phase II Investigation Interim Report, Installation of Groundwater Interceptor Wells in the Western Perimeter Area.

18. AGES, 1984 (May). AGES Laboratory Analysis of Groundwater Samples Prepared for Modern Sanitary Landfill.

19. NUS Corporation, 1984 (June). A Toxilogical Review for Modern Sanitary Landfill.

20. EPA, November 1985. Site Analysis Modern Sanitary Landfill, York County, Pennsylvania. T5-Pic-85126 Prepared by the Bionetics Corporation, Virginia.

21. REWAI, 1985. Phase I Investigation of Leachate Interception Alternatives in the Northern and Eastern Perimeters of the Modern Landfill, York, Pa.

22. Golder Associates, 1985. Evaluation of Leachate Interception Alternatives.

23. REWAI, 1985. The Importance of the Modern Landfill to the Solid Waste Management Needs of South-Central Pennsylvania.

24. Buchart-Horn, Inc., 1985. Concept of Development, Biological Treatment Alternatives at Modern Landfill (Draft).

25. Buchart-Horn, Inc., 1985. Report on Leachate/Groundwater Treatment System at Modern Landfill, Concept Development Plan.

26. Technos, 1985. Evaluation of Hydrogeology at the Modern Landfill, York, Pa.

27. Chemical Waste Management, Inc., 1985. Plan for On-Site Management Activities at Modern Trash Landfill in York, Pa. Documentation for PCB Removal at Modern.

28. No Ref., 1985. Report on the Effect of Post-Construction Stormwater Runoff from Modern Landfill on the Downstream Structures Across Kreutz Creek and its Tributaries.

29. REWAI, 1985. Examination of the Deep Groundwater Flow System, Eastern Perimeter, Modern Landfill

30. REWAI, 1985. Western Perimeter Groundwater Interceptor Well System, Initial 6-month Start-Up Report.

31. E & E, 1986 (May). Draft Remedial Investigation/Feasibility Study Work Plan RI/FS.

32. REWAI, Draft 1986 (Updated 1987). Geology of the Northern Expansion Area of Modern Landfill, York County, Pa.

33. Fred C. Hart Associates, 1986 (April). Geotechnical Evaluation of the Modern Landfill Facility, York, Pa.

34. Fred C. Hart Associates, 1986 (September). As-Built Documentation Gas Control Well Installation, Modern Sanitary Landfill.

35. REWAI, March 1987. 1986 Annual Performance Evaluation Report for the Western and Eastern Perimeter Groundwater Collection Systems of Modern Landfill, York County, Pa.

36. REWAI, Draft 1987. Modern Landfill, Eastern Perimeter Groundwater Collection System, Construction Inspection Reports

37. REWAI, Draft 1987. Phase II Investigation, Design and Start-Up of the Eastern Perimeter Groundwater Collection Well System of the Modern Landfill, York, Pa.

38. Delta Geophysical Services, 1987. Geophysical Investigation, Modern Landfill, York, Pa.

39. REWAI, 1987. Monthly Monitoring Report, Modern Landfill, York County, Pa.

Reference 1. REWAI, 1975. The Feasibility of Utilizing Shallow Pumping Wells as a Primary Leachate Recovery System for the Modern Landfill.

REWAI has concluded that the collection of all leachate generated by the Modern Landfill that would naturally enter the groundwater flow system is feasible by the use of four or five strategically placed pumping recovery wells and a western perimeter collector trench. The volume of pumpage required to assure such capture will vary in accord with the volume of groundwater recharge.

Reference 2. William E. Sacra and Associates, 1976. Erosion and Sediment Control Plan for Modern Trash Removal of York, Inc., Sanitary Landfill and Construction of an Industrial Waste Treatment Facility.

This plan, prepared by William E. Sacra and Associates, notes that grading at the Modern Landfill should be held to a mimimum, as excessive grading may affect groundwater.

Reference 3. E & E, 1982 (October). Preliminary Assessment and Site Inspection Report.

This Ecology and Environment (E & E) report reviews the FIT Region III site inspection which was conducted on June 23, 1982.

Recommendations by FIT Region III are as follows:

- Periodic sampling of the nearby residential wells be performed to monitor off-site migration of constituents.

- Due to the reports of groundwater and surface water being used by area farms for livestock and irrigation purposes, additional sampling of these sources should be performed to determine the potential impacts upon these targets.

- Upon completion of the AGES study, it should be determined if the leachate collecion system is completely effective.

- Since the groundwater is discharging directly into a tributary of Kreutz Creek, reactivation of the on-site treatment facility for groundwater treatment should be investigated.

- Remedial actions to correct the groundwater problem should be investigated.

Reference 4. AGES, 1982. Hydrogeologic Study, Modern Sanitary Landfill.

The site is located in the extreme northwestern edge of the Uplands Section of the Piedmont physiographic province in folded, sheared and faulted Cambrian bedrock units associated in general with a major structural feature known as the Martic Overthrust. Although the principal overthrust block is to the southeast of the site at least two overthrust features have been recognized in the immediate vicinity striking approximately N50^{o} E with the overthrust to the northwest. The sheared planar features dip at a gentle angle to the southeast. Topographic features such as valleys, stream channels, springs, etc. reflect the existence of faulting at or near the ground surface.

Rock units exposed on or within proximity of the site boundaries consist primarily of the Antietam Quartzite and Harpers phyllite, both of Cambrian age. Overburden consists of colluvium, residual soil, and a regolith that varies in thickness depending on the mineralogical character of the bedrock units involved. Bedding (relict) usually parallels the schistosity and in this area dips at high angles to the NW and SE, maintaining a NE strike. Joints and fractures are predominant in the weathered, upper zones of the bedrock.

The character of the fault planes is not well understood, however, considerable mineralization, shearing and brecciation usually accompanies such movement. In the 19th century, deposits of limonite (brown hematite) were worked along the fault zones, where the ore was precipitated from circulating ground water, particularly in the iron-bearing Antietam Quartzite. AGES notes it is entirely possible that the deep trench, noted in the original topography of the landfill site near a projected fault zone may have been a test trench or exploratory excavation for the commercial extraction of iron ores.

AGES also concludes that ground water beneath the main portion of the site is believed to closely follow the surface contours at or near the overburden-rock contact. However, in the higher (southern) end on the landfill area it is felt that the occurrence and flow patterns of the ground water are influenced significantly by the character and structure of the bedrock as modified by the thrust fault zone which is projected into the site probably in contact with some portions of the landfill. Although not fully understood at present these features may have contributed to the transmission of landfill generated contaminants to nearby wells or excavations penetrating the faulted rock zone. It is generally believed that ground water is found mostly in the rock fractures in both the Antietam and Harpers Formations in higher elevations. In that portion of the site located on lower slopes ground water levels approach the surface and in places discharge into tributaries of Kreutz Creek as spring or seeps.

Reference 5. AGES, 1982. Hydrogeologic Study, Appendix 1 and 2, Modern Sanitary Landfill.

This AGES report is a "continuation" of the previous AGES Hydrogeologic Investigation (ref. 4). This study includes:

a.) The performance of an extensive areal reconnaissance.

b.) The drilling of additional monitoring wells.

c.) The performance of a pump test.

d.) Qualitative sampling and anayses.

Reference 6. AGES, 1982. Hydrogeologic Study, Installation of Observation Wells A-5 and A-6 and Extension of Wells A-1 and A-2.

This AGES report presents the installation details for two (2) additional monitoring wells A-1 and A-2.

Monitoring wells A-5 and A-6 were incorporated into the site ground water monitoring program, at the time of installation.

As per AGES well installation specifications (Appendix), Rock Quality Designation (RQD) was used to establish the unfractured rock zone. For monitoring well A-1, continuous rock was encountered beginning at a depth of 124 feet with a RQD of 98 percent being reached between depths of 140 and 145 feet. For monitoring well A-2, continuous bedrock was encountered immediately below the existing steel casing with a RQD of 60 percent being reached between depths of 65 and 71 feet.

Reference 7. AGES, 1982. Report of Laboratory Analysis of Selected Sampling Points Collected June 23, 1982 at the Modern Sanitary Landfill.

This AGES document reports the water quality data for the following points, sampled on 6/23/82:

-Druck Residence.

-Peters Residence.

-Frey Residence.

-Spring House "A".

-Spring House "B".

-Surface water sample in unnamed tributary of Kreutz Creek approximately 200 yards upstream from treatment plant discharge.

-Surface water sample in unnamed tributary of Kreutz Creek at the discharge of the treatment plant.

-Surface water sample in unnamed tributary of Kreutz Creek approximately 200 feet downstream from the treatment plant discharge.

-Well B-1.

-Well B-3.

-Well B-15.

-Well A-2.

-Well A-1.

-Surface sample identified as Northern Tributary, upstream.

-Surface sample identified as Northern Tributary, downstream.

<u>Reference 8.</u> AGES, 1982. Treatability Study, Groundwater Wells A-1 and A-2, Modern Sanitary Landfill.

This AGES report evaluates proposed procedures for removal of volatile organic compounds found in localized groundwater pockets located beneath the Modern Landfill.

AGES has made the following conclusions based on this study:

1) Air stripping for VOC removal in water drawn from wells A-1 and A-2 appears to be the most effective and economical approach.

2) Differences between a simulated on-site lagoon and a transport vehicle as the aeration container are random

and insignificant beyond 6+ hours of aeration except, possibly, in the case of methylisobutyl ketone.

3) Air volumes of 0.025 cfm/gal and detention times for aeration of 24 hours appear to be more than adequate to fully purge the volatile organic compounds.

4) Higher variations in raw VOC concentrations may necessitate higher air volumes and/or longer detention times under aeration particularly in the case of methylisobutyl ketone.

5) Actived carbon, due to its anticipated cost cannot be justified for removal of the VOC consitituents only.

6) Methylisobutyl ketone may be used as an indicator of aeration duration and purging requirements, if relative concentrations of other volatile organic compounds in solution with it remain approximately the same.

7) In any air stripping program, a program to monitor methylisobutyl ketone removal should be implemented as quality control.

Reference 9. AGES, 1982. Long Term Pump Test, Druck Residential Well, Modern Sanitary Landfill.

This AGES report presents the results of a pump test performed on the Druck residential well in October, 1982. The Druck well is located approximately 400 feet south of the Modern Landfill.

The following conclusions have been made by AGES regarding this investigation:

1) Even though a true steady state pumping pattern was not established, the Druck drawdown for a 1.5 gallons/minute pumping rate is approximately six (6) feet.

2) At presently utilized pump rates, the Druck well primarily draws groundwater from its immediate vicinity with recharge from upgradient.

3) The Druck well does not draw groundwater either along strike from the vicinity of the Brown/SCA well or perpendicular to strike from the vicinity of the southern limit of the landfill.

4) The Druck groundwater quality for volatile organics is significantly better than the shallow ground water quality in the vicinity of the landfills southern limit.

Reference 10. AGES, 1982. Hydrogeologic Assessment of Frey Residence, York County, Pa.

This AGES study was performed in order to determine the groundwater flow direction at the Frey and Peters residence.

AGES has made the following conclusions regarding this study:

The Frey well is a 35 foot hand dug well with a 22 foot water level. The existing depth of the Frey well is insufficient to induce flow from the landfill across the referenced discharged point (i.e. the stream). It is highly unlikely that a well, located in the Frey area, could maintain a hydraulic gradient sufficient to induce groundwater to flow beyond a surface water divide. Any cone of depression extending from a domestic well in the Frey area, to the creek would spread laterally along the creek and induce water to flow from the stream. The creek acts as a recharge boundary, for wells located in the Frey area.

Since fractures control groundwater flow in the area, aerial photographs were examined to identify any direct fracture from the landfill to the Frey well. No direct fractures were apparent connecting the landfill to the Frey area, indicating no direct hydraulic connection.

Although no water level information was available for the Peters well, existing hydrogeologic conditions and data collected by AGES Corporation suggest that the reported trace contamination is not from the landfill.

The Peters well is located over 2,500 feet from the landfill and situated in a topographically high area. The topographic position, rock type and surface drainage to Cabin Creek suggest that groundwater flow originating from Peters (and the adjacent topographic high area to the east) flows toward Cabin Creek. Additional water level measurements gathered at or near the Peters residence would further verify the lack of hydraulic connection between the landfill and the Peters residential well.

Reference 11. AGES, 1983. Western Interceptor Study, Modern Sanitary Landfill.

This AGES study was performed with two main objectives:

1) To assess the adequacy of the existing western interceptor to effectively intercept and collect any contaminant moving west from the landfill.

2) To provide engineering design recommendations for modification of the existing system and/or installation of additional interceptor systems, if necessary.

The following conclusions were made by AGES upon completion of the investigation:

1. The interceptor was installed as per the PADER approved specifications. However, the PVC liner was extended to overlay the top of the crushed stone.

2. The bottom PVC liner was not encountered in any of the test pits which extended to the invert of the six (6) inch diameter PVC pipe.

3. At its northern terminus, the measured quantity of discharge is similar to that reported by SCA Services, Inc.

4. An indeterminate percentage of the water collected in the manholes occurs because of stream recharge at the northern end.

5. The northern two-thirds of the interceptor is, at times, above the water table.

6. The lack of bottom liner north of Manhole No. 2 allows approximately 70 thousand gallons per day of water to be discharged into the ground.

7. The presence of volatile organics in the southern most part of the unnamed tributary to Kreutz Creek south of TP-10, is explained by the interceptor not extending at least to the springhouse.

8. The presence of volatile organics in the interceptor indicates that some contaminents are migrating from the landfill to the west in the ground water table.

9. Concentrations of volatile organics are such as to require upgrading and modification of the existing interceptor system.

<u>Reference 12.</u> AGES, 1983 (Aug.). Analytical Report for Modern Sanitary Landfill.

This AGES report presented the water quality data from 8/83 at the Modern Landfill.

<u>Reference 13.</u> AGES, 1983 (Nov.). Analytical Report for Modern Sanitary Landfill.

This AGES report presented the water quality data from 11/83 at the Modern Landfill.

Reference 14. AGES, 1984 (Feb.). Analytical Report for Modern Landfill.

This AGES report presented the water quality data from 2/84 for the Modern Landfill.

Reference 15. REWAI, 1984. Modern Landfill, York, PA., Phase I Investigation of Leachate Collection Alternatives in the Western Perimeter Area.

This REWAI report evaluated the feasibility of a leachate-collection system along the western perimeter.

Phase I Investigation of Leachate Collection Alternatives in the Western Perimeter Area included the following tasks:

- Review of past geologic investigation;
- Test well installation (w-1, W-2, W-3);
- Pumping tests on wells W-1, W-3, and B-20;
- Establishment of stream monitoring points to determine locations of groundwater inflow and to measure the impact of pumping wells upon stream flow;
- Sampling of W-1, W-3, and B-20;
- Examination of leachate containment alternatives; and
- Delineation of necessary additional exploratory work.

Pump tests were conducted on W-1, W-3, and B-20. Well W-2 was omitted from the test due to its low yield. Results of the pump tests in the W-1 area indicated that the major water-bearing zones have an average transmissivity of 1,000 gallons per day per foot (gpd/ft) and a hydraulic conductivity of 35 gpd/ft^2. The majority of groundwater flow exists in the weathered bedrock and saprolite between 25 to 40 feet below ground level. A pump test on W-3 yielded a transmissivity of 260 gpd/ft. Based on a saturated thickness of 13 feet for this aquifer, a hydraulic conductivity of 25 gpd/ft^2 was determined. Results of a pump test on B-20 indicated a transmissivity of 2,200 gpd/ft based on the rate of drawdown. This data for B-20 corresponds with data from a 1975 pump test on this well which gave a transmissivity of 2,000 gpd/ft.

REWAI noted that the results from the geological investigation and pumping test show that the western valley lends itself to division into four distinct hydrogeologic areas which were identified as: the upper Saprolite Area, the Bedrock Area, the Lower Saprolite Area, and the Saprolite-Filled Valley Area. Each section along the western perimeter appears to have a unique flow system which may require different remedial techniques or well densities.

Reference 16. AGES, 1984 (March). Analytical Report of Modern Landfill.

This AGES report presented the water quality data from 3/84 for the Modern Landfill.

Reference 17. REWAI, 1984. Phase II Investigation Interim Report, Installation of Groundwater Interceptor Wells in the Western Perimeter Area.

This REWAI report presented the results of field work performed for the proposed installation of groundwater interceptor wells in the western perimeter area.

Phase II Investigation - Installation of Groundwater Interceptor Wells in the Western Perimeter Area - included the following tasks:

- Construction of E-series borings to define lithology of proposed interceptor well locations and testing for permeability;
- Sampling of existing western perimeter wells; and

- Installation of interceptor wells W-4, W-5, W-7, W-8, W-9, W-10, W-11, W-12, W-13, W-14, and W-15.

The following conclusions were made by REWAI upon completion of this study:

1) Volatile organic contamination is the primary water quality concern with respect to off-site migration. None of the indicator parameters tested (pH, specific conductance, and chloride) were dependable for tracing the volatile organic contamination, although the same groundwater flow mechanism transports them all. Most probably, the high background levels of the indicator parameters make it difficult to detect the small increases produced by the presence of some landfill leachate.

2) Groundwater flow at this site is not isoptropic, since the flow direction is partially controlled by the pronounced northeast-southwest oriented cleavage. The majority of drawdown cones have ellipsoid shapes, oriented in the direction of this local cleavage. Therefore, the direction of groundwater flow will not be strictly perpendicular to the groundwater contours, but skewed in a more easterly direction because of the cleavage.

3) The proposed groundwater interceptor well system is to be comprised of pumping B-20, W-1, W-3, W-4, W-5, W-7, W-8, W-9, W-10, W-11, W-12, and W-13. The water will be transmitted to the treatment plant, and treated before eventual discharge into the creek.

The maximum and initial pumping rates were expected to be approximately 130 gpm. The average rate of pumping estimated to be 90 gpm, which according to flow net calculations should be enough to effect complete capture. Seasonal fluctuations in pumping production are expected, but should result in no more than a 40 percent reduction in the average pumping rate. These values were to be revised after installation and extensive testing of the system.

Reference 18. AGES, 1984 (May). AGES Laboratory Analysis of Groundwater Samples Prepared for Modern Sanitary Landfill.

This AGES report presented the water quality data from 5/84 for the Modern Landfill.

Reference 19. NUS Corporation, 1984 (June). A Toxilogical Review for Modern Sanitary Landfill.

This NUS corporation report reviews the sampling and analysis performed by PADER, FIT Region III, and AGES Corporation, at the Modern Landfill. Samples were collected from monitoring and residential wells and surface points. VOC's were noted by each sampling "team" at each of the monitoring points.

This report notes the possible reporting errors in Barium and Lead in the FIT report. The FIT report notes values for the parameters to be well above the National Interim Primary Drinking Water Standards, while subsequent sampling reveals the values to be well below.

The relatively high Cadmium levels found in the unnamed north tributary of Kreutz Creek are noted. NUS concludes that chronic exposures of the fish to these levels may be fatal.

Reference 20. EPA, November 1985. Site Analysis Modern Sanitation Landfill, York County, Pennsylvania. T5-Pic-85126 Prepared by the Bionetics Corporation, Virginia.

Reference 21. REWAI, 1985. Phase I Investigation of Leachate Interception Alternatives in the Northern and Eastern Perimeters of the Modern Landfill, York, Pa.

The results of this REWAI study indicated that no significant levels of organic contaminants exist on the northern perimeter of the site. However, it was recommended that a monitoring program be implemented. REWAI noted that a strong directional permeability within the fractured bedrock aquifer caused migration of contaminants from the landfill to the east.

REWAI recommended the installation of a line of pumping wells along the edge of the eastern tributary.

Reference 22. Golder Associates, 1985. Evaluation of Leachate Interception Alternatives.

This report was an evaluation of the leachate interception alternatives proposed by REWAI.

Golder Associates notes two primary deficiencies in the hydrogeolgic description. These included:

1) A lack of definition of the general configuration of flow paths.

2) Vertical location of the plume on the eastern boundary of the landfill.

Golder also noted the two primary driving forces in the movement of the plume:

1) Advection.
2) Gravitational forces.

Reference 23. REWAI, 1985. The Importance of the Modern Landfill to the Solid Waste Management Needs of South-Central Pennsylvania.

This report concluded that the bulk of the York County Waste Stream is deposited at the Modern Landfill.

Reference 24. Buchart-Horn, Inc., 1985. Concept of Development, Biological Treatment Alternatives at Modern Landfill (Draft).

This report developed a recommended treatment scheme incorporating biological treatment to achieve the 10 mg/l Biochemical Oxygen Demand (BOD) effluent limit established by the PADER in the NPDES permit. It also considered an interim treatment methodology which utilized the existing lagoon treatment system prior to completion of the new wastewater treatment facility.

Reference 25. Buchart-Horn, Inc., 1985. Report on Leachate/Groundwater Treatment System at Modern Landfill, Concept Development Plan.

This report concluded that satisfactory treatment of the landfills groundwater is attainable through proper pH control. Buchart-Horn recommended that lime be used to raise the pH of the influent to 10.0.

The report also recommended that the groundwater treatment system design must have the flexibility to treat reasonable changes in the groundwater composition.

The recommended leachate treatment system consisted of: lime neutralization, gravity settling, sand filtration and air stripping towers. The recommended sludge treatment included a storage/thickening tank and a plate and frame filter press for final dewatering.

Reference 26. Technos, 1985. Evaluation of Hydrogeology at the Modern Landfill, York, Pa.

This report summarized the hydrogeology of the Modern Landfill Site. Technos noted that ground water may be flowing along lineaments (e.g. bedding planes, joints and fractures) in the underlying phyllite bedrock. It was also noted that the lack of contamination down gradient to the north, and the presence of leachate east and west of the landfill was probably due to the northeast-southwest trend of schistosity within the phyllite and a similar northeast-southwest trending contact between the phyllite/quartzite formations.

Reference 27. Chemical Waste Management, Inc., 1985. Plan for On-Site Management Activities at Modern Trash Landfill in York, Pa. Documentation for PCB Removal at Modern.

This Chemical Waste Management document presents an on-site plan for the removal of drums containing PCB's from the Modern Landfill.

The following sections are covered in the plan:

SECTION	SUBJECT
1.0	TRAINING
2.0	QUALIFICATION OF SUBCONTRACTORS
3.0	SAMPLING AND ANALYTICAL
4.0	CORPORATE RISK MANAGEMENT
5.0	REGULATORY PERMITS
6.0	MOBILIZATION AND DEMOBILIZATION DATES
7.0	HEALTH AND SAFETY PLAN
8.0	CONTINGENCY PLAN
9.0	CONTRACT
10.0	ULTIMATE MANAGEMENT FACILITIES
11.0	OPERATION PLAN
12.0	COMMUNITY RELATIONS

<u>Reference 28.</u> No Ref., 1985. Report on the Effect of Post-Construction Stormwater Runoff from Modern Landfill on the Downstream Structures Across Kreutz Creek and its Tributaries.

The author of this report concludes that the addition of excess stormwater from construction will have little or no effect on the downstream structures.

<u>Reference 29.</u> REWAI, 1985. Examination of the Deep Groundwater Flow System, Eastern Perimeter, Modern Landfill

This REWAI report noted that a downward gradient prevails throughout much of the eastern perimeter. A relatively high horizontal permeablilty vs. downward permeability exists, probably due to decreased weathering with depth. REWAI data also indicated that some groundwater flow could by pass the creek and migrate eastward.

<u>Reference 30.</u> REWAI, 1985. Western Perimeter Groundwater Interceptor Well System, Initial 6-month Start-Up Report.

This REWAI report evaluated the Western perimeter groundwater interceptor well system after six months of operation. REWAI notes that the system would not capture all groundwater flow, but would allow a small amount of groundwater to migrate to a deeper groundwater flow system.

Reference 31. E & E, 1986 (May). Draft Remedial Investigation/Feasibility Study Work Plan RI/FS.

The purpose of this Ecology and Environment (E & E) document is to outline the tasks which must be completed and the information which must be collected to comply with U.S. Environmental Protection Agency (USEPA) requirements for an RI/FS at the Modern Landfill. This plan incorporates all available information from PADER and USEPA files, and data from outside sources.

Reference 32. REWAI, Draft 1986 (Updated 1987). Geology of the Northern Expansion Area of Modern Landfill, York County, Pa.

This study by REWAI identified the geologic formations present at the Modern Landfill:

- Antietam Formation, a sandstone
- Harpers Formation, a phyllite
- Chickies Formation, slate member, a siltstone

A fourth geologic formation, the Vintage Formation, was found at depth by drilling. The Vintage Formation is comprised of sandy dolomite, argillaceaous dolomite, and fine crystalline dolomite.

The geologic structure of the site and the region is very complex. In summary, the rocks of the northern expansion area have been overturned, placing the

Vintage Formation beneath the Antietam Formation. Subsequent thrust faulting has transported the Chickies Formation into its position on-site, and transported a portion of the Antietam Formation over the Vintage Formation, brecciating the underlying Vintage. Folding of all features then occurred. The folding was then followed by high-angle faulting, bringing the Harpers Formation into its present position.

A deep saprolite developed in the Antietam Formation and the Chickies Formation in the northern expansion area. This saprolite development ranges from 0 to 130 feet deep; and is thickest in the valley at the edge of the existing landfill, where saprolite directly overlies carbonate bedrock.

During the exploratory drilling, solution cavities were found in the lined landfill area ranging in vertical height fron 0.8 feet to 2.9 feet. Greater solution cavity development was observed beneath the landfill berms and east of the expansion area. Here, the vertical height of the cavities ranged from 1.6 to 18 feet. All solution cavities contained sandy sediments.

The surficial materials underlying the northern lined landfill area are of four types:

- Sandstone bedrock of the Antietam Formation
- Saprolite developed in the Antietam Formation underlain by sandstone bedrock
- Saprolite developed in the Antietam Formation underlain by Vintage Formation
- Saprolite of the Chickies Formation underlain by Vintage Formation

Through the completion of the studies, the position of solution cavities was narrowed to near the carbonate/non-carbonate rock contact beneath the thrust fault (south of the thrust fault outcrop line). In addition, areas of potential soil collapse were confined to where saprolite development extends to the underlying carbonate bedrock and the trust fault contact exists between the carbonate rock and non-carbonate saprolite.

Reference 33. Fred C. Hart Associates, 1986 (April). Geotechnical Evaluation of the Modern Landfill Facility, York, Pa.

This Fred C. Hart report (HART) documented field work and further defined the subsurface conditions underlying the proposed northern expansion area at the Modern Landfill.

With completion of HART's drilling program, the geologic model developed from previous subsurface work at the site was generally found to be accurate. Conclusions relative to the performance of the landfill are presented below:

1. The HART borings located additional zones of infilled solution cavities and confirmed the extent of solutioning within the dolomite. Furthermore, the infilled cavities are located at varying elevations and appear to be discontinuous. The closure grouting of these boreholes confirmed the discontinuity.

2. The encountered cavities are generally filled and the materials appear to be consolidated and relatively dry indicative of a quiecent area with respect to solution activity both horizontally and vertically.

3. The overlying "soil" materials are generally firm and stable and the overlying rock, although fractured, is competent and capable of supporting the loads of the proposed expansion.

4. The extent of the Chickies Formation was confirmed and the field investigation verified the strength and integrity of the materials to adequately support the loads of the proposed expansion.

5. Although the possibility of settlement cannot be discounted, the probability of it occurring under the proposed loads is small, expected to be less than two feet and more likely less than one foot due to the strength (density) of the overlying materials. Furthermore, the discontinuity of the voids would likely create arching and redistribution of stresses further reducing the possibility of settlement.

6. Capping and liner systems will preclude or, at least, significantly decrease the downward movement of rainfall infiltration further reducing the possibility of solution activity.

HART concluded that the foundation materials are capable of satisfactorily supporting the proposed loads of the landfill without experiencing unacceptable settlements detrimental to the function of the design.

Reference 34. Fred C. Hart Associates, 1986 (September). As-Built Documentation Gas Control Well Installation, Modern Sanitary Landfill.

This Fred C. Hart (HART) report contains as-built documentation for gas control well installation at the Modern Landfill.

Reference 35. REWAI, March 1987. 1986 Annual Performance Evaluation Report for the Western and Eastern Perimeter Groundwater Collection Systems of Modern Landfill, York County, Pa.

This REWAI report contained data and an evaluation of the Western and Eastern Perimeter Groundwater collection systems.

These systems were designed to intercept groundwater migrating eastward and westward from the landfill. The eastern perimeter system consisted of a line of 13 pumping wells; and the western system consists of a line of 12 pumping wells and a 1700-foot long cutoff/collection trench.

The western perimeter groundwater collection system intercepted 30,650,000 gallons of ground water flow in the western tributary valley during 1986. This system operated continuously throughout the year, effecting capture of groundwater migrating to the west of the landfill. Water quality results indicate that total priority pollutant volatile organics are present in significant concentrations (up to 2,097 parts per billion (ppb)) in the groundwater between the landfill and the western tributary of Kreutz Creek. Because of the potential for leachate outbreaks under high groundwater flow conditions within two specific areas of the western perimeter system, Modern Landfill is considering connection of wells W-62, W-64, and a cutoff/collection trench around well W-8 to the western perimeter collection system.

The eastern perimeter collection system has been operating since November 22, 1986, and produced 4,193,000 gallons of water during 1986.

This system was constructed on a fast track schedule, resulting in a pumping system ready for production much earlier than the new site treatment plant. A temporary treatment plant was constructed to handle the flow and allow for earlier institution on the groundwater interception. Because this system was in the midst of a startup phase throughout the year, evaluation of its effectiveness in this report is not appropriate. An eastern perimeter Phase II design report and a startup report will be prepared in early 1987, where the system effectiveness and water quality will be evaluated.

Reference 36. REWAI, Draft 1987. Modern Landfill, Eastern Perimeter Groundwater Collection System, Construction Inspection Reports

This REWAI binder contained inspection reports prepared during construction of the eastern perimeter groundwater collection systems. As well as documenting construction activities, these daily field reports note personnel on site and weather conditions.

Reference 37. REWAI, Draft 1987. Phase II Investigation, Design and Start-Up of the Eastern Perimeter Groundwater Collection Well System of the Modern Landfil, York, Pa.

This REWAI draft report concluded that the eastern perimeter collection system captures the majority of the groundwater flow, but that some flow is by passing the system to the north between W-58 and the landfill edge.

The report also notes that concentrations of total priority pollutant volatile organics increase toward the landfill, while very low concentrations exist to the northeast.

Reference 38. Delta Geophysical Services, 1987. Geophysical Investigation, Modern Landfill, York, Pa.

This Delta Geophysics report identifies voids in the subsurface materials. Three anomalous zones are identified:

1) Voids and/or fracture zones (located to the east).

2) Elevated subsurface conductivities (to the south of the treatment lagoons and north of the toe of the slope).

3) Fire pit location (north of the toe of the slope).

Reference 39. REWAI, 1987. Monthly Monitoring Report, Modern Landfill, York County, Pa.

This REWAI report presents a summary of the data collected during the Eastern and Western Perimeter Groundwater Collection Systems Monitoring and Maintenance Program at the Modern Landfill for March 2, 1987 through April 2, 1987. Data gathered includes:

a.) Average flow.

b.) Instantaneous flow.

c.) Depth to water.

d.) Totalizer reading.

e.) Gallons during month.

f.) Average G.P.D.

APPENDIX B

BIBLIOGRAPHY

1. "Guidance on Feasibility Studies Under CERCLA," Hazardous Waste Engineering Research Laboratory, U.S.E.P.A., June 1985.

2. "Guidance on Remedial Investigations Under CERCLA," Hazardous Waste Engineering Research Laboratory, U.S.E.P.A., June 1985.

3. "Superfund Public Health Evaluation Manual," submitted to the Office of Emergency and Remedial Response, USEPA by ICF Corporation, November 1986.

4. "Final Evaluation Report Review of Revised Draft RI/FS Workplan Modern Sanitation Landfill York,Pennsylvania", Ebasco Services Incorporated, August 11, 1987. (submitted with the September 18, 1987 PADER comments below).

5. Comments from Pennsylvania Department of Environmental Resources, Letter dated September 18, 1987 regarding the Revised Draft RI/FS Work Plan, submitted June 1987.

6. "Draft Data Quality Objectives Development For Uncontrolled Hazardous Waste Site Remedial Response Activities", EPA OSWER Directive 9355.0-7 & 7A, October 1987, Volumes 1 and 2.

7. "Geology and Mineral Resources of York County, Pennsylvania." Stose, G. W. and Jonas, A. I., Topographic and Geologic, County Report 67.

8. "Interim Guidance on Compliance with Applicable or Relevant and Appropriate Requirements" (52 FR No. 166, August 27, 1987).

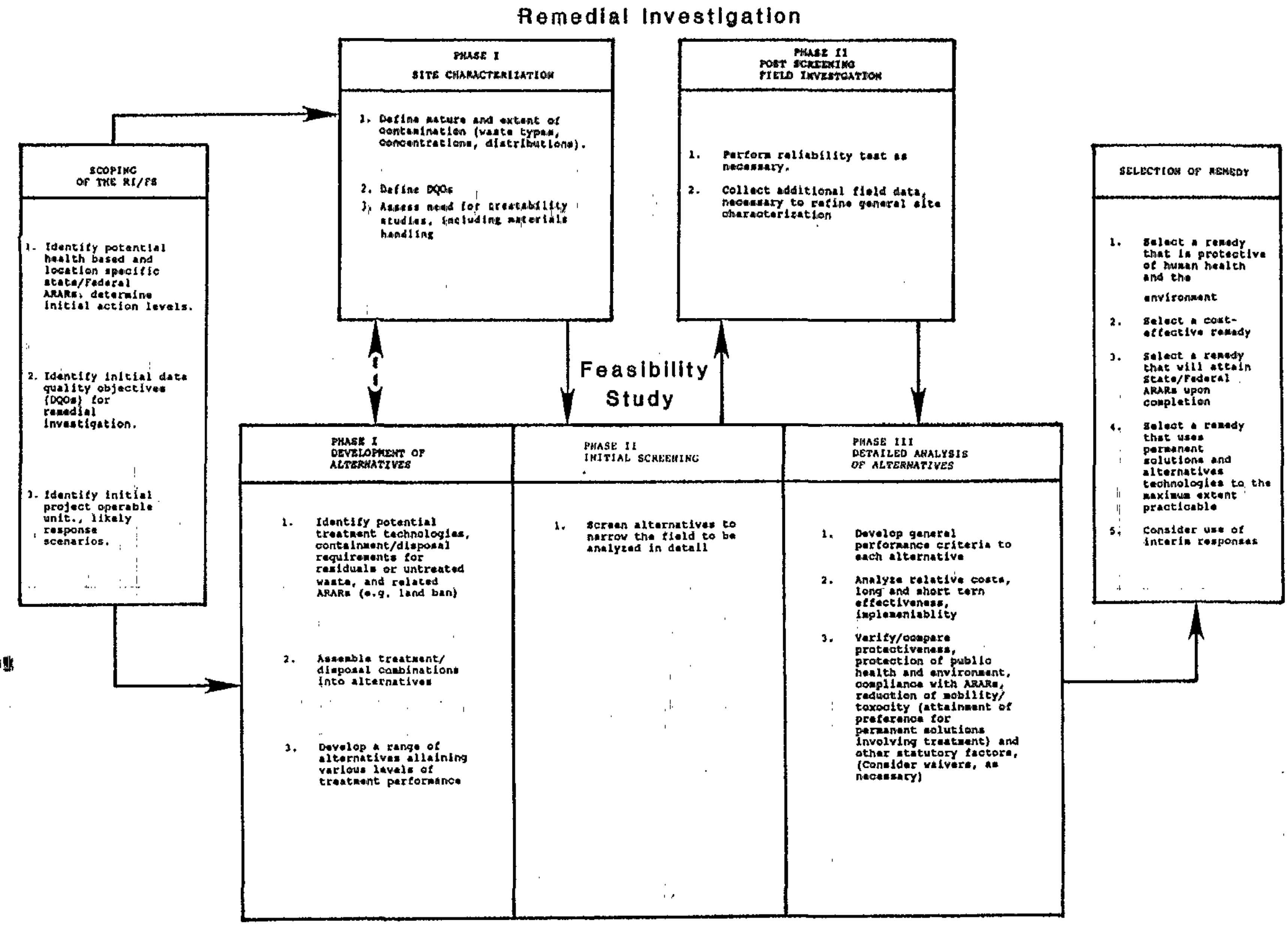
9. "Generic Remedial Investigation Plan for RI/FS," Waste Management, Inc., September 1986.

10. "WMI Manual for Groundwater Sampling," Waste Management, Inc., Revised September 1986.

11. "Draft Alternate Concentration Limit Guidance Based on Section 264.94(b) Criteria, Part I, Information Required in ACL Demonstrations," Office of Solid Waste, Waste Management and Economics Division, USEPA, April 1985.

12. "Interim Guidance on Superfund Selection of Remedy," EPA OSWER Directive 9355.0-19.

Proposed Remedy Selection Process Under Reauthorization



APPENDIX C

Table A-1
Well Installation
Modern Sanitary Landfill
Windsor & Lower Windsor Township
York County
Yorkana, PA

AGES Project No. 43081
Well No. A-1

Surface Elevation[1] 684.5'

Depth (Feet)	Blows/6"[2]	Rock Coring[3]	Soil Description[4]
0-81.0	-		Existing 6" dia. steel cased well
81.0-90.5 90.5-92.0 92.0-102.0 102.0-103.5	- 25-25-25 - 29-26-40		Red-brown Silt with some clay little coarse to find sand, trace of trash (wet)
103.5-104.0 104.0-110.5 110.5-112.0 112.0-116.0	120 - 34-14-33 -		Mottled red, blue, gray, and yellow decomposed Phyllite/shale with thin silt seams (dry)
116.0-120.0 120.0-120.5 120.5-124.0	- 200/5" -		Yellow-brown decomposed Phyllite/sha (damp)
124.0-130.0 130.0-130.0 130.0-140.0 140.0-145.0	- 50/0" - -	RQD-98% Recovery-98%	Blue-gray Phyllite. Bedding approximately 70 to 80° from horizontal

Bottom of Boring

Ground water encountered at a depth of 74.2 feet.

General Notes:

1. Bench mark is well No. 8-15. Datum is taken at 666.35 feet at the top of casing.
2. Standard Penetration Test - 140 pound hammer falling 30 inches.
3. NX core barrel.
4. Laboratory visual identification except where noted.

AGES

Table A-2

Well Installation
Modern Sanitary Landfill
Windsor & Lower Windsor Township
York County
Yorkana, PA

AGES Project No. 43081

Well No. A-2

Surface Elevation[1] 635.2'

Depth (Feet)	Rock coring[2]	Rock Description[3]
0-61.0	-	Existing 6" dia. steel cased well
61.0-61.5	-	White Quartzite
61.5-65.0	-	Green Phyllite
65.0-71.0	ROD-60% Recovery 78%	Green Phyllite. Bedding approximately 70 to 80° from horizontal. All fractures are iron stained.
71.0- 75.0	-	Green Phyllite

Bottom of Boring

Ground water encountered at a depth of 56.2 feet.

General notes:
1. Bench mark is well no. B015. Datum is taken at 666.35 feet at the top of casing.
2. NX core barrel
3. Laboratory visual identification except where noted.
4. Boring extended to 75 feet to facilitate the well construction.

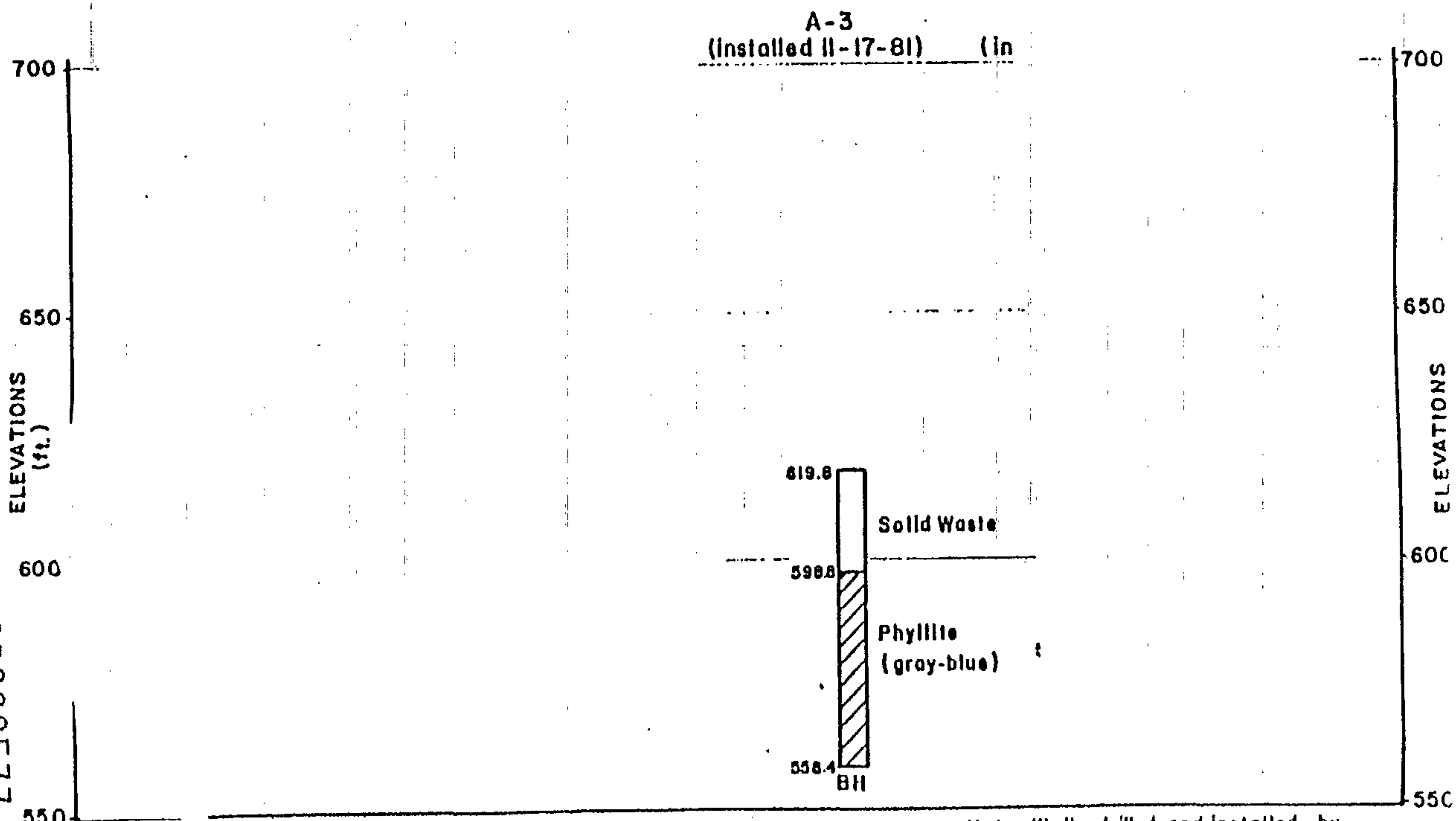
AGES

MODERN SANITARY LANDFILL

AGES Project No. 43081

WELL BORING LOGS

Figure 2



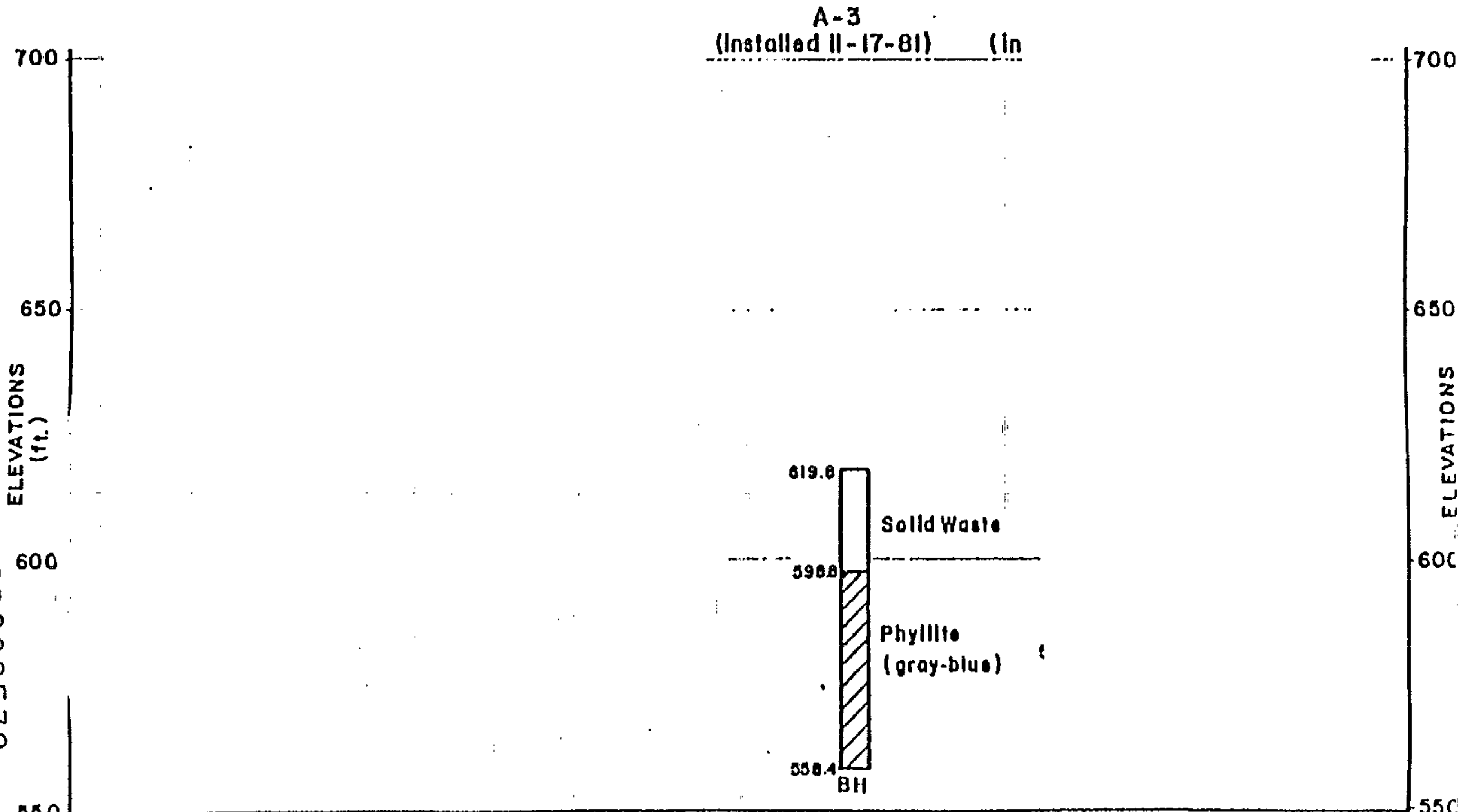
Note: Wells drilled and installed by James P. Kohler and Sons, York, PA.

MODERN SANITARY LANDFILL

AGES Project No. 43081

WELL BORING LOGS

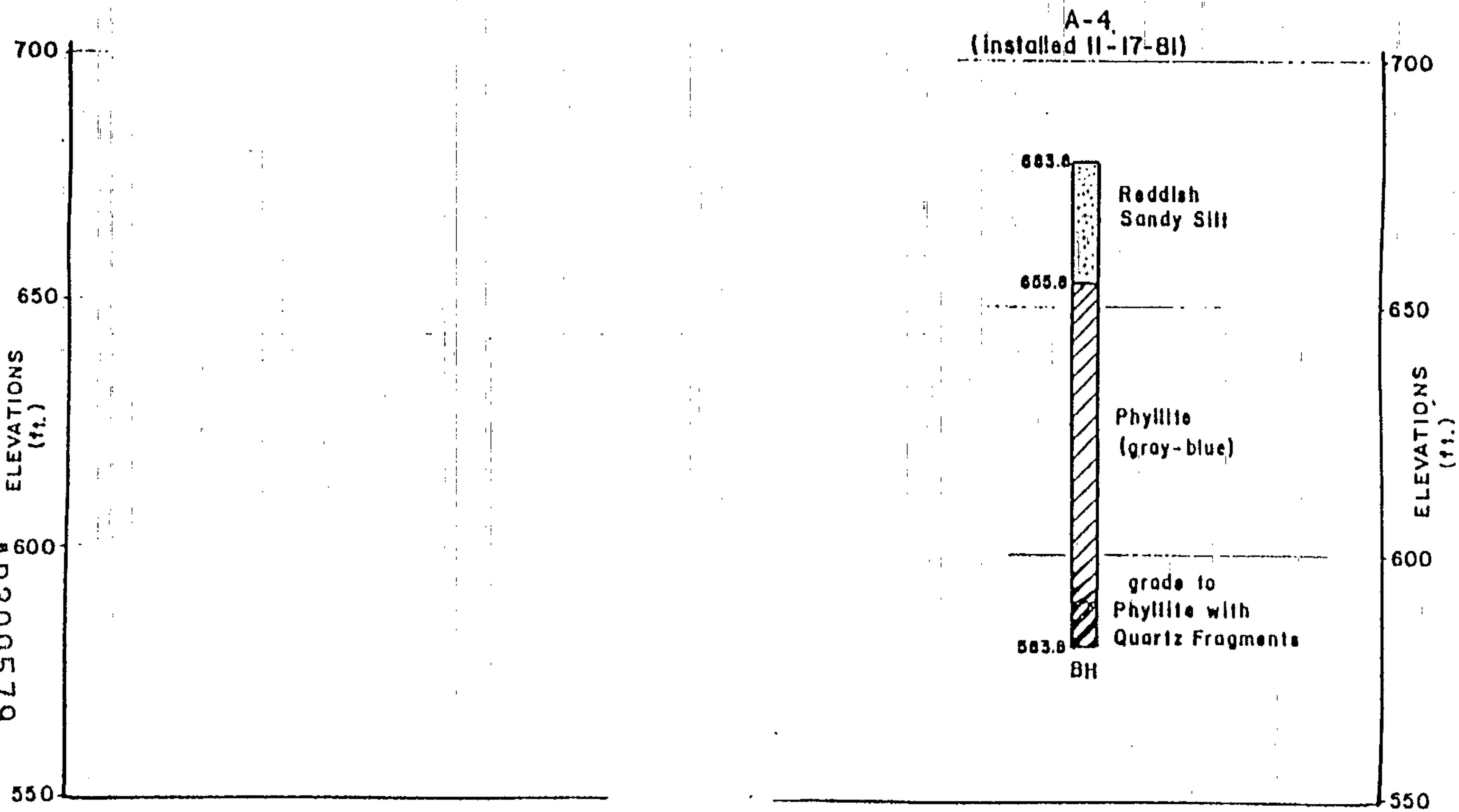
Figure 2



Note: Wells drilled and installed by James P. Kohler and Sons, York, PA.

MODERN SANITARY LANDFILL
AGES Project No. 43081

WELL BORING LOGS
Figure 2



Note: Wells drilled and installed by James P. Kohler and Sons, York, PA.

Table A-3
Well Installation
Modern Sanitary Landfill
Windsor & Lower Windsor Township
York County
Yorkana, PA

AGES Project No. 43081

Well No. A-5

Surface Elevation[1] 663.1'

Depth (Feet)	Soil Description[2]
0.0-13.5	Mottled brown, blue, and gray Clay and rock fragments, with little silt
13.5-17.0	Blue-gray Phyllite/shale (probably weathered)
17.0-26.0	Blue-gray Phyllite/shale, little quartzite, and trace of lignite
26.0-33.0	Blue-gray Phyllite/shale, little quartzite, and trace of lignite interbedded with 6 to 8" seams of red-orange sandstone.
33.0-33.5	Blue-gray Clay
33.5-43.0	Blue-gray Phyllite/shale, little quartzite, and trace of lignite interbedded with 6 to 8" seams of red-orange sandstone
43.0-54.0	Blue-gray Phyllite

Bottom of Boring

Ground water was encountered at a depth of 43.0 feet.

General Notes:

1. Bench mark is well No. B-15. Datum is taken at 666.35 feet at the top of casing.
2. Laboratory visual identification except where noted.

Table A-4
Well Installation
Modern Sanitary Landfill
Windsor & Lower Windsor Township
York County
Yorkana, PA

AGES Project No. 43081

Well No. A-6

Surface Elevation[1] 594.9'

Depth (Feet)	Blows/6"[2]	Soil Description[3]
0.0-8.0	-	Mottled brown, blue-gray decomposed Phyllite/shale, with some silt
8.0-23.0	-	Blue-gray Phyllite/shale interbedded with brown and red sandstone (decomposed)
23.0-25.0	15-84-75-36	Green-brown decomposed Phyllite/shale interbedded with red sandstone seams (dry)
25.0-30.5	-	
30.5-31.5	24-129	grading to with little silt (moist)
31.5-35.5	-	
35.5-37.0	14-11-60	Green-brown decomposed Phyllite and silt (wet)
37.0-46.0	-	
46.0-46.25	200/3"	

Bottom of Boring

Ground water encountered at a depth of 35.5 feet.

General Notes:

1. Bench mark is well No. B-15. Datum is taken at 666.35 feet at the top of casing.
2. Standard Penetration Test - 140 pound hammer falling 30 inches.
3. Laboratory visual identification except where noted.

AGES

MODERN SANITARY LANDFILL
FILE NO. 997.0

MONITORING WELL LOGS

OCTOBER 31, 1973

GENERAL

Drilling done by York Drilling Company, Inc., York, Pennsylvania, equipment was an Ingersoll-Rand Drillmaster 74 WH. Rotary air, eight inch (8") bit. Casing six and five-eighths inch (6-5/8") standard coated waterwell casing. Bottom ten foot (10'0") slotted according to specifications.

Recent heavy rain. Lots of mud.

B-1

Elevation	Depth	
539'	0-15'	Dry buff silty sand.
	15-30'	Dry light buff silt, some rock fragments increasing with depth.
	30-36'	Dry sandy silt, rock fragments of weathered fine-grained schist.
	36-40'	Soft spot, light brown silty sand.
	40-45'	Greenish brown sand, fresh fragments of phyllite.
494'	45'	Water. Fine-grained phyllitic schist.
484'	55'	Terminus of drilling.

Elevation, TOC: 545.77'
Elevation, G.S.: 543.8
Screen Elevation: 501.8' - 491.8'

SWL Elevation (Date): 510.60' (3/24/86)
Drilling Method: Air Rotary

B-2

Elevation	Depth	
541.6'	0-20'	Dry brown silt loam.
	20-50'	Brown silt loam, few rock fragements.
501'	50'	Water.
491'	60'	Terminus of drilling.

Elevation, TOC: 547.50'
SWL Elevation (Date): 514.30'
Elevation, G.S.: 546.3
Drilling Method: Air Rotary
Screen Elevation: 508.3' - 498.3'

B-3

Elevation	Depth	
557.8'	0-5'	Dry buff sand.
	5-15'	Greenish tan silty sand, dry. Parent material phyllite schist.
	15-17'	Harder layer, silty sand.
	17-25'	Some weathered rock fragments (schist).
	25-27'	Very hard, fresh chips of rock in dry silty sand.
	27-30	Soft spot. Same as above.
	30-39'	Alternating hard and soft layers of greenish tan silty sand.
	39-50'	Dry buff silt with weathered phyllitic schist fragments.
	50-54'	Damp buff sand with rock fragments.
	54-60'	Dry greenish brown silt. Rock fragments.
	60-70'	Damp fine-grained sand and silt, light brown. Rock fragments.

B-3 (continued)

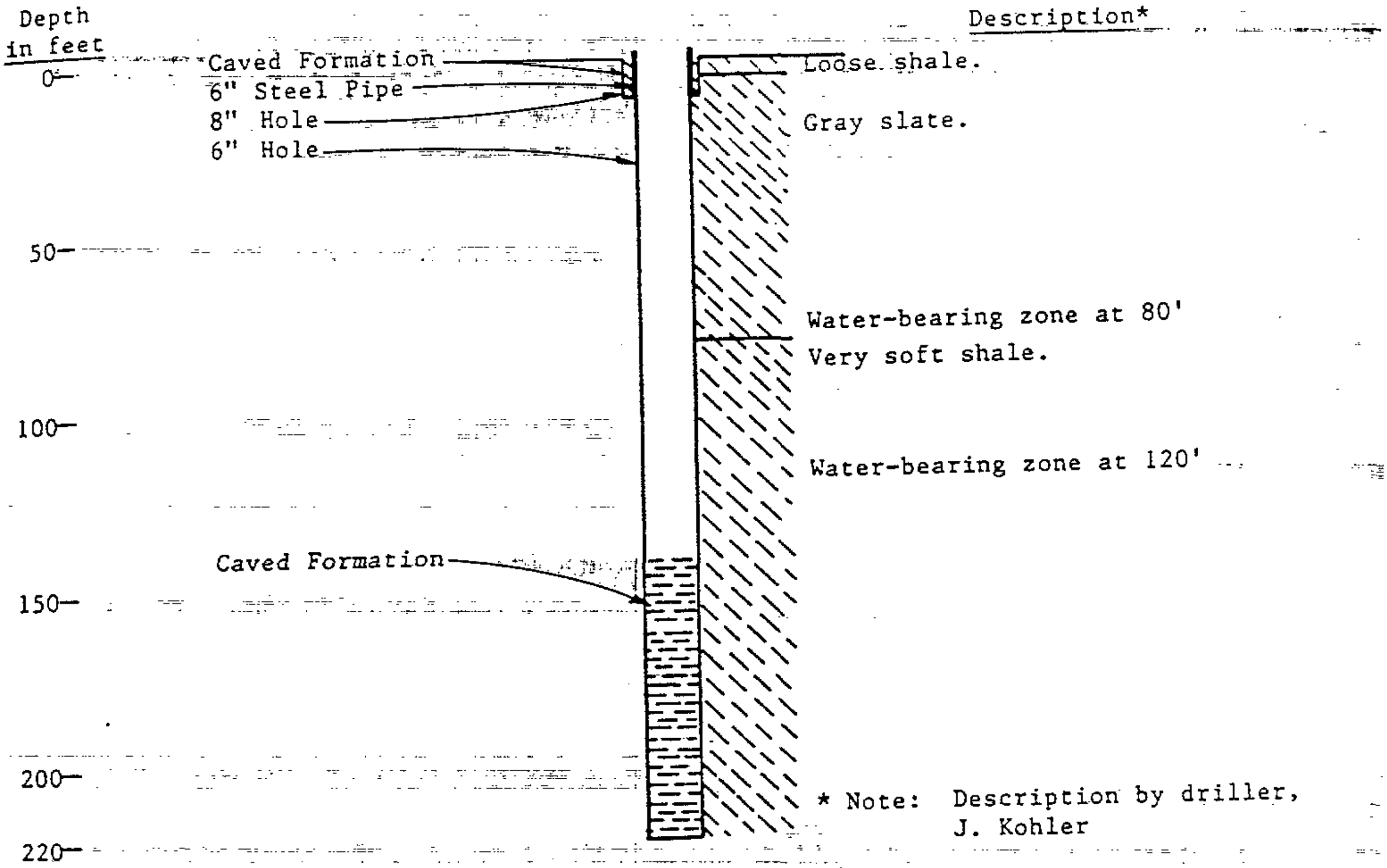
Elevation	Depth	
	70-84'	Damp light brown sandy silt.
	84-95'	Hard moist greenish clayey silt interlayered with moist gray silty clay. Weathered rock fragments throughout.
	95-98'	Greenish gray clay (saprolitic), moist.
459	98'	Terminus of drilling.

Elevation, TOC: 540.15'
Elevation, G.S.: ~539.2'
SWL Elevation (Date): 503.51' (3/29/85)

Screen Elevation: 451.2' - 441.2'
Drilling Method: Air Rotary

Geologic and Well Construction Log

Modern Landfill
Well B-3A



Vertical Scale 1" = 50'

Drilling Began: 8/83
Drilling Completed: 8/83
Total Depth: 220'
Elevation, TOC: 540.67'
Elevation, G.S.: 539.2'

Screened Interval: Open rock hole from 10'-
SWL Elevation (Date): 507.65' (3/24/86)
WBZ: 80' and 120'
Total Yield: 25 gpm
Drilling Method: Air Rotary
Open Rock Hole Elevation: 529.2' - 399.2'

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