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EPA REGION V ARCS PROGRAM

Donohue

VOLUME 1

FINAL WORK PLAN

SOUTH ANDOVER
SECOND OPERABLE UNIT
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
ANDOVER, MINNESOTA

APRIL 1990

U.S. EPA Contract
68-W8-0093

Donohue & Associates, Inc.
In association with

[illegible]

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Prepared for:

U.S. Environmental Protection Agency
Emergency and Remedial Response Branch
Region V
230 South Dearborn Street
Chicago, Illinois 60604

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ANDOVER, MINNESOTA

APRIL 1990

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EXECUTIVE SUMMARY

Donohue & Associates, Inc. (Donohue) is submitting this Work Plan to the U.S. Environmental Protection Agency (EPA) for the South Andover Second Operable Unit Remedial Investigation/Feasibility Study (RI/FS) in response to Work Assignment No. 20-5F45 Region V ARCS Contract No. 68-W8-0093.

The South Andover Superfund Site is located in Andover, Minnesota (Anoka County) 16 miles north-northwest of Minneapolis. The site is comprised of several privately owned parcels, which jointly encompass more than 50-acres. Several active businesses involved with auto salvaging operations occur both on and adjacent to the site. Private residences are also located along the west side of the site. Continued residential development is occurring both north and south of the site.

Background historical information indicates that waste storage and disposal activities were initiated at the South Andover site since the mid-1950s. Previous studies indicate that more than 1,000 drums of waste were stored on several contiguous parcels owned by Cecil Heidelberger, William Batson, David and Shirley Heidelberger, Charles Mistelske, and Cyril Link. Historical land use information indicates that the storage, disposal and incineration of ink, ink and paint sludge, adhesives, chlorinated and non-chlorinated solvents, and other wastes occurred at various locations across the site. Solvent recovery, operations, and the storage of transformers and salvaged electrical equipment have been reported. Solid and liquid chemical waste dumping and open pit burning of solvents reportedly occurred during the 1960s and 1970s. Drum storage and chemical waste disposal sites have been partially obscured, by auto salvage operations, and more than 3 million tires which were stockpiled on-site.

Actions to limit waste handling operations at the South Andover site were initiated in 1973 when Anoka County officials instructed Cecil Heidelberger to remove and dispose of chemical wastes stored on his property. In 1976, the Minnesota Pollution Control Agency (MPCA) issued a Citation of Violation to Cecil and Marian Heidelberger for unregulated chemical waste storage. The MPCA then initiated actions to regulate the other identified waste handlers including corporate contributors in 1980 and 1981. Sixteen parties including site owners, operators, and corporate waste generators were notified in 1982 by the EPA Office of Enforcement and Compliance Monitorir · that the EPA was considering actions at the site. In July 1985, the EPA n. :ified 21 PRPs that it was the intent of that agency to conduct an RI/FS at the South Andover site. However, failure by the EPA to negotiate an agreement with the PRPs resulted in the subsequent ranking and inclusion of the South Andover Site in the Superfund Program.

Several investigations have been conducted since the late 1970s. The studies have attempted to identify the nature and extent of groundwater, soil, sediments, and surface water contamination that may occur at the site. The results of these studies indicate that local contamination of these media by inorganic and organic compounds may occur. Chemical sampling performed in deep soil borings also suggest that soil contamination may occur at considerable depth. Inventoried drums have been sampled and found to include ink and ink sludge, paint and paint sludge, and various other chlorinated and nonchlorinated solvents and resins.

The primary objectives of the South Andover Second Operable Unit RI/FS are to characterize the nature and extent of potentially contaminated soil or buried contamination, the nature and extent of potential surface water and sediment contamination, determine the potential need to perform air sampling, conduct a baseline risk assessment, and identify applicable cleanup standards. Furthermore, the scope of the RI/FS will be focused to prioritize investigative methods, assess data needs, and identify potential remedial alternatives for each media.

Program elements comprising the South Andover RI field investigation include a site survey, geophysical and geomorphological investigations, and the completion of chemical soil sampling during soil boring and trenching programs. Other tasks include surface water and sediment sampling, air monitoring, and performing a baseline risk assessment.

This Work Plan and the associated project plans are contained in four volumes. Volume 1 (Work Plan, this document) presents the technical scope of work and includes a discussion of the site setting and background history, an initial site evaluation, project rationale and approach, a discussion of the ten RI/FS tasks to be completed, a schedule for completion of the tasks, and a discussion of project management. The Work Plan also includes a Baseline Risk Assessment Plan (Appendix A) and the anticipated program schedule (Appendix B). Costs and key assumptions associated with the RI/FS are contained in Volume 1A. Volume 2 contains the Field Sampling Plan (FSP), Volume 3 contains the Quality Assurance Project Plan (QAPP), and Volume 4 contains the Health and Safety Plan (HASP).

1.0 INTRODUCTION

Donohue & Associates, Inc., (Donohue) is submitting to the U.S. Environmental Protection Agency (EPA), this Work Plan for the South Andover Superfund Site Second Operable Unit RI/FS in response to Work Assignment No. 20-5F45 under Region V ARCS Contract No. 68-W-0093. A general description of the project, and the organization of site-specific Work Plan submittals are presented below.

1.1 PURPOSE

The purpose of the South Andover Remedial Investigation is to obtain information which will be used to identify and characterize major areas across the site where significant soil or buried contamination may occur. Other goals include obtaining information which will allow the EPA to assess whether potential contamination of sediment or surface water is indicated, evaluate the need to perform air sampling, and to gather data necessary to support a baseline risk assessment for the purpose of determining potential risks to human health.

The purpose of the South Andover Feasibility Study (FS) is to screen and evaluate remedial alternatives that may be appropriate for the site based on technical, environmental, public health, and economic considerations.

1.2 WORK PLAN PREPARATION ACTIVITIES

Project Work Plans for the South Andover RI/FS have been prepared in accordance with current EPA Guidance Documents including:

1. Draft Guidance for Conducting Remedial Investigations and Feasibility Studies under CECRLA-Interim Final (EPA, October 1988; OSWER Directive No. 9335.3-01).

2. Data Quality Objectives for Remedial Response Activities Development Process (EPA, March 1987; OSWER Directive No. 9355.07-7b).

3. Superfund Public Health Assessment Manual (EPA, October 1986; 540-1-83-060).

4. Superfund Exposure Assessment Manual, Final Draft (EPA, OERR, September 1986).

Prior to completing project Work Plans, Donohue conducted the following activities:

1. Reviewed background information concerning the site presented in the Final Remedial Investigation Report (1988), and the Public Comment Feasibility Study Report (1988) prepared by CH2M Hill. Other information reviewed

included a draft Quality Assurance Project Plan (QAPP) prepared by CH2M Hill (1985), other reports summarizing prior investigative studies conducted at the site, and related EPA and MPCA agency review correspondence.

2. Conducted a joint scoping meeting with key EPA and MPCA staff. Donohue also corresponded with these agencies during Work Plan preparation to ensure that agency concerns were addressed.

3. Conducted a meeting involving key Donohue staff to determine data needs and data quality objectives based on discussions from the EPA scoping meeting.

4. Conducted a joint site visit with EPA and MPCA to view existing conditions and land uses at, and adjacent to, the South Andover site.

5. Conducted a pre-QAPP meeting with EPA Environmental Services Division staff to discuss the general project approach of the RI field investigation. This meeting included a discussion of data needs and data quality objectives, field screening techniques and their applicability, and other related information.

1.3 REPORT ORGANIZATION

This Work Plan and the associated project plans prepared for the South Andover RI/FS are contained in four volumes. Volume 1 (Work Plan, this document) presents the technical scope of work and includes a discussion of site background and setting, an initial site evaluation including potential waste types and volumes, potential pathways of contaminant migration, project approach and rationale, and data needs and data quality objectives. Also included in this volume is a discussion of the ten RI/FS tasks discussed in the EPA Statement of Work, a schedule for their completion, and a discussion of project management. A Baseline Risk Assessment Plan is included in Appendix A. The schedule for the South Andover RI/FS is presented as Appendix B of the Work Plan. Costs and key assumptions associated with completing the RI/FS are contained in the Contract Pricing Proposal (Volume 1A).

The Field Sampling Plan (FSP) is designated as Volume 2. This document introduces and discusses field sampling rationale and objectives, procedures and methodologies, equipment needs, decontamination procedures, quality control, and field documentation requirements.

Volume 3 represents the site-specific Quality Assurance Project Plan (QAPP) prepared for the South Andover RI/FS. The QAPP has been developed in accordance with EPA guidelines pertaining to field investigation activities and laboratory analyses. The QAPP discusses project organization and data management, site-specific methodologies and equipment, sample numbering and screening procedures, sample storage and shipping protocols, laboratory and field quality control/quality assurance, and equipment calibration techniques.

The site-specific Health and Safety Plan (HASP) is designated as Volume 4. This document describes health and safety protocols to be followed during the South Andover RI field program.

2.0 SITE BACKGROUND AND SETTING

2.1 LOCATION, SITE HISTORY, AND PAST RESPONSE ACTIONS

2.1.1 Site Location and Description

The South Andover site is located near the southern limits of Andover, Minnesota, approximately 16 miles north-northwest of Minneapolis and 3 miles northeast of the City of Anoka. The site is situated at 45° 16' N Latitude, and 93° 12' W Longitude, in the south half of Section 34, Township 32 North, Range 24 West (Grow Township) (Figure 2-1).

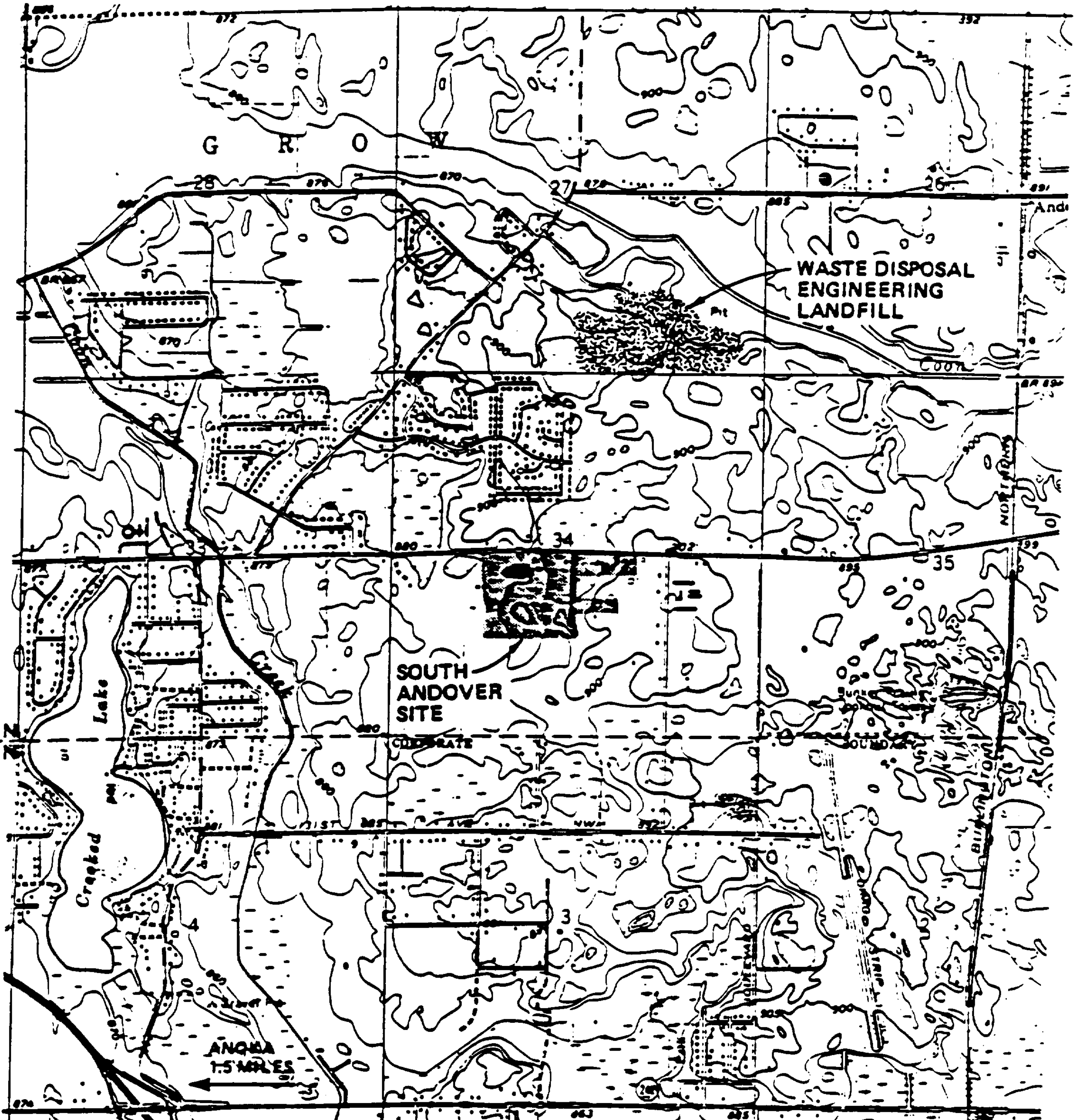
The South Andover site is comprised of several parcels of land which jointly total approximately 50 acres. As shown in Figure 2-2, the site is irregular in shape. Bunker Lake Boulevard defines the northern extent of the site, while Jay Street is located approximately 500 feet east of the site. Several small businesses involved with used car and auto parts sales, auto salvage operations, and auto body repair occur both at the site, and adjacent to the site along both roads. Past and present landowners are shown in Figure 2-2. For many years this area was sparsely populated. However, residential development was initiated 1/4-mile north of the site in the early 1970s, and continued development is occurring to the east, north, and south.

2.1.2 Site History and Land Use

Historical background information indicates that auto salvage operations, and the storage, disposal and incineration of ink, ink and paint sludge, adhesives, chlorinated and non-chlorinated solvents, and other wastes have occurred at various locations across the site (Figure 2-2). Solvent recovery, and the storage of transformers and salvaged electrical equipment have also been reported. Former drum storage and chemical waste disposal sites have been partially obscured by more than 3 million tires which were landfilled at the site.

Industrial waste handling operations are reported to have been initiated at the South Andover site during the mid 1950s. It has been estimated that more than 1,000 drums of waste were stored on several contiguous parcels owned by Cecil Heidelberger, William Batson, David and Shirley Heidelberger, Charles Mistelske, and Cyril Link (Figure 2-2). Each of these occurrences is discussed more fully below.

Activities conducted at the Cecil Heidelberger property reportedly included auto salvage operations, and the unregulated storage and on-site disposal of drummed chemical wastes. Available information suggests that both trenching and depression filling in former wetland areas occurred at the site. Additionally, local indiscriminate dumping and burning of wastes is also known to have occurred. Available information indicates that drums containing inks and solvents were stored at the Cecil Heidelberger Musket Ranch and Trading Post



N

0 2000 4000
Scale in Feet

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FIGURE 2-1
LOCATION OF SOUTH ANDOVER SITE
SOUTH ANDOVER

SOURCE: CH2M HILL, 1988

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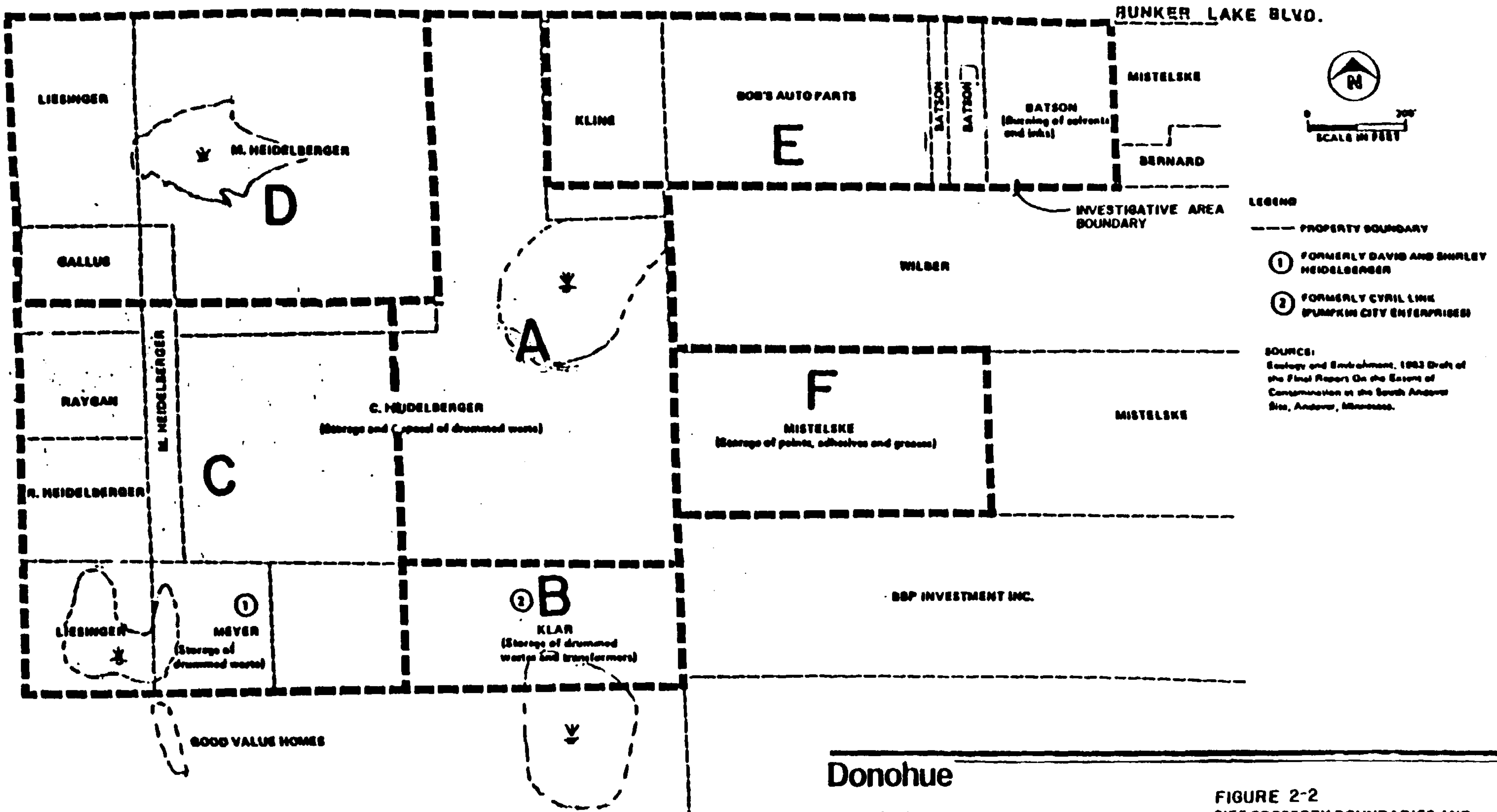

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FIGURE 2-2
SITE PROPERTY BOUNDARIES AND REPORTED WASTE DISPOSAL ACTIVITIES
SOUTH ANDOVER

as early as 1954, and on-site disposal of waste began in 1965. Activities included solvent recovery, the sale of decantable liquids, and the periodic dumping and burning of other wastes on this property. No records documenting waste storage or disposal activities were kept at the Heidelbergers. Approximately 75 percent of the property was later covered with an estimated 3 million tires. Tire removal activities have recently been completed (October 1989) revealing other potential drum storage and chemical waste storage areas. The maximum extent of tires at the South Andover site as determined from a review of historic aerial photos is depicted in Figure 2-2a.

Open pit burning of liquid wastes are reported to have been initiated at the William Batson (Vapor Steam Baths) property in 1970. Thousands of barrels of solids and liquids were allegedly burned in open pits at this site. In addition, liquid wastes may have been dumped into a wetland located near the western edge of the property, prior to the infilling of the wetland (now Bob's Auto Parts).

The former David and Shirley Heidelberger property (now Meyer) was also used for the storage of drummed industrial wastes. Approximately 200 drums of chemical waste were stored along the northern edge of the property. Uncontrolled spillage was reported to have occurred periodically.

Available information indicates that the Charles Mistelske property (Commercial Auto Parts) was used for the storage of thousands of gallons of paints, adhesives, and greases. These activities were initiated in 1973.

Several operations were allegedly conducted at the former Cyril Link-Pumpkin City Enterprises property (now Klar). This reportedly included the storage of transformers and other salvaged electrical equipment and junk, smelting operations, and the storage of 110 drums of chemical wastes and solvents.

Two tire fires have occurred at the South Andover site. The first fire occurred during July 1988, near the northeastern portion of the Cecil Heidelberger property. This fire was confined to this general area where small piles of tires and rubber chips were located. The use of water on the fire may be of possible concern due to potential organic contaminants that may have been released to the soil or groundwater as a result of pyrolysis. Review of historical chemistry data on tire fires indicates that the use of water to extinguish tire fires aids in the formation of polynuclear aromatic hydrocarbons (PNAs) and volatile aromatic compounds. Benzo(a)pyrene, pyrene, chrysene, anthracene, phenanthrene, benzene, toluene, and styrene have been detected by the Wisconsin DNR in tire-derived smoke. Results obtained from tire fires in Washington and Virginia also suggest that the formation of these compounds in smoke from tire fires may be dependent on the water usage.

While the organic compounds associated with tire fires are very water insoluble, it is possible that residual concentrations of these substances may have been sorbed onto ash or the surficial soil at the South Andover site. The possibility that contamination of the surficial soil or groundwater may have

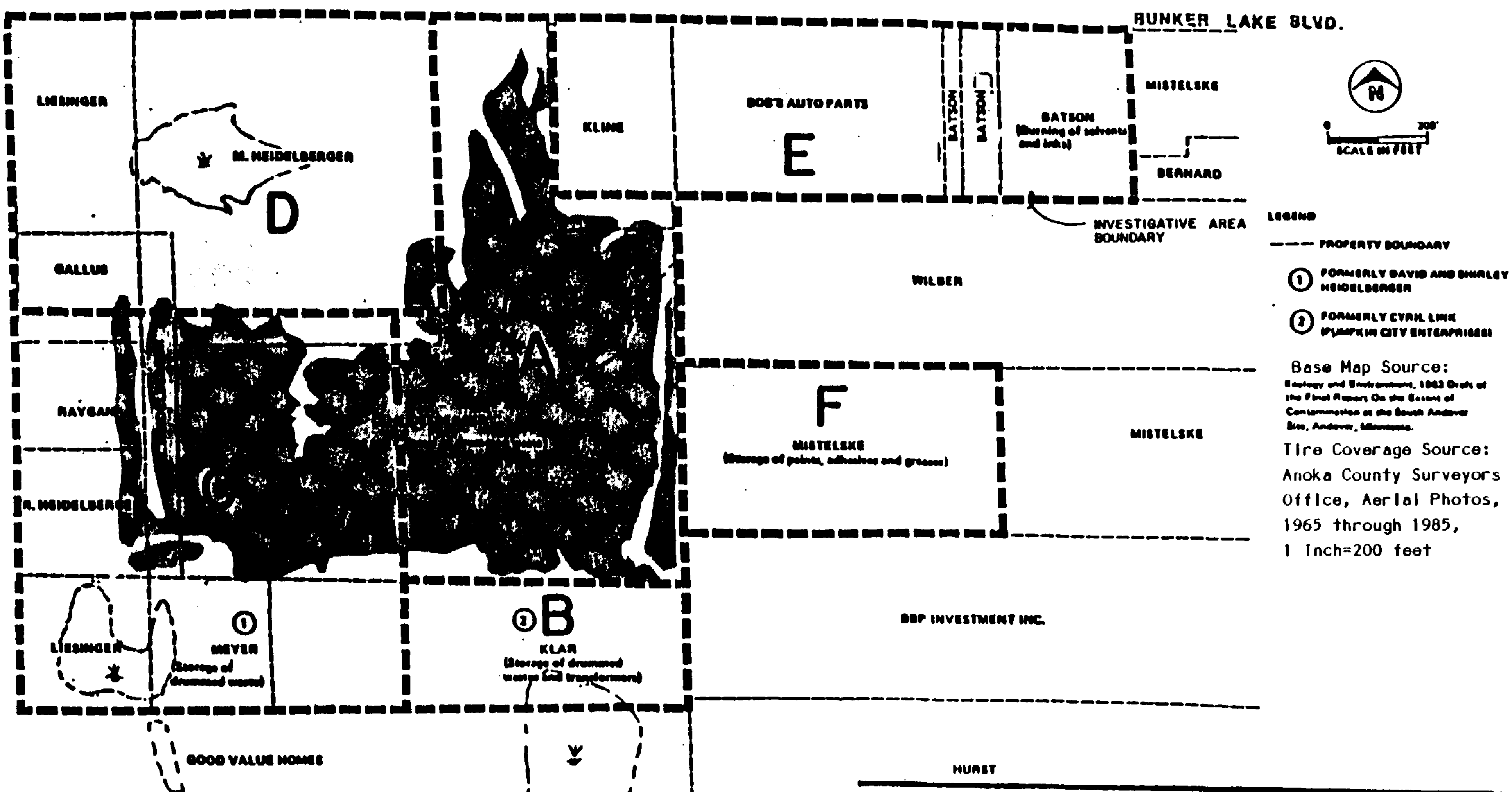

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FIGURE 2-2A
MAXIMUM TIRE COVERAGE
SOUTH ANDOVER

resulted from the July 1988 tire fire will be addressed by analyzing the surficial soil for aromatic volatile organic compounds and polynuclear aromatic hydrocarbons.

A second, much larger tire fire occurred at the South Andover site on February 7, 1989. Information obtained from the MPCA indicates that this fire involved three to five acres and approximately 300,000 tires located near the southeastern portion of the Cecil Heidelberger property. A fire break was established around the fire area, with limited use of water. The fire was smothered with sand after burning approximately two to three days. A limited number of empty drums, and drums containing industrial chemical wastes were involved in the fire.

Currently, nearly all of the tires have been removed except for a few isolated piles of tires and tire chips. Areas showing tire coverage from earlier MPCA photographs have been cleared, however, a potential for buried tires and tire fire residue exists.

The Waste Disposal Engineering Landfill is located 3,000 feet northeast of the site. This landfill, which formerly accepted hazardous waste, is a National Priorities List site undergoing remedial design.

2.1.2.1 Population and Land Use

The South Andover site is located near a relatively large metropolitan area which includes Minneapolis (population 370,951), Anoka (population 16,408), and Andover (population 13,086) (Figure 2-1). Manufacturing is the leading source of income, with wholesale and retail trade being the largest industrial employer in the area. Tourism, lumbering, and farming are other important industries.

Small businesses and new residential developments are common in the vicinity of the South Andover Site. Small businesses deal in used cars, auto parts, auto salvage and auto body repair. There are several small recreational lakes in the area. Crooked Lake is 1 mile west of the site and Bunker Lake is 1-1/4 mile to the east. The site is generally located within the Coon Creek watershed, which supports an oak savanna plant community.

2.1.2.2 Aerial Photographic Time Series

A series of historical aerial photographs (scale 1 inch:200 feet) were reviewed to obtain information concerning prior land uses. All were obtained from the Anoka County Survey. The date of the photos reviewed, and pertinent information is discussed below. Figure 2-2 provides general ownership information for orienting past activities conducted at the site.

Photo	
1965	This photo shows a relatively undisturbed wetland located near the northern limits of the site. The

only disturbance is the east to west trending Bunker Lake Boulevard which bisects the wetland. The South Andover site extends south from the Boulevard. Development of William Batson's property along northeast margin of site has occurred, and a few junked cars are present. Unknown disturbance of natural soils is observed on southwest part of the Batson property (next to junked cars). The aerial shows a building at Batson's property with an unusual roof. This building remains as a reference throughout the time series. A few junk cars are also observed on the Cecil Heidelberger property. Possible drum storage along east central margin of Heidelberger property is indicated along a dirt road.

1969

By 1969, development of a slightly higher area coincident with the northwest portion of C. Heidelberger's property, near the access to Bunker Lake Boulevard. A roadway and wetland filling has been initiated along northwest corner of C. Heidelberger property between 1965 and 1969. Trenching begins along the southeast portion of Heidelberger's property between 1965 and 1969. This trench is linear and north/south trending. Two possible drum storage areas are observed, one on the Batson property, and the other on the Cecil Heidelberger property. According to former MPCA Project Manager, Mike Vennewitz, several feed troughs are visible in the south central portion of the property. These troughs were used as separators for waste sludges brought to the site in drums.

1973

This photo shows continued wetland filling from the expanded linear trench along the southeast corner of C. Heidelberger's property. The wetland is being filled from the south, as trenching procedures probably filled a lower wet area to the north. A later geotechnical boring investigation conducted in this area by Subterranean Engineering suggests that material emplaced in the wetland included oil soaked soils, peat, and sandy fill material. The initiation of wetland filling is observed on the Batson property. Potential drum storage is also depicted near the southeast and southern portion of the site.

1977

The south to north roadway filling the wetland is completed along the east margin of the Cecil Heidelberger property. The Batson property has been filled from east to west near Bunker Lake Boulevard, and is now covered with cars. The west margin of the "Commercial" Auto property contains numerous drums. "Pumpkin City Enterprises" (Cyril Link property) shows drums and an apparent spillage area. Drum storage is also observed along southern margin of the David Heidelberger property. Drums are spotted throughout the Cecil and David Heidelberger property. The Batson burn pits are possibly identified from this photo. More tires cover the C. Heidelberger property, especially southwest of the former wetland area along the east side of the property. Bob's Auto has been constructed in the former wetland area along Bunker Lake Boulevard.

1981 The 1981 photo shows that most previous drum storage areas are no longer present. Drums apparently have been removed from "Commercial" Auto. However, tires and tire salvage operations completely cover the Cecil Heidelberger property. Operations at the Kline property (west of Bob's Auto) have expanded southward into the former wetland area. Batson continues to fill the wetland from the east. Cars are parked on recently filled wetland area at Bob's Auto. Drums still appear along the west and southwest portion of the site on David Heidelberger's property. Miscellaneous debris (possibly drums) are observed at Pumpkin City Enterprises.

1985 Several cars have been removed from the Cecil Heidelberger property. Tire removal has also begun. Materials have been removed from the Klar property. The wetland area (west of Batson property) is now totally filled. Cars are parked on the recently filled area at Bob's Auto.

1989 Most tires across the site have been removed. Miscellaneous debris occurs along the southern portion of the site. A wetland along the northwest corner of site is filled between 1985 and 1989. Junked cars from "Mom's" Auto now occupy the recently filled surface.

2.1.3 Current Conditions

Current conditions show tire removal nearly complete across the site. A few isolated shredded tires and radial tire steel belts are scattered across areas of the Cecil and David Heidelberger properties. A major portion of the site (excepting active businesses) has been fenced, and access into the site is locked.

Major residential development is occurring both directly north-northwest and south of the site. The northern development is essentially complete, while initial grading activities are occurring south of the site. Single family residences located on the western portion of the site are also currently occupied.

Auto repair and salvage operations continue to occur both on, and adjacent to, the South Andover site.

2.1.4 Regulatory Response Actions

Actions to limit waste handling operations at the various properties at the South Andover site began in 1973 when Anoka County officials instructed Cecil Heidelberger to remove and dispose of chemical wastes stored on his property. Investigation of the site was initiated by the MPCA in 1973 after a citizen complaint of suspected residential well contamination was received. In 1976, the MPCA issued a Citation of Violation to Cecil and Marian Heidelberger for unregulated chemical waste storage. These individuals continued processing waste in early 1977, and stopped accepting waste in 1978 when they sold the property to Parmak, Inc. Parmak intended to reclaim the several million stockpiled tires located on the property.

The MPCA initiated actions to regulate the other identified waste handlers in 1980 and 1981. Notice of Violations for the improper storage and disposal of chemical wastes were served to Shirley Heidelberger, Cyril Link and Charles Mistelske. Cecil Heidelberger continued to dispose of additional industrial waste at this time by mixing the contents of 700 drums with waste oil for use as fuel in an asphalt plant.

Available MPCA correspondence has indicated that ACME Tag Company, Bemis Company, Color-Add Packaging, and Standard Solvents Company were notified by the MPCA in 1980 as to their potential responsible party (PRP) status. Sixteen parties, including site owners, operators, and waste generators were notified in 1982 by the EPA Office of Enforcement and Compliance Monitoring that the EPA was considering actions at the site. All parties were also informed of their potential joint and several liability related to these activities. The MPCA took similar actions in 1983, outlining remedial actions for the sites.

In July 1985 the EPA notified 21 PRPs that it was the intent of that agency to conduct an RI/FS at the South Andover site, but that EPA would also consider an offer by the PRPs to conduct the RI/FS. Failure to negotiate such action with the PRPs resulted in the EPA using Superfund to conduct the South Andover RI/FS.

Copies of the Proposed Plan for Remedial Action (RA) for the surficial aquifer (Operable Unit I) were sent to the PRPs on February 1, 1988. On February 26, the EPA Region V Office notified all PRPs that the EPA intended to conduct an

RA, and that the PRPs had 60 days to submit a good faith proposal. No response was received upon issuance of the Record of Decision (ROD) on March 30, 1988.

A Remedial Investigation (RI) involving soil gas surveying, soil borings, monitoring well installation, and soil and groundwater sampling was performed by CH2M Hill during the period from Fall of 1985, through the Summer of 1987. Chemical results from the RI generally supported earlier studies, indicating that soil and groundwater contamination does occur across selected areas of the site. This information led the EPA to issue on March 30, 1988, a Record of Decision (ROD) which presents a summary of existing site conditions and discusses the feasibility of implementing remedial alternatives for the surficial aquifer, designated as Operable Unit I (OU-I). In the ROD, the EPA concluded that a groundwater extraction and treatment system should be implemented to limit the extent of groundwater contamination within OU-I. However, subsequent sampling has yielded ambiguous results regarding the presence or absence of groundwater contamination, suggesting that implementation of the ROD may not be warranted at this time. This uncertainty has resulted in the EPA initiating an additional study to further characterize on-site conditions. Donohue was selected to perform a Design Investigation (DI) to provide information to the EPA for the explicit purpose of allowing that agency to decide whether it is appropriate to implement or modify the existing ROD.

The South Andover Design Investigation presently being conducted by Donohue also focuses on obtaining additional groundwater quality and hydrogeologic information concerning OU-I. Information obtained during the DI will be used to (1) evaluate whether significant groundwater contamination exists within OU-I, (2) determine potential groundwater discharge areas, (3) identify potential receptors lying between the site and groundwater discharge points, (4) identify potential risks to downgradient receptors, and (5) provide additional information for the design of a remedial action should such action be necessary.

2.1.5 Previous Investigations

2.1.5.1 Soils

Several subsurface investigations have been conducted at the South Andover Site since the late 1970s. Previously investigated areas are depicted in Figure 2-3. An early geotechnical boring investigation for International Tire Recycling Corporation was conducted by Subterranean Engineering to assess the suitability of soils for construction purposes. However, the soil boring program revealed that oil soaked soils, peat, and fill materials occurred in a former wetland area, located near the northern entrance into the site from Bunker Lane Boulevard. The oil soaked soil had been buried by about 4 feet of sandy fill material.

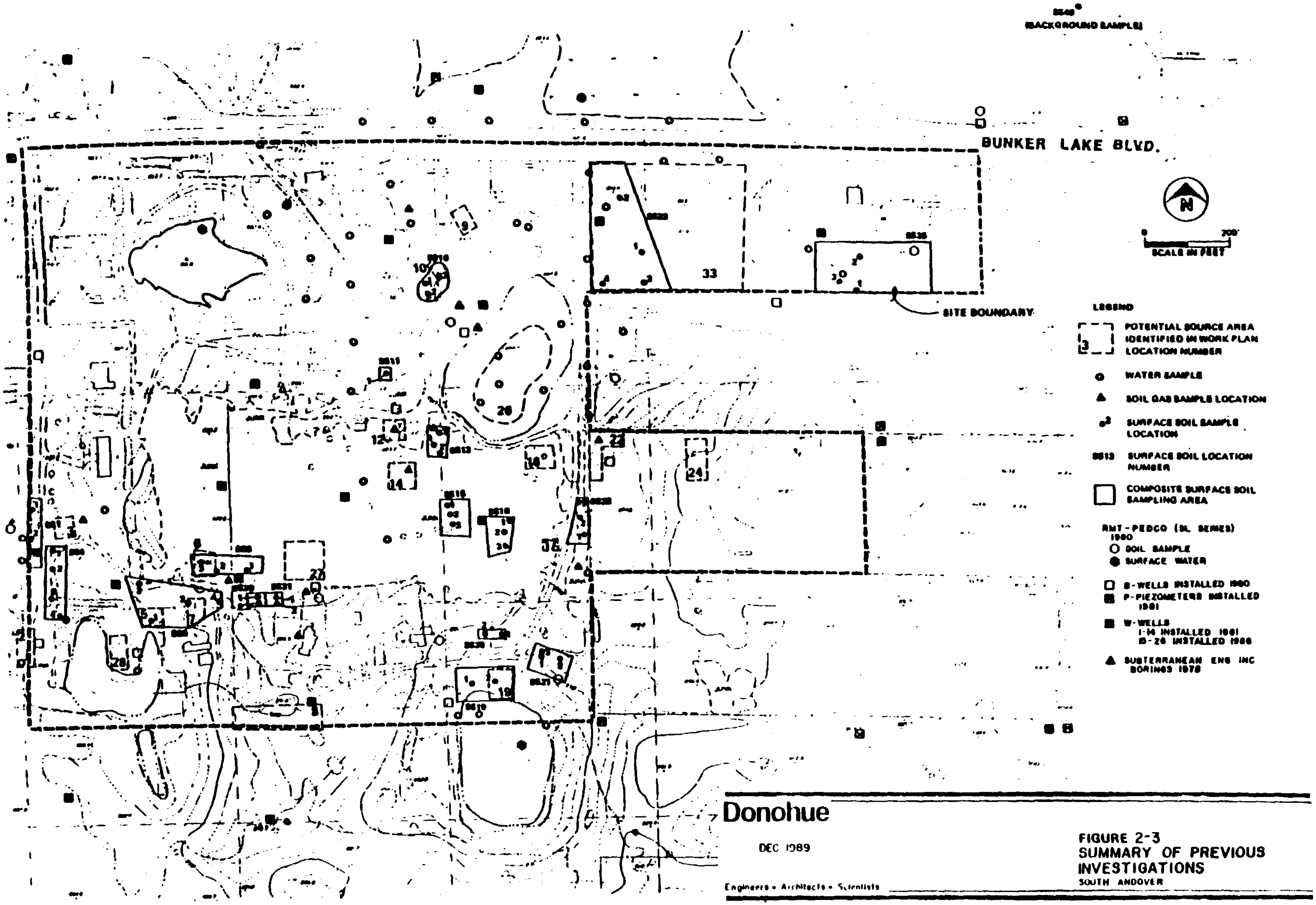

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FIGURE 2-3
SUMMARY OF PREVIOUS INVESTIGATIONS
SOUTH ANDOVER

SOURCE: CH2M HILL

Residual Management Technology and PEDco Environmental conducted a more extensive soil boring and well installation program for the MPCA and US EPA Region V Technical Assistance Panels Program (1979). This investigation included the completion of a series of well nests (24 wells at 10 locations) either at, or near, the South Andover site. Soil samples were collected from depths of 1 to 4.5 feet below the ground surface at 8 locations across the site. Results from the RMT/PEDco boring program indicate that surficial soils locally contain concentrations of selected metals (chromium, lead, zinc, and copper) which exceed levels normally observed in native soils. In addition, the data indicated local contamination of the soil by various organic constituents.

The US EPA Region V Field Investigation Team (FIT) program performed by Ecology and Environment (1981) also involved the chemical sampling of soils. The results obtained indicate that soil contamination may occur to a maximum depth of 102 feet. However, the significance of the data obtained during this study is not known. Discussions given in the FIT report suggest that the observed contamination may have been caused by either laboratory induced effects from trichlorofluoromethane, or field contamination by acetone and methylene chloride. Toluene was detected in soil samples from 44 and 49-foot depths, near two wells exhibiting potential groundwater contamination. The observed deep soil contamination was reported to have been caused by aqueous phase transport. The concentrations of inorganic constituents in soils were inconclusive, and were considered to fall within normal background concentrations.

Further subsurface investigations were conducted by CH2M Hill in 1985 and 1986 as part of a Remedial Investigation for EPA. This program included chemical sampling of surficial soils (average 3-foot depth), soil sampling within deeper borings and the installation of groundwater monitoring wells. Contamination of surficial soil by Volatile Organic Compounds (VOCs), PCBs, metals, and other substances was reported to occur at the majority of sample locations (Figures 2-4, 2-5). Soil samples from the middle aquitard also showed VOC contamination, indicating that contamination may occur at depth.

2.1.5.2 Drum or Waste Characterization

Sampling and analysis of waste from drums located at the South Andover site was performed by the MPCA in 1980. This investigation revealed that several waste types were present at the site, including waste ink and ink sludge, paint and paint sludge, and nonchlorinated or chlorinated solvents. Waste characterization information indicated that many drums contained flammable substances which may be classified as hazardous waste.

Other drum inventories were conducted by alleged PRPs at the South Andover Site between 1980 and 1984. PACE laboratories was contracted by a consortium of waste producers to identify substances from all drums, and to chemically sample soils from locations that may have been impacted by waste materials. A

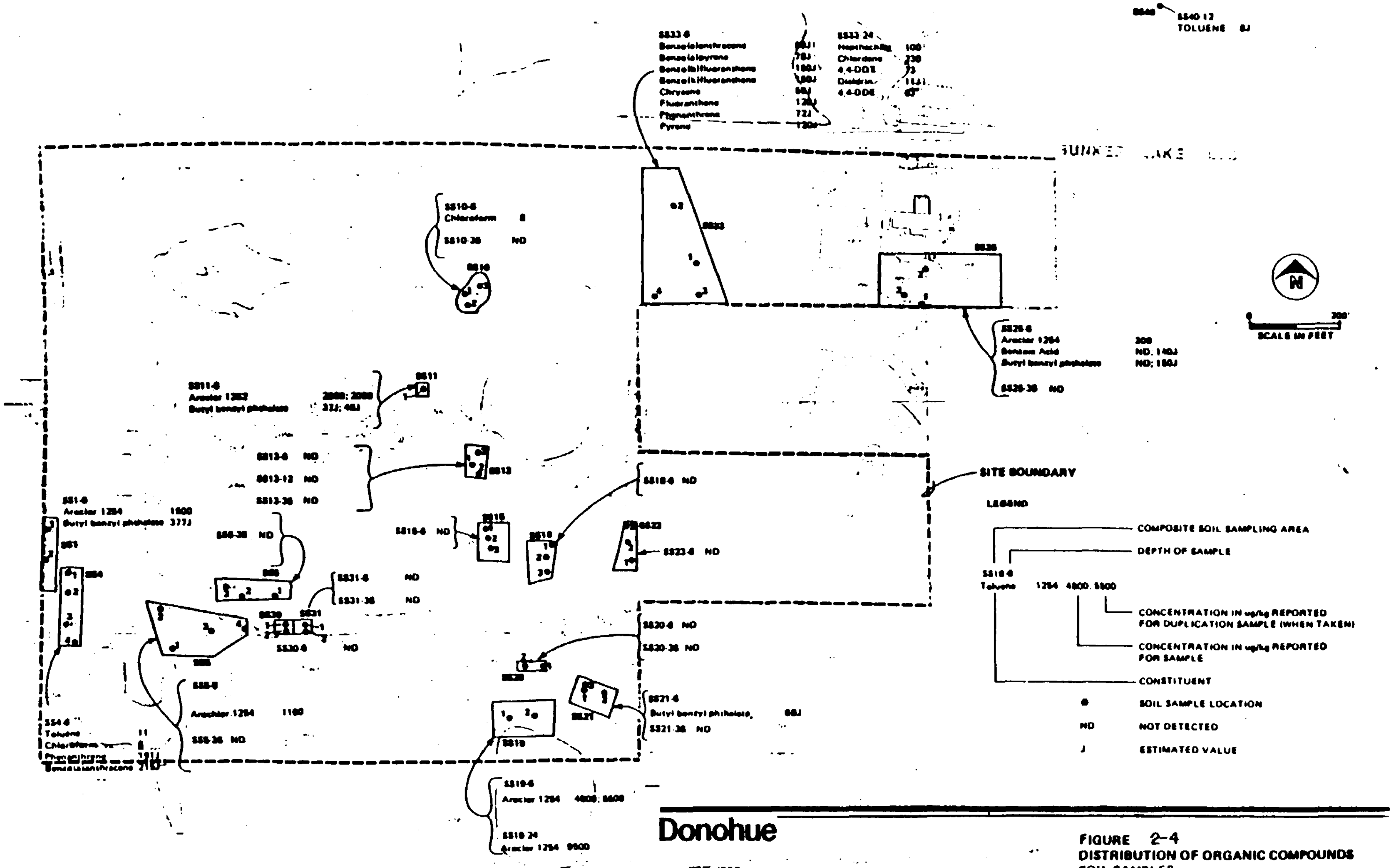

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FIGURE 2-4
DISTRIBUTION OF ORGANIC COMPOUNDS
SOIL SAMPLES
(CONCENTRATION IN UG/KG)
SOUTH ANDOVER

SOURCE: CH2M HILL, 1988

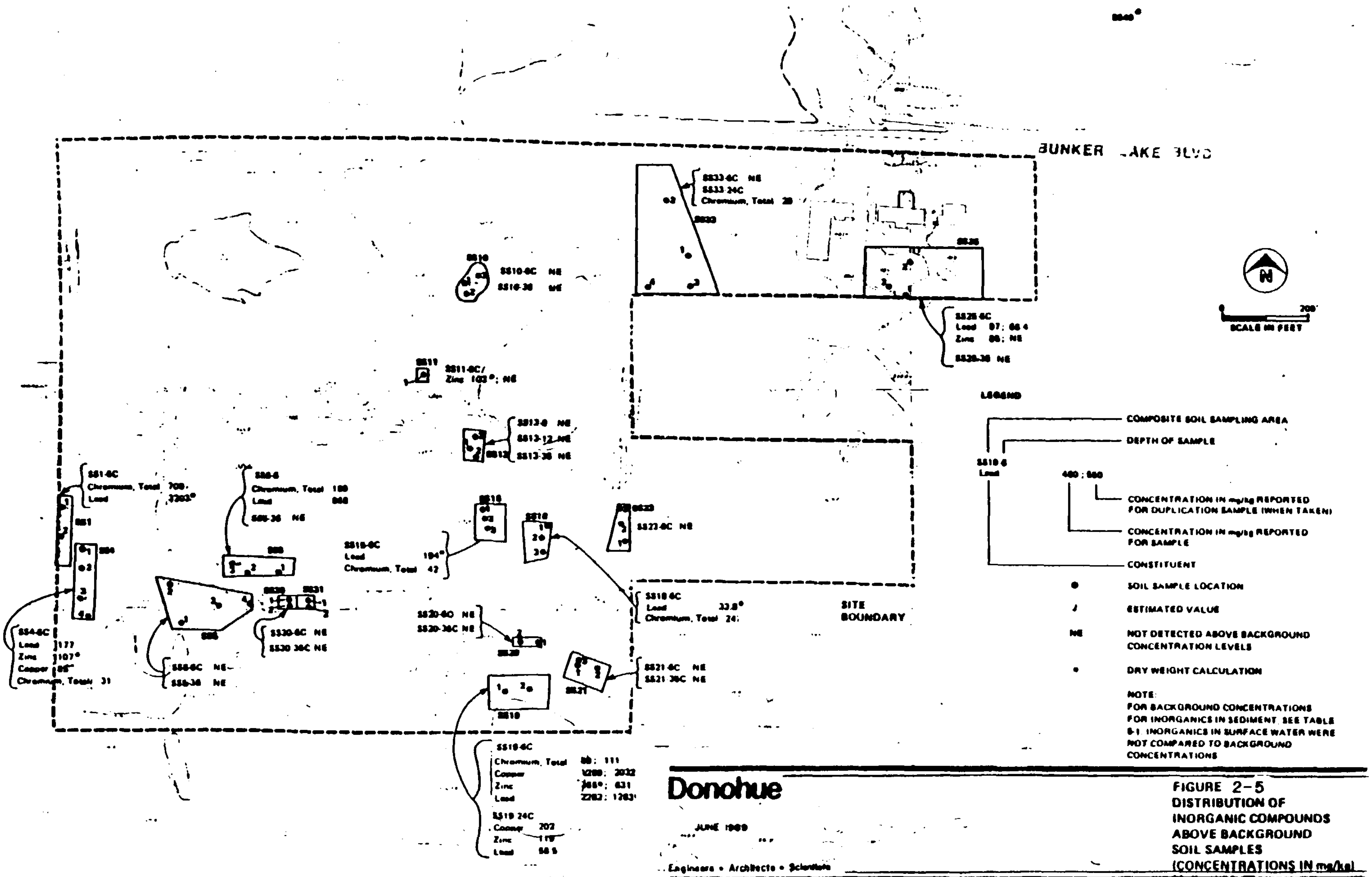

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FIGURE 2-5
DISTRIBUTION OF INORGANIC COMPOUNDS ABOVE BACKGROUND SOIL SAMPLES (CONCENTRATIONS IN mg/kg)

SOURCE: CH2M HILL, 1988

variety of residues and sludges (including PCBs) were identified. The concentrations of maximum contaminants of concern associated with such sources are presented in Table 2-1.

2.1.5.3 Sediment and Surface Water

RMT/PEDco performed a surface water quality survey of six water bodies located on, and adjacent to, the South Andover site (September 1980). Chemical analysis for selected organic and inorganic parameters indicate that the surface water and sediment was locally impacted by organic compounds (Figure 2-6). Selenium concentrations exceeded primary drinking water standards at two locations, while cyanide concentrations exceeded MPCA Standards at four locations (Figure 2-7). Phenolics and mercury concentrations also exceeded MPCA Standards at two locations.

Data obtained during the CH2M Hill investigation has indicated that surface water bodies at the site may contain detectable levels of VOCs. In addition, the concentration of selected metals in surface water sediment reflect the fact that all surface water bodies at the site have been impacted by dumping. Elevated concentrations of aluminum, chromium, copper, lead, manganese, iron, and zinc were reported by CH2M Hill.

2.1.5.4 Groundwater

A preliminary hydrogeologic report at the Heidelberger property was conducted by RMT/PEDco in 1979, with a subsequent well installation program in 1980. Some of the major conclusions indicated that extensive groundwater contamination occurs within the upper sand aquifer. Deeper wells penetrating the underlying silty till aquitard also indicated organic and inorganic contamination. Well B8C showed elevated levels of methylene chloride and tetrachloroethylene. In addition, Wells B8C, B1C, B4B, and B10C contained levels of cyanide and selenium above Primary Drinking Water Standards.

The Ecology and Environment (FIT) field investigation focused on completing an expanded groundwater investigation at the South Andover site. Twenty-two piezometers and 26 additional monitoring wells were installed during FIT activities. This study revealed that while groundwater flow within the surficial aquifer is multi-directional, flow is generally directed from the northeast towards the south. The most significantly contaminated well showed high concentrations of polynuclear aromatic hydrocarbons (PNAs) and trace metals. Other wells showed significant levels of inorganic and organic contamination, with organic contamination restricted to on-site locations. This study also attempted to evaluate the interrelationship between groundwater quality at the South Andover site, and observed groundwater contamination at the Waste Disposal Engineering Landfill (3,000 feet north). The study determined that the relationship between these sites was unclear.

TABLE 2-1

CONTAMINANTS DETECTED 1980-1986
SOUTH ANDOVER SITE
Andover, Minnesota

Contaminant	Matrix	Highest Conc. Reported
Methylene Chloride	Drums	680,000 mg/l
Isopropyl Alcohol	Drums	740,000 mg/l
1,1,1-Trichloroethane	Drums	3,000 mg/l
Trichloroethylene	Drums	510,000 mg/l
Benzene	Drums	48,000 mg/l
Methyl Isobutylketone	Drums	330,000 mg/l
Tetrachloroethylene	Drums	42,000 mg/l
Toluene	Drums	1,000,000 mg/l
Xylene	Drums	570,000 mg/l
N-Butyl Alcohol	Drums	440,000 mg/l
Methyl Acetate	Drums	120,000 mg/l
Chromium	Soil - 6"	700 mg/kg
Lead	Soil - 6"	6733 mg/kg
Cyanide	Soil - 6"	48 mg/kg
PCB-Aroclor 1254	Soil - 6"	5.50 mg/kg
PCB-Aroclor 1254	Soil - 24"	9.50 mg/kg
Phenanthrene	Soil - 6"	0.19 mg/kg
Benzo(a)anthracene	Soil - 6"	0.21 mg/kg
Benzo(b)fluoranthene	Soil - 6"	0.150 mg/kg
Benzo(k)fluoranthene	Soil - 6"	0.150 mg/kg
Chrysene	Soil - 6"	0.059 mg/kg
Pyrene	Soil - 6"	0.120 mg/kg
Toluene	Soil - 13"	0.024 mg/kg
Methylene Chloride	Soil - 6"	3.09 mg/kg
2-Butanone	Soil - 36"	12.1 mg/kg
Phenol	Surface Water	0.014 mg/l
Benzoic Acid	Surface Water	0.089 mg/l
Lead	Surface Water	0.087 mg/l
Selenium	Surface Water	0.035 mg/l
Lead	Sediment	0.09 mg/kg
Naphthalene	Sediment	0.680 mg/kg
Benzoic Acid	Sediment	2.30 mg/kg
Phenol	Sediment	1.90 mg/kg
2-Methyl Naphthalene	Sediment	0.57 mg/kg
Phenanthrene	Sediment	0.29 mg/kg
Fluoranthene	Sediment	0.36 mg/kg
Pyrene	Sediment	0.29 mg/kg
Benz(a)anthracene	Sediment	0.28 mg/kg

TABLE 2-1

CONTAMINANTS DETECTED 1980-1986
SOUTH ANDOVER SITE
Andover, Minnesota
(Continued)

Contaminant	Matrix	Highest Conc. Reported
Chrysene	Sediment	0.16 mg/kg
Benzo(b)fluoranthene	Sediment	0.420 mg/kg
Benzo(k)fluoranthene	Sediment	0.420 mg/kg
Benzo(a)pyrene	Sediment	0.220 mg/kg

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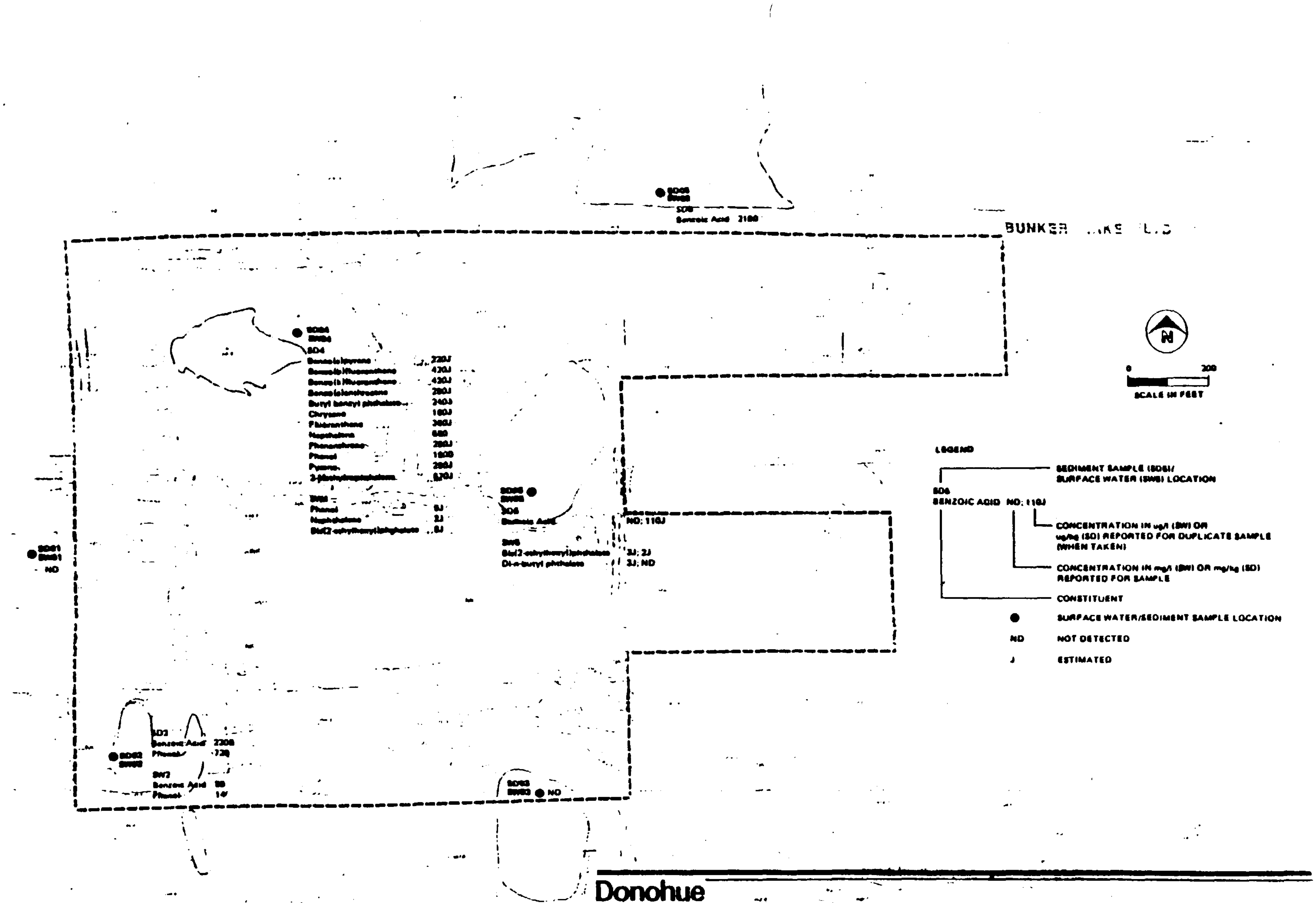

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FIGURE 2-6
DISTRIBUTION OF ORGANIC COMPOUNDS
SURFACE WATER AND SEDIMENT SAMPLES
SOUTH ANDOVER

SOURCE: CH2M HILL, 1988

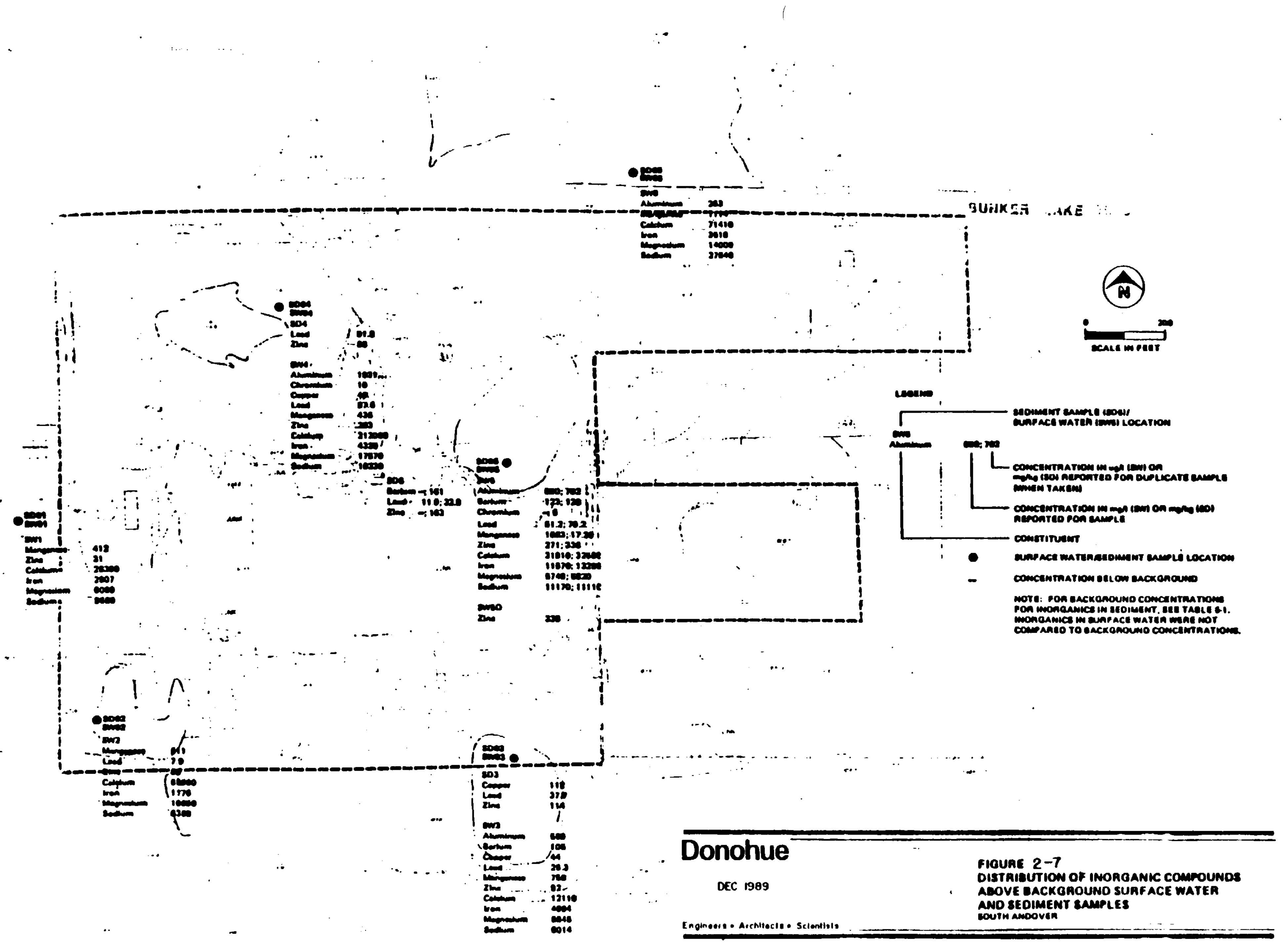

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FIGURE 2-7
DISTRIBUTION OF INORGANIC COMPOUNDS ABOVE BACKGROUND SURFACE WATER AND SEDIMENT SAMPLES
SOUTH ANDOVER

SOURCE: CH2M HILL

An additional 19 groundwater monitoring wells were installed as part of the CH2M Hill investigation. Groundwater sampling data obtained during this investigation support the results of the RMT/PEDco study, indicating that the surficial aquifer has been impacted by selected metals and VOCs. Results of the CH2M Hill study also suggest that possible contamination of the lower sand aquifer has occurred.

2.2 PHYSIOGRAPHIC SETTING

2.2.1 Geology

The following discussion of geology is divided into two sections. The first describes the regional geology of the Anoka Sand Plain and the second, the Site Geology of the immediate area of the South Andover Site. Each section includes descriptions of glacial and bedrock stratigraphy.

2.2.1.1 Regional Geology

The regional geology of east central Minnesota is dominated by the Anoka Sand Plain physiographic region. This broad sand plain covers approximately 850 square miles in east-central Minnesota (Farnham, 1956). The area has been subjected to several glacial advances and retreats during the Pleistocene Epoch. The present landscape strongly reflects the influence of mid- to late Wisconsinan glaciation and subsequent modification by aeolian and fluvial processes. Glacial deposits consist primarily of till and outwash which range in thickness from 100 to 300 feet. Existing topography is about 300 feet as a result of the most recent advances of the Superior lobe and the Grantsburg sublobe during the mid- and late-Wisconsinan Period. The Superior till consists of massive, red, silty, clayey sand. The till deposited by the Grantsburg sublobe is typically a calcareous, gray silty, clayey sand. The gray outwash sand which comprises the Anoka Sand Plain was deposited as the Grantsburg sublobe retreated. These glaciofluvial deposits form a 20- to 60-foot mantle over the underlying till units.

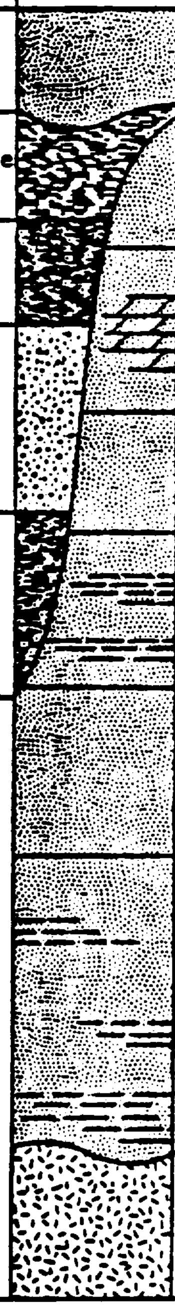
The bedrock underlying the Anoka Sand Plain consists predominantly of Cambrian and Precambrian sandstones with interbedded shales and siltstones overlying a Precambrian basement complex. Bedrock elevations range from less than 600 feet to more than 850 feet (Jirsa et al., 1986), and reflect the presence of bedrock valleys up to 300 feet deep. Regional bedrock and glacial stratigraphy is presented in Figure 2-8, and a regional geologic cross-section through Anoka and Sherburne Counties is presented in Figure 2-9.

2.2.1.2 Site Geology

The following discussion of site geology at the South Andover site is based upon data collected during the following investigations: Subterranean Engineering (1978), Residual Management Technology/PEDco Environmental (1980), Ecology and Environment (1983), Pace Laboratory (1984), and CH2M Hill (1987).

GLACIAL DRIFT

HYDROLOGIC CLASS.	DESCRIPTION	UNIT AND THICKNESS
Local Aquifer	Sand	0-100' Outwash
Aquitard	Silt and Clay Laminated	0-70' Glacial Lake Deposits
Aquitard	Gray Silty Till, Unstratified and Unsorted	0-150'+ Grantsburg Sublobe Till
Local Aquifer	Sand and Gravel, Stratified Variable Sorting	0-150' Outwash and Ice Contact Deposits
Aquitard	Red Brown Sandy Till	0-100' Superior Lobe Till



BEDROCK

UNIT AND THICKNESS	DESCRIPTION	HYDROLOGIC CLASS.	AGE
0-50' Jordan Sandstone	White to Yellow Fine to Coarse Quartzose and Sandstone	Regional Aquifer	CAMBRIAN
0-200'+ St. Lawrence and Franconia Formations	Dolomite, Siltstone Sandstone and Shale. Glauconitie; Green, Yellow, Red, and White.	Local Aquifer, Regional Aquitard	CAMBRIAN
0-60' Ironton and Galesville Sandstone	White to Yellow Fine to Coarse Sandstone	Regional Aquifer	CAMBRIAN
0-150' Eau Claire Formation	Sandstone, Shale and Siltstone. Glauconitic; Green, Yellow red and White.	Local Aquifer, Regional Aquitard	CAMBRIAN
200' Mt. Simon Sandstone	Gray to Pink Medium to Coarse Sandstone Some Pebbles.	Regional Aquifer	CAMBRIAN
200+ Hinkley and Fon du Lac Formations	Hinkley-Yellow to Red, Fine to Coarse Sandstone; Interbedded Shale Fond du Lac- Sandstone; Siltstone Shale; Arkosic		PRECAMBRIAN
Undifferentiated Igneous and Metamorphic Rocks	Gneiss, Granite and Schist	Regional Aquiclude	PRECAMBRIAN

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U.S.G.S. ATLASES HA-509 AND HA-528

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FIGURE 2-8
REGIONAL STRATIGRAPHIC COLUMN
SOUTH ANDOVER

SOURCE: CH2M HILL, 1988

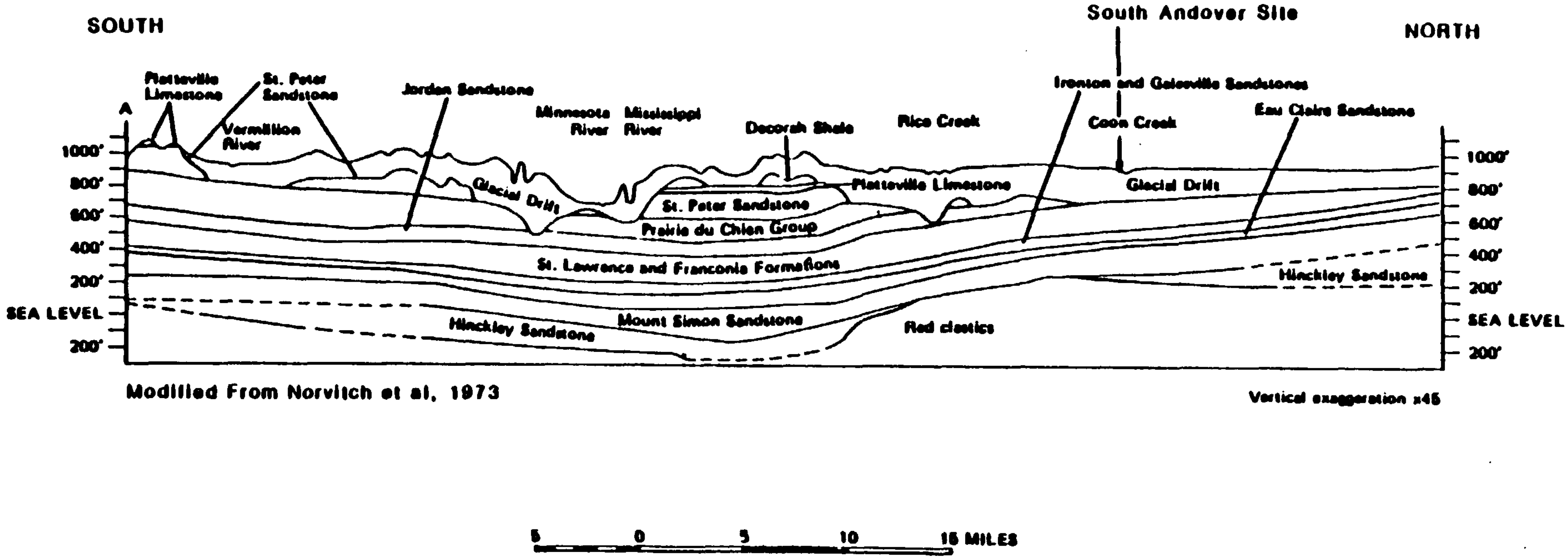

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FIGURE 2-9
REGIONAL GEOLOGIC CROSS SECTION
SOUTH ANDOVER

SOURCE: CH2M HILL, 1988

Subsurface investigations carried out at the South Andover Site reported that four major unconsolidated units are present. Their relative positions are illustrated in the site stratigraphic column (Figure 2-10). The upper sand aquifer is made up primarily of the outwash and dune sands of the Anoka Sand Plain. The middle aquitard is composed primarily of lake sediments, with localized, discontinuous till bodies. The lower sand aquifer is glaciofluvial in origin, most likely Superior Lobe outwash. Reddish-brown Superior Lobe clayey till underlies the lower sand aquifer.

The upper sand aquifer consists of fine-grained, subrounded sand with a trace of medium sand and silt. The unit ranges from 20 to 50 feet in thickness at the site. A 2- to 7-foot thick silty sand (topsoil) is present within the unit and swamp deposits characterized as black organic silt also occur locally.

The middle aquitard is made up of three subunits. The uppermost unit is comprised of a localized, discontinuous, thin, gray sandy clay recognized regionally as the Grantsburg Sublobe till. This unit is underlain by a sandy silt unit that is probably lacustrine, which in turn overlies a lacustrine clay and clayey silt unit. Total thickness of the aquitard varies from 50 to 70 feet. Twenty-six feet of relief is exhibited by the upper surface of the middle aquitard. A structural contour map of the top of the aquitard is shown in Figure 2-11.

A lower sand unit comprised of Superior outwash or ice contact deposits lies approximately 100 feet beneath the South Andover site. This unit, interpreted as glaciofluvial deposits, is comprised of fine- to medium-grained sand lenses, which locally contain coarse sand and gravel. Minor silt (15 percent) was also noted. Thickness of the lower sand unit ranges from 9 to 35 feet.

The Superior lobe till is the lowermost unconsolidated glacial unit occurring at the site. This unit consists of a red sandy clay to 5 feet thick. The continuity of this unit beneath the site is not well defined (CH2M Hill, 1988).

Bedrock Units

The uppermost bedrock units underlying the South Andover site are assigned to the St. Lawrence and Franconia Formations (Figure 2-10). Both formations consist predominantly of interbedded sandstone and shale. Approximately 100 feet of topographic relief is observed on the subcropping bedrock surface beneath the site, with progressive deepening toward the west (CH2M Hill, 1988). While depth to bedrock at the site is not well defined, available data suggests that these units generally occur between depths of 85 and 160 feet. A deep southwest-trending preglacial bedrock valley is located west of the site. It is likely that a tributary to this major bedrock feature extends under the site. Another bedrock valley is located towards the southeast. This feature extends to the northwest, towards the site (Figure 2-12).

SYSTEM	GEOLOGIC UNIT	THICK-NESS		DESCRIPTION	ORIGIN	HYDROLOGIC CLASS
Quaternary	Sand	20'-50'		0-8' Silty Fine Sand	Topsoil & Fill	Upper Sand Aquifer
				0-12' Fine Sand	Fill	
				0-8' Black Organic Silt	Swamp Deposits	
				5'-16' Brown Fine Sand	Dune Sand or Grantsburg Outwash	
				5'-26' Gray Fine Sand and Silty Sand		
	Sandy Clay	50'-70'		0-5' Gray Sandy Clay	Grantsburg Till	Middle Aquitard
	Silt and Sandy Silt			20'-40' Silt and Sandy Silt, 4' Lens of Silty Sand, Traces of Coarse Sand and Gravel	Glacio-Lacustrine Over Most of Site. May Be Till in SW Corner	
	Clayey Silt and Clay			10'-45' Clayey Silt and Clay, Laminated, up to 1/2" Bands of Red Clay	Glacio-lacustrine	
	Sand and Gravel	9'-35+		Sand, Sand and Gravel and Silty Sand	Superior Outwash or Ice Contact Deposits	Lower Sand Aquifer
	Sandy Clay	0-5+				
Cambrian	St. Lawrence Formation and Franconia Formation	up to 150'		Red Sandy Clay	Superior Till	Superior Till
				Yellow Siltstone, Tan and Green Shale and Sandstone		Bedrock

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FIGURE 2-10
SITE STRATIGRAPHIC COLUMN
SOUTH ANDOVER

SOURCE: CH2M HILL, 1988

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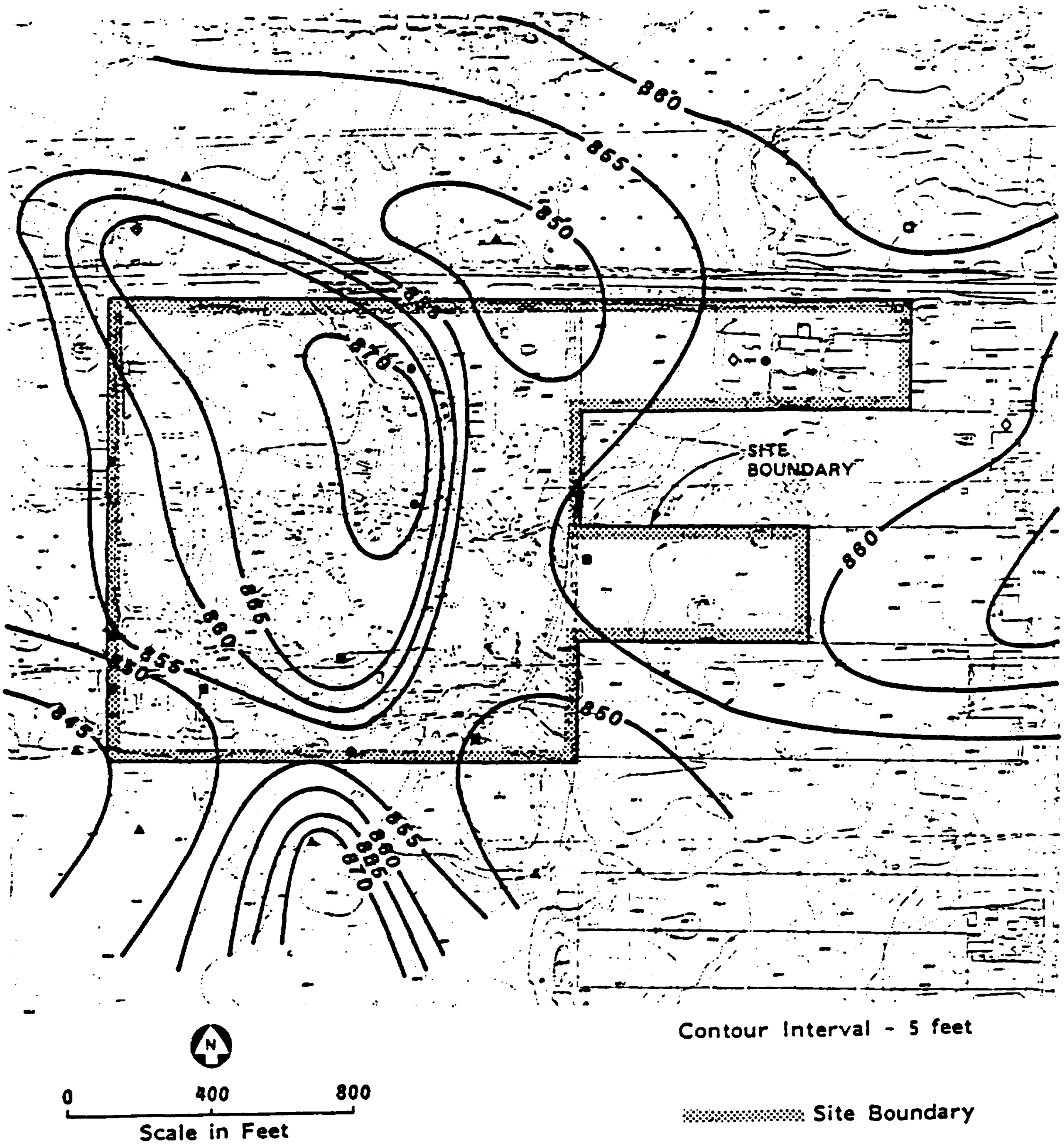

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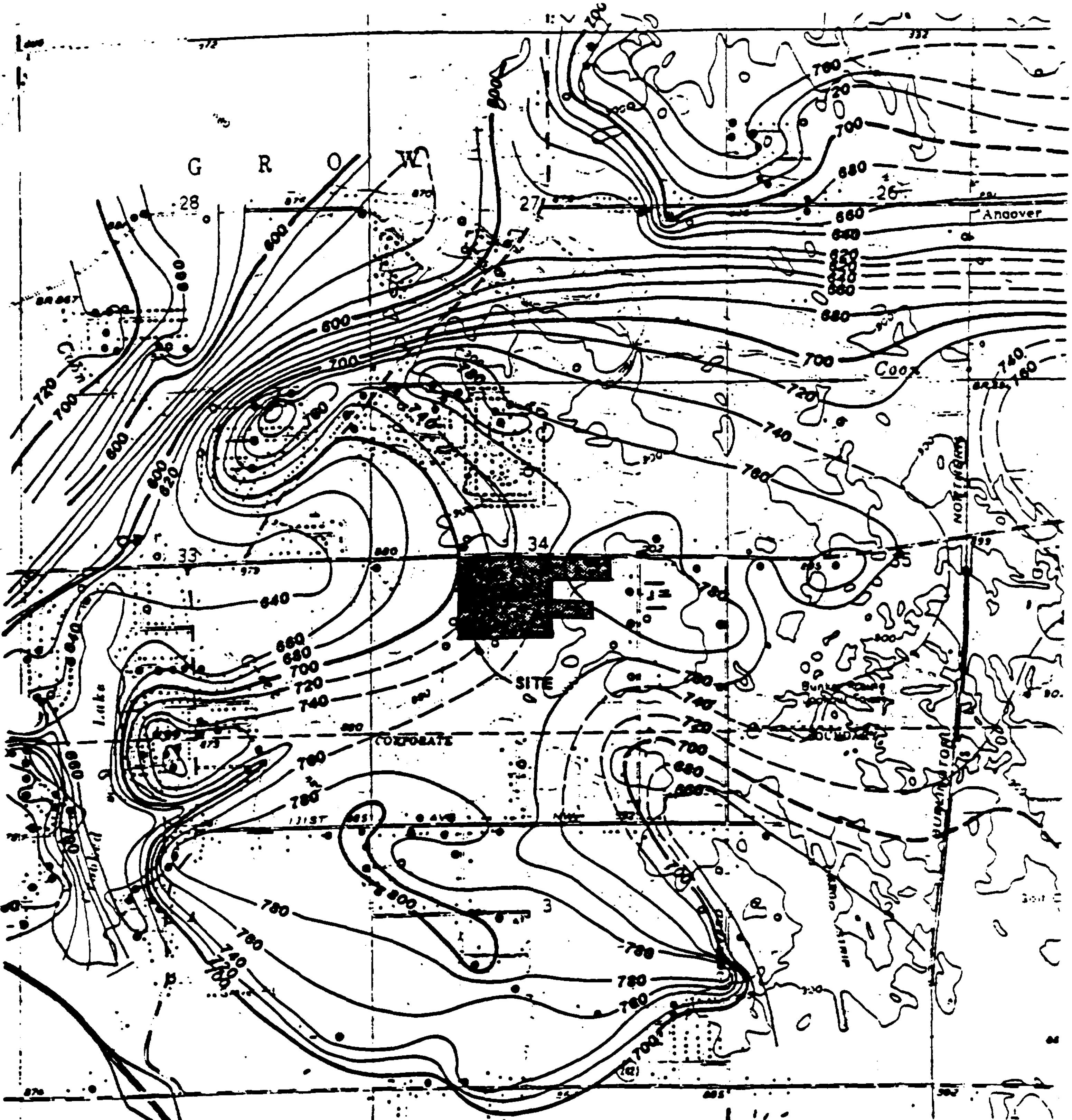
FIGURE 2-II
ELEVATION OF THE TOP OF THE MIDDLE AQUITARD
SOUTH ANDOVER

Source: CH2M Hill, 1988



Contour Interval 20 Feet

LEGEND

- Drift Borehole Log
- Bedrock Borehole Log

0 2000 4000

Scale in Feet

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SOURCE: CH2M HILL, 1988

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FIGURE 2-12
BEDROCK TOPOGRAPHY
SOUTH ANDOVER

2.2.2 Surficial Soils

Soils in the area are mapped as Zimmerman-Isanti-Lino Soil Association (Soil Conservation Service, 1977). They are developed on a broad undulating sand plain and consist of excessively-drained to somewhat poorly-drained fine sand. This soil association covers nearly 50 percent of Anoka County and is comprised of a number of minor soils, including Anoka, Markly, Rifle, and Sartell soils. Most of the soils at the South Andover site are of the Sartell Series. Formed primarily on outwash sands, these soils are well-drained on short, irregular slopes often associated with aeolian blowout areas. Limited areas of the site consist of Lino loamy fine sand soil, characterized by poorly-drained areas.

2.2.3 Groundwater Hydrogeology

2.2.3.1 Regional Hydrogeology

Major aquifers used in the region occur both within glacial drift deposits, and in the underlying bedrock. The principal bedrock aquifers include the Jordan Sandstone, the Franconia-Ironton-Galesville Formations, and the Mt. Simon-Hinckley-Fond du Lac Formations (Figure 2-8). These units consist primarily of quartzose, sandstones, with interbedded siltstones and some shale. Groundwater flow within the bedrock aquifer is to the southeast (Ericson et al., 1974).

The lithologic and hydraulic characteristics of the glacial drift are quite varied. Well-sorted, coarse-grained outwash or sandy-till deposits typically serve as aquifer units, while interbedded poorly stratified clay and silt glacial till or lacustrine deposits act as intervening aquicludes or aquitards. Typically, thicker sequences of glacial drift overlie bedrock valleys, excavated by preglacial and interglacial stream action.

The unconfined (water table) aquifer system is located within the glacial drift unit throughout Anoka County. Depth to the water table ranges from 5 to 15 feet in this general vicinity. Regional groundwater flow within the surficial aquifer is directed toward the southeast, except near major streams.

Glacial Drift Aquifers

Gray, fine-grained outwash sand forms the uppermost aquifer within the Anoka Sand Plain. This aquifer can yield up to several hundred gallons per minute (gpm), depending on the lithologic characteristic of the unit and the saturated thickness penetrated. The surficial aquifer is used locally for private water supplies.

The upper sand aquifer is underlain by an aquitard composed of laminated silt and clay which represents glacial lake deposits, or the Grantsburg Sublobe till. Thickness of the aquitard ranges from 50 to 70 feet in the vicinity of the site. This aquitard typically displays low hydraulic conductivity.

A lower sand aquifer unit comprised of sand and gravel units (outwash and ice contact deposits) underlie the gray till of the Grantsburg Sublobe. This aquifer is an important water supply source in the region. The hydraulic conductivity, saturated thickness, and yields associated with this aquifer are highly variable. The lower sand aquifer is underlain by the Superior lobe till (an aquitard).

Bedrock Aquifers

The principal bedrock water supply aquifer in this region is the Jordan Sandstone which is characterized by its high porosity and hydraulic conductivity. Well yields from this unit locally exceed 1,000 gpm. The Jordan Sandstone is underlain by the St. Lawrence Formation which is considered a confining bed because of its low hydraulic conductivity.

The Franconia and Ironton-Galesville Formations underlying the St. Lawrence Formation form a common aquifer unit. Hydraulic conductivity is highly variable within this aquifer. Kanivetsky (1979) reports hydraulic conductivity values ranging from 1.2×10^{-2} cm/sec to 1.4×10^{-3} cm/sec, with a reported storage coefficient of 10^{-4} to 10^{-6}. Reported yields range from 15 gpm to 600 gpm, with a maximum of 1,200 gpm (Ericson et al., 1974). The aquifer is underlain by the Eau Claire Formation. The Eau Claire may yield small quantities of water to wells but is considered a poor water source.

The Mt. Simon, Hinckley and Fond du Lac Formations are hydraulically connected. Reported yields from this aquifer unit range from 10 gpm to 600 gpm with a reported maximum yield of 1,300 gpm. Kanivetsky (1979) reported hydraulic conductivities ranging from 7.0×10^{-2} cm/sec to 9.0×10^{-2} cm/sec. The storage coefficient observed for this unit ranges from 10^{-2} to 10^{-6}.

2.2.3.2 Site-Specific Hydrogeology

Hydraulic Characteristics of Glacial Deposits

Site hydrogeology is represented by two glacial sand aquifer units, which are separated by intervening low-permeability fine-grained deposits. Surficial outwash and dune sands comprising the Anoka Sand Plain are referred to at the site as the Upper Sand Aquifer. Silty glacial till and lacustrine deposits underlying this aquifer act as a semi-permeable confining unit (an aquitard). Sand and gravel units representing outwash or ice contact deposits form the Lower Sand Aquifer.

The hydraulic characteristics of the surficial glacial deposits were evaluated by CH2M Hill during the Operable Unit I RI using a variety of field and laboratory data including water elevation information, slug test data, lab permeabilities and pump test data. The calculated mean hydraulic conductivity of the Upper Sand Aquifer as determined from slug test analysis is 1.4×10^{-4} cm/sec. This value reflects the relatively coarse nature of the surficial soils. The intervening aquitard exhibits a calculated mean hydraulic conductivity of 9.2×10^{-6} cm/sec near the upper portion of the unit, which decreases to 2.3×10^{-6} cm/sec near its base. A pump test performed by CH2M Hill in the Lower Sand Aquifer has indicated that some hydraulic interconnection between this unit and the upper aquifer system occurs, indicating that the lower aquifer is semi-confined. The hydraulic conductivity of the Lower Sand Aquifer is 4.6×10^{-3} cm/sec as calculated by the Hantush semi-confined method. The observed variability in grain size for this unit suggests that the hydraulic conductivity of this aquifer also varies areally within this aquifer.

Groundwater Flow Characteristics

The water table occurs approximately 5 to 10 feet below the surface within the unconfined Upper Sand Aquifer system. Measured water table elevations range from 871 feet to 885 feet above MSL. The average saturated thickness is 25 feet, increasing slightly to the southeast. Historic water level information reported for this aquifer by the U.S.G.S. in Anoka County indicate an annual fluctuation of 5 feet (2 feet seasonally).

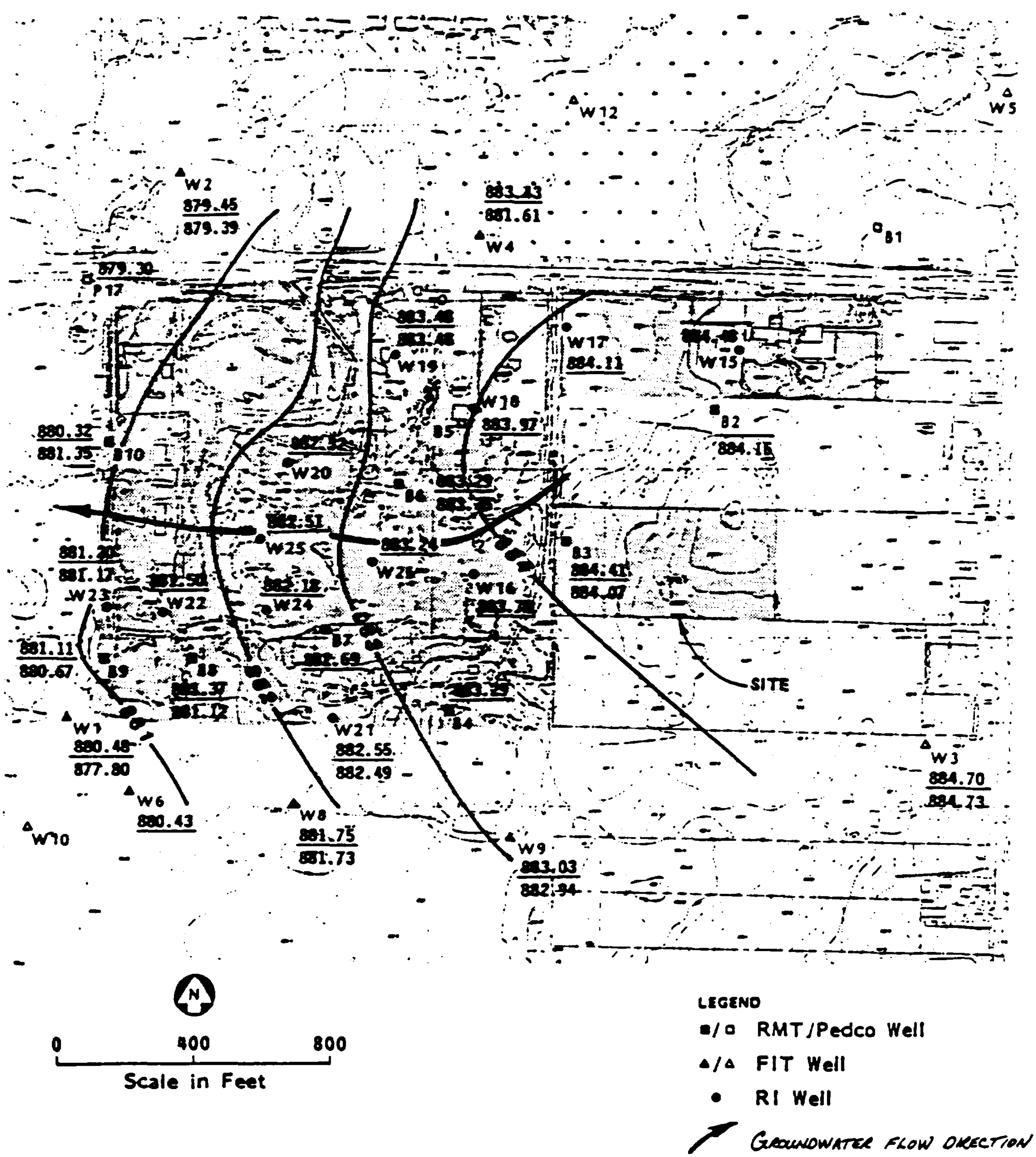
The general configuration of the water table as determined by CH2M Hill is presented in Figure 2-13. Horizontal groundwater flow in the Upper Sand Aquifer radiates westerly across the site. Horizontal flow gradients range from 0.0024 to 0.0052 ft/ft, with a maximum downward vertical flow gradient of 0.10 ft/ft (CH2M Hill, 1988). Calculated flow rates range from 17 to 37 ft/yr horizontally, and 3.5 to 230 ft/yr vertically.

Groundwater movement through the middle aquitard is generally downward. Calculated flow velocities as given in the CH2M Hill RI Report range from 0.78 to 2.55 ft/yr.

The potentiometric surface of the Lower Sand Aquifer (Figure 2-14) indicates that lateral flow within this unit is directed to the southwest across the site at rates ranging from 16 to 125 ft/yr. The magnitude of vertical groundwater flow in the Lower Sand Aquifer, and the possible interaction of this aquifer with bedrock was not evaluated during the RI.

2.2.3.3 Water Quality and Use

Nearly all water used in the Coon Creek watershed is obtained from groundwater sources. The surficial outwash is the most readily available source of groundwater in the region, however major water users commonly obtain supplies from Cambrian or Precambrian sandstone beds underlying the drift. Most wells completed in the Franconia-Ironton-Galesville aquifer are at depths of 150 to 500 feet. Wells completed in the glacial drift range from 20 to 150 feet deep (Ericson et al., 1974). Municipal water supplies account for nearly 50 percent of water use in the region.



883.43 Water Table Well Water Level Elevation

881.61 Bottom of Sand Aquifer Water Level Elevation

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FIGURE 2-13
WATER TABLE CONFIGURATION
SEPTEMBER 11, 1986
CONTOUR INTERVAL 1 FT' - DATUM MSL
SOUTH ANDOVER

SOURCE: CH2M HILL, 1988

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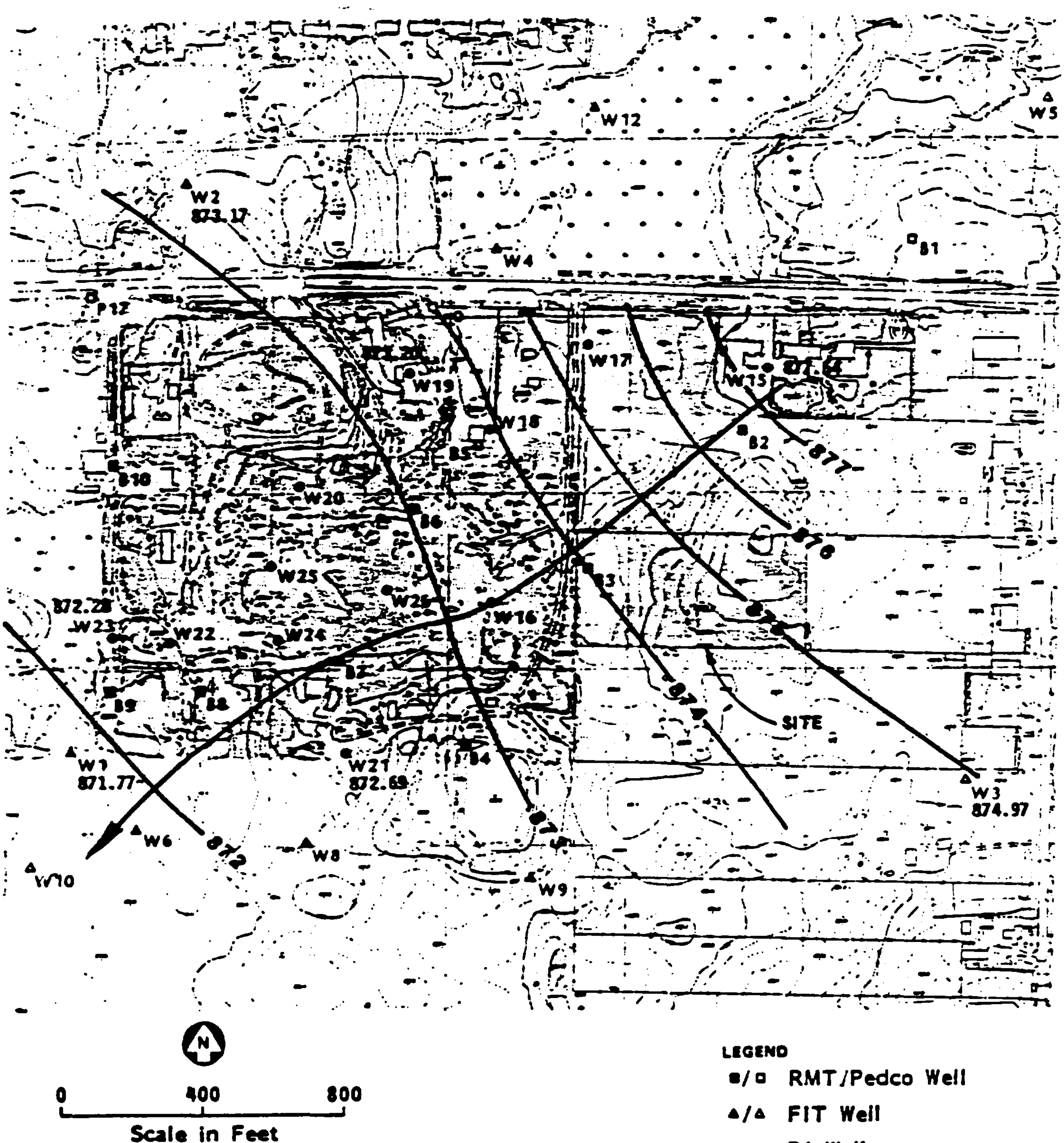

LEGEND

■/□ RMT/Pedco Well

▲/△ FIT Well

● RI Well

GROUNDWATER FLOW DIRECTION

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SOURCE: CH2M HILL, 1988

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FIGURE 2-14
POTENTIOMETRIC SURFACE
OF LOWER SAND AQUIFER
SEPTEMBER 11, 1988
CONTOUR INTERVAL 1 FT.- DATUM MSL
SOUTH ANDOVER

Groundwater in this region is of the calcium magnesium bicarbonate type and is generally hard to very hard. Groundwater is commonly high in iron and manganese. Due to the heterogeneous mineralogic composition of the glacial drift deposits, groundwater in the surficial aquifer displays greater ranges in concentration of major ions than water in bedrock aquifers. Total dissolved solids for the glacial drift aquifers ranges from 123 to 420 mg/l. Maximum iron and manganese concentrations are approximately 42 and 1.6 mg/l, respectively. Total dissolved solids for the bedrock aquifers ranges from 160 to 390 mg/l. Maximum iron and manganese concentrations are 3.8 and 0.36, respectively (Ericson et al., 1974).

Several subsurface investigations have demonstrated that contamination of the surficial soils and groundwater has occurred at the South Andover site. Contaminants of concern observed in the soil and groundwater at the site include chromium, lead, methylene chloride, acetone, toluene, xylene, tetrachloroethylene, 1,1,2-trichloroethylene, phenols and phthalates. Other volatile organic compounds, semivolatile organic compounds, and base metals have also been detected. PCBs were observed in the soil in selected areas.

2.2.4 Regional and Site Topography

Topographic variation across the Anoka Sand Plain is slight, consisting of low upland regions, sand dunes, eolian blowouts, and long southwest-trending troughs. These troughs were formed by major subglacial streams (Wright, 1972). Topographic relief in Anoka County is about 300 feet with the average elevation ranging between 870 and 900 feet above mean sea level (Soil Conservation Service, 1977). Total relief of the South Andover site is approximately 20 feet, however, aerial photography shows that major site topographic modifications have occurred since the 1950s. Major wetland areas shown on 1930s and 1950s photos have been filled.

2.2.5 Surface Water

Surface water drainage across Anoka County is controlled by the Rum River, Coon Creek, Rice Creek, and ultimately by the Mississippi River. The northeastern part of the County is drained by the Sunrise River which flows easterly to the St. Croix River. The South Andover site is located in the Coon Creek Watershed. Regional slope in the site vicinity is generally westward towards Coon Creek, located approximately 1 mile west of the site. Several small recreational lakes are present throughout the area. Those closest to the site include Crooked Lake (1 mile west) and Bunker Lake (1-1/4 mile east). In addition, six surface water bodies occur within localized depressions located on or near the site. Surface drainage in the vicinity of the site is entirely to lakes, ponds, and wetlands (CH2M Hill, 1988).

2.2.6 Climate

The climate for southeastern Minnesota and the South Andover site is continental, subject to frequent outbreaks of continental polar air throughout the year (Ruffner, 1980). Mean annual temperature for the region is 47 degrees Fahrenheit, with mean January temperatures averaging 14 degrees Fahrenheit, and mean July temperatures averaging 70 degrees Fahrenheit. The length of the growing season in southeastern Minnesota is approximately 160 days. The soil freezes the first week of December and thaws about mid-April. Average maximum frost depth is between 3 and 4 feet.

Local precipitation data has been compiled at the Minneapolis-St. Paul International Airport. Mean annual precipitation is 32 inches (Ruffner, 1980). Seasonal snowfall averages approximately 40 inches, with snow cover of 1 inch or more occurring 85 to 100 days annually. Summer is normally the wettest season with approximately two-thirds of the annual precipitation occurring between the months of May and September. Annual cloud cover is over 50 percent in this area of southeastern Minnesota. Daily winds are predominantly northwesterly.

3.0 INITIAL EVALUATION

3.1 TYPES OF WASTE PRESENT

A comprehensive summary of past land use, regulatory response actions, and investigative studies is given in Section 2.0 of this document. A summarization of waste types and other site characterization data is presented below.

An estimated 1,000 drums or more of waste were stored on several contiguous parcels owned by Cecil Heidelberger, William Batson, David and Shirley Heidelberger, Charles Mistelske, and Cyril Link. Industrial waste handling operations are reported to have been initiated at the South Andover site during the mid 1950s. The handling of these wastes at the South Andover site is reported to have begun in 1954 with the storage of solvents and inks at Cecil Heidelberger's Musket Ranch and Trading Post. Disposal of these chemicals is reported to have begun in 1965.

Waste disposal at the Batson property now known as "Vapors Steam Bath" began in 1970 where thousands of barrels of solids and liquids were allegedly disposed of by open pit burning. No information is available regarding the types or amounts of materials combusted. Similarly, chemical waste storage began at the Mistelske property (Commercial Auto) in 1973. Information suggests that thousands of gallons of paints, adhesives, and greases were stored on the property.

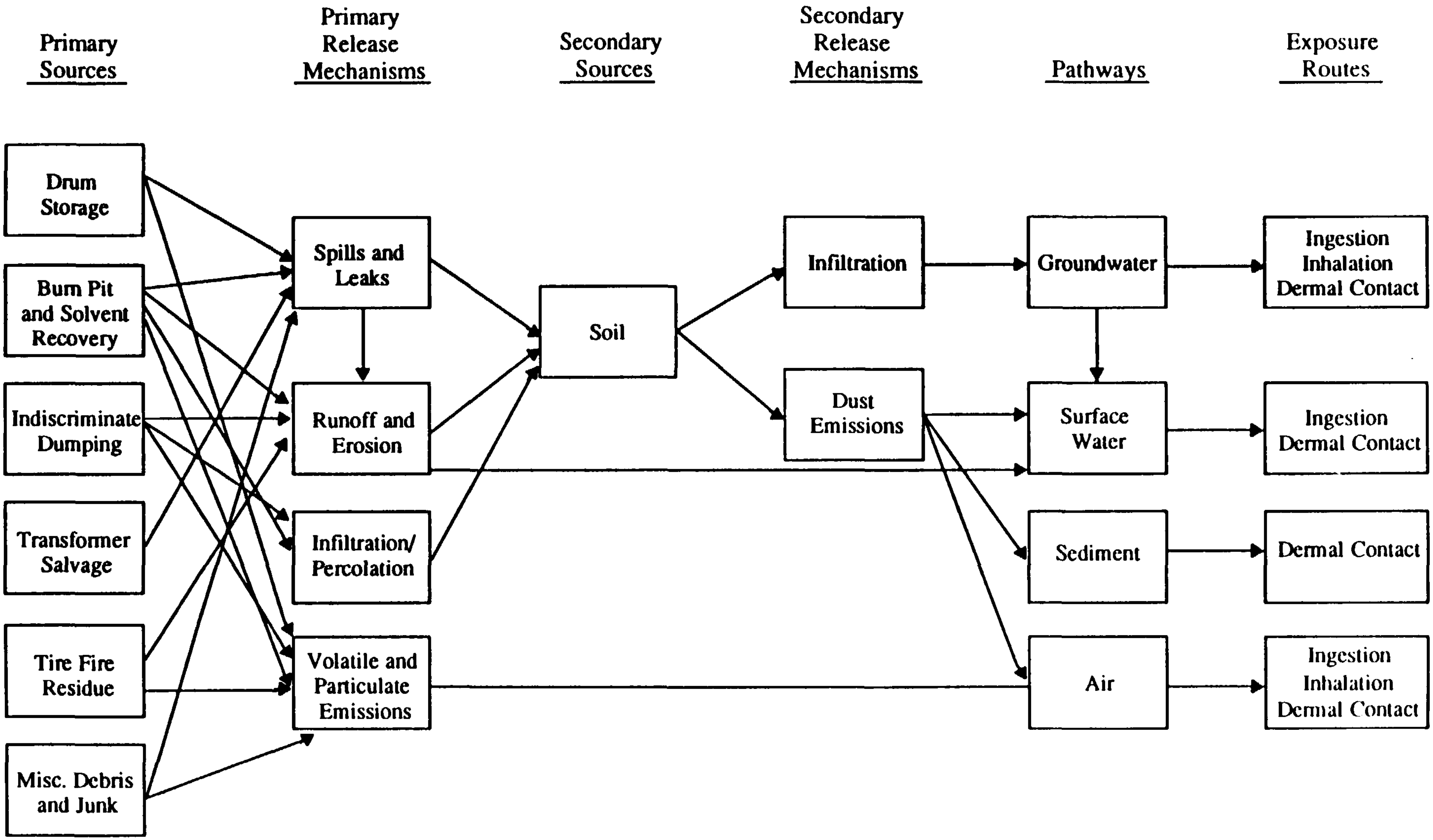
Early sampling and analysis of drum contents were performed by the MPCA during September 1980. A number of drums were analyzed for their contents, and the results were recorded. Following the MPCA drum analysis Pace Laboratories conducted several drum inventories contracted through Bemis during the early to mid 1980s. The inventories were in response to the MPCA who notified Acme Tag Co., Bemis Co., Color-Ad Packaging, and Standard Solvents Co. of their responsible party status in 1980. The drum inventory and waste characterization showed types varying from dry paint sludge residue to chlorinated liquid with sludge. Table 2-1 is a list of waste types identified at the South Andover site from the Pace Laboratory investigation. Further analytical investigation from drums located at the site examined PCB content. Sludges, gels, and residue materials showed PCB levels less than 50 ppm. However, most material sampled for PCBs contained at least low levels. Composite soil samples taken at 2 locations showed PCB concentrations less than 1 ppm.

3.2 POTENTIAL CONTAMINANT MIGRATION PATHWAYS AND PRELIMINARY PUBLIC HEALTH AND ENVIRONMENTAL IMPACTS

The sources and potential pathways of contaminant migration are shown on Figure 3-1, the Site Conceptual Model. Primary contaminant sources include drum storage areas, burn pit and solvent recovery, indiscriminate dumping, transformer salvage, tire fire residue, and miscellaneous debris and junk. Primary release mechanisms include spills and leaks, volatile and particulate

FIGURE 3-1

SITE CONCEPTUAL MODEL
SECOND OPERABLE UNIT
SOUTH ANDOVER RI/FS
Anoka County, Minnesota



emissions, and runoff and erosion. These release mechanisms can be expected to impact soils, thereby causing the soil to act as a secondary contaminant source. Secondary release mechanisms include infiltration, which may result in potential contamination of groundwater, sediment, and surface water. Potential contaminant transport pathways to receptors include groundwater, sediment, surface water and air. Primary receptors include humans through ingestion, inhalation, and dermal contact, and terrestrial and aquatic environmental species through ingestion, inhalation, and dermal contact.

Contaminants of concern include heavy metals (especially copper, chromium, lead, and zinc), and organic compounds (including PCBs, phthalates, chloroform, toluene, benzoic acid, phenol, PNAs, and pesticides).

3.3 PRELIMINARY IDENTIFICATION OF REMEDIAL RESPONSE OBJECTIVES AND GENERAL RESPONSE ACTIONS

Preliminary remedial response objectives and general response actions were identified for the soil medium at the South Andover site to mitigate risks to public health and the environment. The preliminary remedial action objectives, the general response actions, and associated potential remedial technology types are summarized in Table 3-1. After data have been gathered and evaluated, the preliminary response objectives will be refined and further developed or, as appropriate, will be eliminated. The remedial technologies will also be reviewed and developed. Newly recognized remedial technologies and processes may be added to provide a broader base from which to select remedies. The technologies and processes that are determined to be inappropriate for the South Andover site will be eliminated.

The media to be evaluated for potential remediation at the South Andover site are surface and subsurface soils, surface water, and sediment. Evaluation of the nature and extent of potential groundwater contamination within the surficial aquifer unit is not addressed in this investigation, but rather in the Design Investigation.

Human health remedial action objectives for soil are to prevent ingestion, direct contact with, or inhalation of soil, and bioaccumulation of toxic compounds that would result in exposure to toxic doses of contaminants or cancer risks greater than the range of 10^{-4} to 10^{-7}. Environmental objectives include preventing migration of contaminants that would result in excess of maximum contaminant limit (MCLs) and water quality levels. The general response actions include: (1) the no-action alternative, (2) institutional controls, (3) containment, (4) treatment, and (5) removal and disposal.

TABLE 3-1

PRELIMINARY IDENTIFICATION OF REMEDIAL ACTION OBJECTIVES,
GENERAL RESPONSE ACTIONS, AND TECHNOLOGY TYPES
SOUTH ANDOVER RI/FS
ANOKA COUNTY, MINNESOTA

Environmental Media	Remedial Action Objectives	General Response Actions	Remedial Technology Types	Process Options
Soil	For Human Health: Prevent ingestion/direct contact with soil containing copper, chromium, lead, zinc, PCBs, phthalates, chloroform, toluene, phenol, PNAs, and pesticides in excess of toxic doses.	No Action: - No action Institutional Controls: - Access restrictions - Monitoring and analysis - Site use limitations	No Action Options: - None Institutional Controls: - Access restrictions - Monitoring and analysis - Site use limitations	No Action Options: - Not applicable Institutional Control Options: - Deed restrictions - Site access limitations - Monitoring and analysis
	Prevent direct contact, ingestion, or inhalation of soil having 10^{-4} to 10^{-7} excess cancer risk from chromium and other substances.	Containment Actions: - Containment	Containment Technologies: - Vertical barriers - Capping - Containment	Containment Process Options: - Conventional slurry walls - Deep soil mixing - Vibrated beam technique - Single-layer cap - Multi-layer cap - Macroencapsulation
	For Environmental Protection: Prevent migration of contaminants that would result in groundwater contamination in excess of MCLs and water quality criteria.	Removal/Treatment Actions: - In-situ treatment - Removal/treatment/disposal - Removal/disposal	Treatment Technologies: - Thermal treatment - Physical/chemical treatment - Biological treatment - Stabilization/solidification	Thermal Treatment Process Options: - Rotary kiln incineration - Infrared thermal treatment - Circulating fluidized bed combustion - In-situ heating Physical/Chemical Treatment Process Options: - In-situ vacuum extraction - In-situ steam extraction - Solvent extraction - Supercritical extraction - Soil washing - In-situ soil flushing - Low temperature thermal desorption

TABLE 3-1

PRELIMINARY IDENTIFICATION OF REMEDIAL ACTION OBJECTIVES,
GENERAL RESPONSE ACTIONS, AND TECHNOLOGY TYPES
SOUTH ANDOVER RI/FS
ANOKA COUNTY
(Continued)

Environmental Media	Remedial Action Objectives	General Response Actions	Remedial Technology Types	Process Options
Soil (Continued)				Biological Treatment Process Options: - Aerobic - Anaerobic - Land treatment - In-situ biological treatment - White rot fungus
				Stabilization/Solidification Options: - On-site solidification/ stabilization - In-situ stabilization - On-site vitrification - In-situ vitrification
			Removal Technologies: - Bulk removal	Removal Options: - Dragline - Backhoe, excavator - Mudcat
			Disposal Technologies: - Land disposal	Disposal Technology Options: - Off-site secure landfill - On-site secure landfill

NOTE: Existing process options not listed in this table were considered and eliminated from further consideration on the basis of technical feasibility. These process options were eliminated in order to streamline the remedial investigation and feasibility study.

ARCS/P/SANDRIFS/AB3

3.4 PRELIMINARY IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND TO-BE-CONSIDERED REQUIREMENTS (TBCs)

ARARs, as defined by CERCLA, are (1) any standard, requirement, criterion, or limitation under any federal environmental law; and (2) any promulgated standard, requirement, criterion, or limitation under a state environmental or facility siting law that is more stringent than any federal standard, requirement, criterion, or limitation. ARARs that relate to the level of pollutant allowed are called chemical-specific; ARARs that relate to the presence of a special geographic or archaeologic area are called location-specific; and ARARs that relate to a method of remedial response are called action-specific.

To-be-considered requirements are non-promulgated criteria, advisories, and guidance which may be useful in evaluating risks or developing a remedial alternative when ARARs do not exist for a particular chemical or when the existing ARARs are not protective of human health or the environment.

3.4.1 Potential Applicable or Relevant and Appropriate Requirements

The National Contingency Plan (NCP) and CERCLA Compliance Policy define "applicable" requirements as Federal requirements for hazardous substances that would be legally applicable at the site if this response were not undertaken under CERCLA Section 104. "Relevant and appropriate" requirements are those that, while not applicable, apply to problems similar to those encountered at this site. Requirements may be relevant and appropriate if they would be applicable except for jurisdictional restrictions associated with the requirement. In the selection of remedial alternatives, relevant and appropriate requirements are to be afforded the same weight and consideration as applicable requirements. Federal and State regulatory requirements preliminarily identified as being potentially applicable or relevant and appropriate to the South Andover site are listed in Table 3-2. This list of ARARs will be reviewed and developed over the course of the RI/FS.

3.4.2 Potential To-Be-Considered Requirements

Other non-promulgated criteria, advisories, and guidance or proposed regulations (i.e. TBCs) may be useful in evaluating risks or developing a remedial alternative. A preliminary identification of TBCs is also given in Table 3-2. Proposed Federal and State regulations will be reviewed over the course of the project for their applicability in evaluating risks or developing remedial alternatives for the South Andover site.

TABLE 3-2

PRELIMINARY IDENTIFICATION OF
ARARs and TBCs
SOUTH ANDOVER RI/FS
South Andover, Minnesota

Law, Regulation, or Policy	Applicability
FEDERAL	
40 CFR 260 through 264 and 266 and 268 Resource Conservation and Recovery Act (RCRA) of 1976 Hazardous Waste Regulations	Regulates the management, generation, transport, storage, treatment, and disposal of hazardous waste in the course of remedial action. RCRA requirements may apply to the stock-piling, transport, treatment, and disposal of excavated soil and sludge materials and treatment residuals. These regulations are administered by the MPCA under act 115B.
40 CFR 50 Clean Air Act of 1963, as amended	Sets Ambient Air Quality Standards. The standards would be applied to discharges of toxic substances to the atmosphere during waste handling and treatment.
40 CFR 122, 125, 129, 136, and Subchapter N National Pollutant Discharge Elimination System (NPDES) Program of the Clean Water Act (CWA) of 1977	Regulates the discharge of water into surface waters. The regulations contain EPA permitting requirements, criteria, and standards for the NPDES, toxic pollutant standards, and guidelines of procedures for the analysis of waste constituents for NPDES applications.
OSHA Standards 29 CFR 1910 Occupational Safety and Health Act	Regulates working conditions to ensure safety and health of workers. Administered by the Minnesota Department of Health.
40 CFR 29 Intergovernmental Review of Federal Programs	Requires intergovernmental review of projects using federal funds, state funds, or a cooperative agreement between the state and federal agencies.

TABLE 3-2

PRELIMINARY IDENTIFICATION OF
ARARs and TBCs
SOUTH ANDOVER RI/FS
South Andover, Minnesota
(Continued)

Law, Regulation, or Policy	Applicability
40 CFR 141 Primary Drinking Water Regulations of the National Safe Drinking Water Act of 1974, as amended PL 93-523	Establishes MCLs and MCLGs of certain contaminants for public water systems. The SDWA enacts legislation regulating public water systems.
STATE OF MINNESOTA	
Act 116 of 1967, as amended Pollution Control Agency s 116.07 subds 2,4.	Provides the Air Quality Division with the authority to impose restrictions on the amount of air pollutants in order to protect the public health from adverse effects. Air emissions may occur during any soil disturbance, handling or treatment, and groundwater pumping or treatment.
Act 116 of 1967, as amended Pollution Control Agency s 116.07 subd 4,4b Hazardous Waste Management	Provides the Solid and Hazardous Waste Division with the authority to regulate the management, generation, transportation, treatment, storage, and disposal of hazardous waste. Standards for interim status, including closure and post closure rules, are provided for hazardous waste treatment, storage, or disposal facilities.
Act 115A of 1980, as amended Waste Management s 115A.D1 to 115A.72. Solid Waste	Regulates the disposal of nonhazardous solid waste.

TABLE 3-2

PRELIMINARY IDENTIFICATION OF
ARARs and TBCs
SOUTH ANDOVER RI/FS
South Andover, Minnesota
(Continued)

Law, Regulation, or Policy	Applicability
Act 115, as amended Individual Sewage Treatment Systems	Regulates the design, location, installation, use, and maintenance of individual sewage treatment systems.
Public Water Resources	
Act 115B of 1983, as amended Minnesota Environmental Response and Liability Act (MERLA)	Gives the Minnesota Pollution Control Agency (MPCA) the authority to request responsible parties to undertake cleanup or take action at sites where those responsible for the contamination are unknown, unable, or unwilling to undertake cleanup activities.

ARCS/P/SANDRIFS/ABO

4.0 REMEDIAL INVESTIGATION AND FEASIBILITY STUDY RATIONALE AND APPROACH

4.1 DATA NEEDS AND QUALITY OBJECTIVES

Data collected during the South Andover RI/FS will be used for a number of purposes which include: (1) determine the nature and extent of soils and buried contamination, and evaluate whether contamination of surface water and sediment is indicated (site and waste characterization), (2) establish the level of protection needed for investigators or workers at the site (health and safety), (3) evaluate the threat posed by the site to public health and the environment (risk assessment), and (4) evaluate remedial technologies and alternatives.

Major program elements to be completed during the RI field program are shown in chronological order on Table 4-1. Major program elements, their interrelationship, and key decision points for the South Andover RI/FS are shown on Exhibit A (in pocket). A summary of sampling and analysis requirements is presented in Table 4-2.

Data needs specific to this work assignment have been identified by evaluating historical background information concerning the site, development of a site conceptual model (Figure 3-1), and determining what additional data are necessary in order to accomplish the project objectives. Decision types and data needs are identified in the following paragraphs for the media of interest. Data needs were also identified according to response action/ remedial technologies previously identified as potentially feasible for this site. Table 4-3 presents a matrix which relates the potential general response action and remedial technology for this site with the data needed to evaluate the response action. Data requirements to characterize potential treatment residuals have not been incorporated into this table other than effluent discharge. This table represents only a preliminary identification of data needs according to general response actions and remedial technologies and is used as a guide to determine data requirements. Data use analytical levels as defined in Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA - Interim Final (OSWER Directive 9355.3-01, October 1988) are discussed more fully below.

As shown in the site conceptual model, possible primary contaminant sources at the South Andover site include spills and leaks at drum storage areas, indiscriminate dumping of wastes, and potential contaminant releases associated with transformer salvaging operations, tire fires, and the open pit burning of wastes. In addition, many areas of the site have historically been involved with auto salvage operations. Such activities have resulted in the disposal of miscellaneous auto parts, miscellaneous junk, and other debris. Primary contaminant release mechanisms include spills and leaks, runoff and erosion, infiltration and percolation, and volatile organic and particulate emissions.

TAB. 4-1

Investigative Field Elements
South Andover, Minnesota

Task	A	B	C	D	E	F	Number of Locations/ Samples
1. Conduct site survey (20 ac)	x	x	x	NC	NC	NC	-
2. Perform geophysical program							
- Terrain conductivity (20 ac)	x	x	x	NC	NC	NC	-
- Magnetometer survey (20 ac)	x	x	x	NC	NC	NC	-
3. Geomorphological investigation	x	x	x	x	x	x	-
- Chemical soil sampling	x	x	x	x	x	x	-
- No. locs./chemical samples	17/34	5/10	16/32	6/12	5/10	3/6	52/104
4. Surface water/sediment sampling	x	x	x	x	NC	NC	-
- No. locs./chemical samples	1/2	1/2	1/2	1/2	0	0	4/8
5. Trenching	x	x	x	x	x	x	-
- No. test pits/chem. samples	6/12	6/12	4/8	1/2	2/4	1/2	20/40
6. Deep soil borings							
- Borings to 15-ft depth	x	x	x	x	x	x	-
o No. locs./chemical samples	3/6	2/4	2/4	1/2	3/6	1/2	12/24
o No locs./geotech samples	NC	NC	1/2	NC	1/2	NC	-
- Borings to 50-ft depth	x	x	NC	NC	NC	NC	-
o No. locs./chemical samples	2/4	1/2	0	0	0	0	3/6
o No locs./geotech samples	1/2	1/2	NC	NC	NC	NC	-

Notes:

x = Activity performed at identified area.
NC = Activity not conducted at identified area.

ARCS/P/SANDRIFS/AC0

TABLE 4-2

Sampling and Analysis Summary
South Andover RI

							Field QC					Lab QC			
Sample Matrix	Field Parameters	DQO Level	Lab Parameters	DQO Level	Lab	Field Samples	BB	TB	FB	FD	Total to Lab	LD	MSD	MS	Purpose of Samples
1A. Surficial Soil (Maximum: 52 locations w/ 2 samples each)	VOA's by HNU	I	TCL VOA	IV	CLP	104	6	–	–	11	121 Max	–	6	6	– Identify for potential contamination of surficial soils at select locations to include: • Known or suspected waste disposal/drum staging areas. • Recognized geophysical anomalies • Areas previously identified as indicating contamination
	PNA's by GC/FID	II	TCL BNA	IV	CLP	104	6	–	–	11	121	–	6	6	
			TCL PCB/P	IV	CLP	104	6	–	–	11	121	–	6	6	
	Pb, Cr by XRF	II	TAL Metals/CN	IV	CLP	104	6	–	–	11	121	6	–	6	
1B. Surficial Soil (Maximum: 26 locations w/ 1 sample each)			TOC	V	CLP SAS	26 Max	6	–	–	–	32	–	–	–	– Provide information for preliminary baseline risk assessment – Provide information for screening potential remedial alternatives – Identify areas meriting further investigation

Notes:

CLP samples will be shipped within 24 hours of collection for next day delivery to the laboratory.

PNA, Pb, Cr, (DDQ Level II) analyses to be done by a close support laboratory.

Legend
BB = Background Blank
TB = Trip Blank
FB = Field Blank
FD = Field Duplicate
LD = Lab Duplicate
MSD = Matrix Spike Duplicate
MS = Matrix Spike

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TABLE 4–2

Sampling and Analysis Summary
South Andover RI

							Field QC					Lab QC			
Sample Matrix	Field Parameters	DQO Level	Lab Parameters	DQO Level	Lab	Field Samples	BB	TB	FB	FD	Total to Lab	LD	MSD	MS	Purpose of Samples
1C. Trench Soil (20 locations w/ 2 samples each)	VOA's by HNU	I	TCL VOA	IV	CLP	40	–	–	–	4	44	–	3	3	– Identify for potential contamination of soils from select locations to include: • Known or suspected waste disposal/drum staging areas. • Recognized geophysical anomalies • Known or suspected fill areas • Identified areas of surficial soil contamination – Allow visual identification of potential waste types and hazards – Provide information for performing baseline risk assessment – Provide information for screening potential remedial alternatives – Identify areas meriting further investigation
			TCL BNA	IV	CLP	40	–	–	–	4	44	–	3	3	
			TCL PCB/P	IV	CLP	40	–	–	–	4	44	–	3	3	
			TAL Metals/CN	IV	CLP	40	–	–	–	4	44	3	–	3	
			<u>TCLP/ZHE</u>: TCL VOA TCL BNA TCL PCB/P TAL Metals/CN	V	CLP/SAS	5 Max	–	–	–	1	6	–	1	1	

<u>Notes:</u>

CLP samples will be shipped within 24 hours of collection for next day delivery to the laboratory.

Legend
BB = Background Blank
TB = Trip Blank
FB = Field Blank
FD = Field Duplicate
LD = Lab Duplicate
MSD = Matrix Spike Duplicate
MS = Matrix Spike

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TABLE 4–2

Sampling and Analysis Summary
South Andover RI

							Field QC					Lab QC			
Sample Matrix	Field Parameters	DQO Level	Lab Parameters	DQO Level	Lab	Field Samples	BB	TB	FB	FD	Total to Lab	LD	MSD*	MS*	Purpose of Samples
2A. Sediment (4 locations w/ 2 samples each)			TCL VOA	IV	CLP	8	–	–	–	1	9	–	1	1	– Identify for potential contamination of sediments at select locations
			TCL BNA	IV	CLP	8	–	–	–	1	9	–	1	1	– Identify areas meriting further investigation
			TCL PCB/P	IV	CLP	8	–	–	–	1	9	–	1	1	
			TAL Metals/CN	IV	CLP	8	–	–	–	1	9	1	–	1	
			TOC	V	CLP SAS	4	–	–	–	–	4	–	–	–	
3A. Surface Water (4 locations w/ 2 samples each)	pH	II	TCL VOA	IV	CLP	8	–	1	1	1	11	–	1	1	– Identify for potential contamination of surface water at select locations
	Conductivity	II	TCL BNA	IV	CLP	8	–	–	1	1	10	–	1	1	
			TCL PCB/P	IV	CLP	8	–	–	1	1	10	–	1	1	
	Temperature	I	TAL Total Metals/CN	IV	CLP	8	–	–	1	1	10	1	–	1	– Identify areas meriting further investigation
			TAL Dissolved Metals	IV	CLP	8	–	–	1	1	10	1	–	1	
			COD	V	CLP SAS	4	–	–	1	1	6	1	–	1	
			TSS	V	CLP SAS	4	–	–	1	1	6	1	–	1	
			TP	V	CLP SAS	4	–	–	1	1	6	1	–	1	
			TDS	V	CLP SAS	4	–	–	1	1	6	1	–	1	

Notes:

* Extra sample volume must be collected for water samples designated for MS/MSD analysis. Triple the normal sample volume for VOA analysis and double the normal sample volume for BNA and PCB/P analyses shall be collected.

CLP samples will be shipped within 24 hours of collection for next day delivery to the laboratory.

Legend
BB = Background Blank
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FD = Field Duplicate
LD = Lab Duplicate
MSD = Matrix Spike Duplicate
MS = Matrix Spike

5-31-90

TABLE 4–2

Sampling and Analysis Summary
South Andover RI

Sample Matrix	Field Parameters	DQO Level	Lab Parameters	DQO Level	Lab	Field Samples	Field QC					Lab QC			Purpose of Samples
							BB	TB	FB	FD	Total to Lab	LD	MSD	MS	
1D. Soil From 15–Ft Borings (12 locations w/ 2 samples each)	VOA's by HNU	I	TCL VOA	IV	CLP	24	–	–	–	3	27 max	–	2	2	– Identify for potential contamination of soils at depth from selected areas of concern identified during Phase I activities – Identify for potential contamination of soil at depth at other areas – Provide information for performing baseline risk assessments – Provide information for screening potential remedial alternatives – Identify areas meriting further investigation
			TCL BNA	IV	CLP	24	–	–	–	3	27	–	2	2	
			TCL PCB/P	IV	CLP	24	–	–	–	3	27	–	2	2	
			TAL Metals/CN	IV	CLP	24	–	–	–	3	27	2	–	2	
			Grain Size	III	Pool	4	–	–	–	–	4	–			Evaluate potential contaminant mobility, treatability alternatives
			Atterberg	III	Sub	4	–	–	–	–	4	–			
			TOC	V	CLP SAS	4	–	–	–	–	4	–			
1E. Soil From 50–Ft Borings (3 of 12 locations 2 samples each)	VOA's by HNU	I	TCL VOA	IV	CLP	6	–	–	–	1	7	–	1	1	– Same objectives as presented for 1A (above) – Identify for potential contamination of soils from acquitard unit – Risk assessment
			TCL BNA	IV	CLP	6	–	–	–	1	7	–	1	1	
			TCL PCB/P	IV	CLP	6	–	–	–	1	7	–	1	1	
			TAL Metals/CN	IV	CLP	6	–	–	–	1	7	1	–	1	

Notes:
CLP Samples will be shipped within 24 hours of collection for next day delivery to the laboratory.

Legend
BB = Background Blank
TB = Trip Blank
FB = Field Blank
FD = Field Duplicate
LD = Lab Duplicate
MSD = Matrix Spike Duplicate
MS = Matrix Spike

5-31-92

TABLE 4–2

Sampling and Analysis Summary
South Andover RI

Sample Matrix	Field Parameters	DQO Level	Lab Parameters	DQO Level	Lab	Field Samples	Field QC: BB	Field QC: TB	Field QC: FB	Field QC: FD	Field QC: Total to Lab	Lab QC: LD	Lab QC: MSD	Lab QC: MS	Purpose of Samples
1E. Soil from 50–ft Borings			Grain Size	III	Pool Sub	4	–	–	–	–	4	–	–	–	– Same objectives as presented for 1A (above)
			Atterberg	III	Pool Sub	4	–	–	–	–	4	–	–	–	
			TOC	V	CLP SAS	4	–	–	–	–	4	–	–	–	
			Permeability	III	Pool Sub	2	–	–	–	–	2	–	–	–	

<u>Notes:</u>

CLP samples will be shipped within 24 hours of collection for next day delivery to the laboratory.

Legend
BB = Background Blank
TB = Trip Blank
FB = Field Blank
FD = Field Duplicate
LD = Lab Duplicate
MSD = Matrix Spike Duplicate
MS = Matrix Spike

TABLE 4-3
PRELIMINARY IDENTIFICATION OF DATA NEEDS ACCORDING TO RESPONSE ACTION/REMEDIAL TECHNOLOGY
SOUTH ANDOVER RI/FS
ANOKA COUNTY, MINNESOTA

PRELIMINARY

DATA NEEDS	NO ACTION	INSTITUTIONAL CONTROLS	CONSTRUCTION RELATED ACTIVITIES: DUST CONTROL	GRADING	REVEGETATION	EXCAVATION/ REMOVAL	CONTAINMENT: CAPPING	SLURRY WALLS/ DEEP SOIL MIXING/ VIBRATED BEAM METHOD	MACROENCAPSULATION	GROUNDWATER PUMPING	MATERIALS HANDLING: SOLIDS SEPARATION	DEWATERING	BIOLOGICAL TREATMENT: AEROBIC	ANAEROBIC	LAND TREATMENT	IN-SITU BIOLOGICAL TREATMENT	PHYSICAL/CHEMICAL TREATMENT: SOLVENT EXTRACTION	SUPER CRITICAL EXTRACTION	SOIL WASHING	IN-SITU SOIL FLUSHING	IN-SITU VACUUM/ STEAM EXTRACTION	LOW TEMPERATURE THERMAL DESORPTION
SITE CHARACTERISTICS																						
- STORAGE TIME									X													
- ACCESSIBILITY					X	X	X	X	X	X		X			X	X				X	X	
- LAND USE	X	X	X		X		X				X	X			X	X				X		
- ECOLOGICAL AREAS	X	X		X	X	X						X			X					X		
- VEGETATION	X	X				X		X							X	X				X		
- TOPOGRAPHY				X	X	X		X		X		X			X					X	X	
- DRAINAGE	X	X		X	X	X		X							X	X				X		
- LOCATION/PERFORMANCE OF RCRA TREATMENT/DISPOSAL FACILITY									X													
CLIMATE																						
- PRECIPITATION			X	X	X	X				X		X	X	X	X					X		
- TEMPERATURE					X		X						X	X		X						
- EVAPORATION					X										X							
- WIND SPEED DIRECTION			X																			
HYDROGEOLOGY																						
- DEPTH TO IMPERMEABLE STRATA	X	X						X		X										X		
- SEISMIC HISTORY								X														
- SUBSURFACE CHARACTERIZATION	X	X				X		X		X					X	X				X	X	
- TRANSMISSIVITY, STORATIVITY	X	X								X					X	X				X		
- DEPTH TO GROUNDWATER/LEACHATE					X		X	X		X					X	X				X		
- RATE & DIRECTION OF FLOW	X	X						X		X					X	X				X		
- HYDRAULIC CONDUCTIVITY	X	X						X		X					X	X				X		
- PUMPING RATE TO CONTAIN PLUME										X										X		
- LOCATIONS OF WELLS										X												
- WELL INTERFERENCE										X												
SOIL/WASTE CHARACTERISTICS																						
- AVAILABILITY OF COVER MATERIAL					X		X															
- GRAIN SIZE			X	X	X	X	X	X		X	X				X		X	X	X	X	X	X
- ATTERBERG LIMITS			X	X	X	X	X	X		X					X							
- % MOISTURE					X	X	X								X					X	X	X
- PROCTOR COMPACTION			X				X										X	X	X			
- PERMEABILITY					X		X	X							X	X	X	X	X	X	X	
- TRIAXIAL & DIRECT SHEAR TEST (STRENGTH)							X															
- % ORGANIC MATTER	X	X	X	X	X	X	X									X	X	X	X	X	X	X
- MICROBIOLOGY CELL ENUMERATIONS																X						
- DEPTH, TYPE, THICKNESS OF BOTTOM LINER, AND FINAL COVER																						
- RECHARGE RATE																						
CONTAMINANT CHARACTERISTICS																						
- VOLATILITY	X	X	X										X	X	X		X	X	X		X	X
- SORPTION, PARTITION COEFFICIENTS	X	X	X					X							X		X	X	X	X	X	X
- EFFECTIVENESS OF DUST SUPPRESSION			X																			
- BIODEGRADATION	X	X											X	X	X	X						
- SOLUBILITY	X	X								X					X							
- DENSITY	X	X								X												
- COMPATABILITY								X	X													
- TOXICITY	X	X				X				X			X	X	X	X				X		
WASTE CHARACTERIZATION																						
- VOLUME	X	X	X			X	X		X		X	X	X	X	X		X	X	X	X	X	X
- EXTENT OF CONTAMINATION	X	X	X		X	X	X	X					X	X		X	X	X	X	X	X	X
- CONCENTRATIONS AND TYPE	X	X				X	X		X	X		X	X	X	X	X	X	X	X	X	X	X
- AIR	X	X	X												X							
- SOILS	X	X	X		X	X	X	X	X			X			X	X	X	X	X	X	X	X
- GROUNDWATER	X	X				X		X		X			X	X	X	X						
- LIQUID WASTE	X	X											X	X	X	X						
- SEDIMENTS	X	X																				
- SLUDGE																						
- OTHER						X	X		X													
- AERIAL PHOTO INTERPRETATION		X					X	X					X	X	X	X						
- DRUMS	X	X				X		X	X													
- LOWER LIMIT OF WASTE																						
- LEACHATE/GAS COLLECTION/VENTING INFORMATION																						
CHEMICAL/PHYSICAL ANALYSIS																						
- ORGANIC COMPOUNDS					X			X	X				X	X	X	X	X	X	X	X	X	X
- METALS					X			X	X				X	X	X	X	X	X	X	X	X	X
- TSS, TS						X					X	X	X	X	X	X						
- TDS						X					X	X	X	X	X	X						
- TOC, COD					X			X					X	X	X	X	X	X	X			
- BOD													X	X	X	X	X	X	X			
- TEMPERATURE													X	X	X	X						
- DISSOLVED OXYGEN													X	X	X	X						
- NUTRIENTS					X								X	X	X	X						
- pH					X			X					X	X	X	X	X	X	X	X	X	X
- No					X			X					X	X	X	X						
- OIL AND GREASE																	X	X	X			
- HEAT CONTENT																						
- ASH CONTENT																						
- VISCOSITY																						
- CHLORINE CONTENT													X	X	X							
- Fe, Mn																						
- HARDNESS								X														
- ALKALINITY																						
- SULFATES													X	X	X							X
SURFACE WATER CHARACTERISTICS																						
- WATER DEPTH																						
- GAUGE MEASUREMENTS	X	X																				
- STREAM CHANNEL MORPHOLOGY	X	X																				
- 100 YEAR FLOODPLAIN	X	X		X	X	X	X															
SEDIMENT CHARACTERISTICS																						
- BOTTOM SEDIMENTS CHARACTERISTIC																						
- DREDGABLE VOLUME																						
ARARS	X	X	X	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X
WATER SUPPLY INFORMATION																						
- WATER QUALITY OF NEW SOURCE												X										
- LOCATION OF NEW SOURCE																						
- DISTANCE TO NEW SOURCE																						
- REQUIRED TREATMENT																						
- EXPECTED DURATION OF NEED																						
- INSTALLATION REQUIREMENTS																						
- CURRENT AND PROJECTED WATER USE AND LOCATIONS																						
- LOCATION AND NEEDS OF FACILITY OR USER QUALITY, VOLUME																						

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TABLE 4-3
PRELIMINARY IDENTIFICATION OF DATA NEEDS ACCORDING TO RESPONSE ACTION/REMEDIAL TECHNOLOGY
SOUTH ANDOVER RI/FS
ANOKA COUNTY, MINNESOTA
(CONTINUED)

PRELIMINARY

DATA NEEDS	STABILIZATION/ SOLIDIFICATION					THERMAL DESTRUCTION/ INCINERATION			LAND DISPOSAL		EFFLUENT DISCHARGE									
	IN-SITU STABILIZATION/ SOLIDIFICATION	ON-SITE STABILIZATION/ SOLIDIFICATION	SURFACE MICRO-ENCAPSULATION	ON-SITE VITRIFICATION	IN-SITU VITRIFICATION	ROTARY KILN INCINERATION	INFRARED THERMAL TREATMENT	CIRCULATING FLUIDIZED BED COMBUSTION	OFF-SITE LANDFILL	ON-SITE LANDFILL	AGRICULTURAL/ INDUSTRIAL USE	POTABLE WATER	BLENDING	REINJECTION	PUBLICLY OWNED TREATMENT WORKS	SEEPAGE BASIN	SUBSURFACE DRAINS	SURFACE WATER DISCHARGE	TEMPORARY STORAGE	ALTERNATE WATER SUPPLY
SITE CHARACTERISTICS																				
- STORAGE TIME																			X	
- ACCESSIBILITY	X	X		X	X				X	X		X			X	X	X	X		X
- LAND USE	X				X	X	X		X	X						X	X			
- ECOLOGICAL AREAS									X	X						X	X			
- VEGETATION	X			X	X	X	X		X	X						X	X			
- TOPOGRAPHY	X			X	X	X	X		X	X						X	X		X	
- DRAINAGE					X	X	X		X	X						X	X		X	
- LOCATION/PERFORMANCE OF RCRA TREATMENT/DISPOSAL FACILITY									X	X										
CLIMATE																				
- PRECIPITATION	X	X	X	X	X											X	X			
- TEMPERATURE	X	X	X	X	X															
- EVAPORATION																				
- WIND SPEED DIRECTION																				
HYDROGEOLOGY																				
- DEPTH TO IMPERMEABLE STRATA																	X			
- SEISMIC HISTORY																				
- SUBSURFACE CHARACTERIZATION	X				X				X	X				X		X	X			
- TRANSMISSIVITY, STORATIVITY									X	X				X		X	X			
- DEPTH TO GROUNDWATER/LEACHATE	X				X				X	X				X		X	X			
- RATE & DIRECTION OF FLOW									X	X										
- HYDRAULIC CONDUCTIVITY																X	X			
- PUMPING RATE TO CONTAIN PLUME																				
- LOCATIONS OF WELLS														X						
- WELL INTERFERENCE																X	X			
SOIL/WASTE CHARACTERISTICS																				
- AVAILABILITY OF COVER MATERIAL		X							X	X										
- GRAIN SIZE	X	X	X	X	X	X	X	X	X	X						X	X			
- ATTERBERG	X	X	X	X	X				X	X						X	X			
- % MOISTURE	X	X	X	X	X	X	X	X	X	X										
- PROCTOR COMPACTION									X	X						X	X			
- PERMEABILITY	X				X											X	X			
- TRIAXIAL & DIRECT SHEAR TEST (STRENGTH)									X	X										
- % ORGANIC MATTER	X	X	X	X	X	X	X	X	X	X						X	X			
- MICROBIOLOGY CELL ENUMERATIONS																				
- DEPTH, TYPE, THICKNESS OF BOTTOM LINER, AND FINAL COVER									X	X										
- RECHARGE RATE																X	X			
CONTAMINANT CHARACTERISTICS																				
- VOLATILITY	X	X	X	X	X	X	X	X												
- SORPTION, PARTITION COEFFICIENTS																				
- EFFECTIVENESS OF DUST SUPPRESSION																				
- BIODEGRADATION																				
- SOLUBILITY																				
- DENSITY																	X			
- COMPATABILITY																				
- TOXICITY											X	X	X	X	X			X		
WASTE CHARACTERIZATION																				
- VOLUME	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
- EXTENT OF CONTAMINATION	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
- CONCENTRATIONS AND TYPE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
- AIR																				
- SOILS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
- GROUNDWATER																				
- LIQUID WASTE																				
- SEDIMENTS																				
- SLUDGE																				
- OTHER											X	X	X	X	X	X	X	X	X	X
- AERIAL PHOTO INTERPRETATION	X				X				X	X										
- DRUMS	X				X	X	X	X	X	X										
- LOWER LIMIT OF WASTE																				
- LEACHATE/GAS COLLECTION/VENTING INFORMATION																				
CHEMICAL/PHYSICAL ANALYSIS																				
- ORGANIC COMPOUNDS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
- METALS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
- TSS, TS						X					X	X	X	X	X	X	X	X		
- TDS											X	X	X	X	X	X	X	X		
- TOC, COD	X	X	X	X	X						X	X	X	X	X	X	X	X		
- BOD												X			X					
- TEMPERATURE																				
- DISSOLVED OXYGEN																				
- NUTRIENTS											X	X	X	X	X	X	X	X		
- pH	X	X	X	X	X						X	X	X	X	X	X	X	X		
- Na											X	X	X	X	X	X	X	X		
- OIL AND GREASE											X	X	X	X	X	X	X	X		
- HEAT CONTENT						X	X	X												
- ASH CONTENT						X	X	X												
- VISCOSITY						X	X	X												
- CHLORINE CONTENT						X	X	X			X	X	X	X	X	X	X			
- Fe, Mn											X	X	X	X	X	X	X			
- HARDNESS																				
- ALKALINITY																				
- SULFATES											X	X	X	X	X	X	X			
SURFACE WATER CHARACTERISTICS																				
- WATER DEPTH																				
- GAUGE MEASUREMENTS																				
- STREAM CHANNEL MORPHOLOGY																				
- 100 YEAR FLOODPLAIN																				
SEDIMENT CHARACTERISTICS																				
- BOTTOM SEDIMENTS CHARACTERISTIC																				
- DREDGABLE VOLUME																				
ARARS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WATER SUPPLY INFORMATION																				
- WATER QUALITY OF NEW SOURCE																				X
- LOCATION OF NEW SOURCE																				X
- DISTANCE TO NEW SOURCE																				X
- REQUIRED TREATMENT											X	X	X	X	X	X	X	X		X
- EXPECTED DURATION OF NEED											X	X	X	X	X	X	X			X
- INSTALLATION REQUIREMENTS																		X		X
- CURRENT AND PROJECTED WATER USE AND LOCATIONS											X	X	X	X	X	X	X	X		X
- LOCATION AND NEEDS OF FACILITY OR USER QUALITY, VOLUME											X									

The anticipated source for secondary contaminants at the South Andover site is soil. Historical background information summarized in Section 2.0 in this document suggests that on-site soils have been impacted locally by organic and inorganic compounds at levels above those normally observed in soils. Historical data obtained during previous studies also indicates that sediment and surface water contamination site has occurred. Historical groundwater monitoring data from the site is inconclusive. Nevertheless, available data suggests that the upper sand aquifer has also been impacted by organic and inorganic constituents, including barium, cadmium, iron, manganese, zinc, trans-1,2-dichloroethylene, ethyl benzene, xylenes, acetone, toluene, 1,1,2-trichloroethylene, and 2-hexanone. CH2M Hill (1988) has also reported that contamination of the lower sand aquifer may occur.

Surficial soil sampling will be performed at known or suspected waste storage or disposal sites to characterize the nature and extent of potential chemical contamination. The soil chemistry data collected will also be used to complete a baseline risk assessment, and to evaluate remedial action alternatives. Soils will be field screened for volatile organics with a photoionization detector (DQO Level I). A close-support laboratory will also be used to field screen soil for polynuclear aromatics (PNAs) and metals by gas chromatography (GC/FID) and x-ray fluorescence (XRF) methods (DQO Level II). Select samples exhibiting potential contamination will undergo CLP analyses for RAS organics to include volatile organics (VOCs), base neutral acids (BNAs), polynuclear aromatics (PNAs), and PCBs/pesticides (DQO Level IV). In addition, the samples collected will undergo analyses for RAS metals and cyanide (DQO Level IV). Select samples will also be analyzed for Total Organic Carbon (TOC) to provide information useful for evaluating potential remedial alternatives (DQO Level V).

Trenching operations will be undertaken at areas of the site where geophysical anomalies occur, or where field screening results indicate that surficial soil contamination is present. Chemical sampling of soil will occur during trenching operations to provide information useful for investigating recognized anomalies, and to define the nature and extent of buried contamination. Excavated soils will undergo field screening for VOCs with a photoionization detector (DQO Level I). Select samples from each excavation indicating contamination will undergo CLP analyses for RAS organics and inorganics. In addition, a waste characterization (TCLP/ZHE) will be performed on certain samples visually indicating contamination, to assist in remedial alternatives screening (DQO Level V).

A second, limited chemical soil sampling program involving the use of a drill rig will also be conducted at the South Andover site to obtain information concerning the vertical extent of potentially contaminated soil or buried waste. This program includes the screening and chemical sampling of near surface soils and soils from a fine-grained unit at depth which serves to separate the surficial aquifer from the deep aquifer system. Soil samples collected from deeper soil borings will be field-screened for VOCs with a photoionization detector (DQO Level I) and select samples will undergo CLP analysis for RAS organics and inorganics (DQO Level IV). In addition, geotechnical analyses will be performed by the drilling subcontractor to further characterize site geology and hydrogeology. This will include grain size, Atterberg limits, and lab permeability (DQO Level III).

As shown in the South Andover site conceptual model, four contaminant migration pathways have been identified. Groundwater has been identified as the pathway of maximum concern because of its connection to other pathways, and because of the potential for receptor exposure. However, the nature and extent of potential groundwater contamination at the South Andover site will not be determined during this RI/FS. Rather, a Design Investigation to characterize current groundwater quality at the site is being conducted by Donohue as part of a separate work assignment.

While air monitoring for health and safety purposes will be conducted during the field program, air sampling will not be undertaken. However, investigation of the air pathway action will be recommended should the RI soil chemistry data indicate that potential soil contamination does exist at the site.

Lastly, a limited sediment and surface water chemical sampling program will be performed to investigate each of the two remaining contaminant migration pathways. The goals of this program are to assess whether contamination of these media is indicated, and to provide information useful for determining whether additional investigation is merited. CLP analysis will be performed for RAS organics and inorganics (DQO Level IV). In addition, CLP analyses for TOC, COD, and other parameters will be performed to provide information useful for remedial alternative screening (DQO Level V).

4.2 WORK PLAN APPROACH

4.2.1 Remedial Investigation Overview

The design of the South Andover RI field program has evolved from our review of available background information regarding current and prior ownership and land use, regulatory and enforcement correspondence or actions, and other information obtained during prior investigations conducted at the site. In addition, input received from key EPA and MPCA staff during project planning has been incorporated into the project approach developed by Donohue to ensure that agency concerns are satisfied.

As shown in Exhibit A, the proposed project approach includes several key decision points where agency input will be solicited. This mechanism will also promote cost and schedule control, and ensure that the objectives and goals of the South Andover RI/FS are accomplished.

4.2.2 Remedial Investigation Field Program Approach

Previous studies have indicated that drum storage, indiscriminate dumping of wastes, transformer salvaging operations, waste incineration, tire fires, and the storage of miscellaneous junk and debris have occurred at the South Andover site. Previous subsurface investigations have indicated that the soil, sediment, surface water, and groundwater from selected areas of the site is, or may be, contaminated with inorganic and organic compounds. Known wastes include ink and ink sludge, paint and paint sludge, chlorinated and nonchlorinated solvents, resins, transformer oil, and other substances.

Historic aerial photos, site photographs, correspondence files, and interview information obtained from those familiar with the site's history suggest that significant filling of several topographically depressed areas has occurred. This includes a wetland formerly occupying approximately 13.8 acres near the north-northeastern portion of the site and bisected by Bunker Lake Boulevard. Photographs taken in 1984 show trenches containing buried drums and waste materials extending to a depth of more than 10 feet in this same general area.

Several other areas of concern where known or suspected waste disposal and soil contamination is indicated at the site. Soil sampling completed during a remedial investigation completed by CH2M Hill has documented that surficial soils across selected areas of the site have been impacted by chemical contamination. Chemical sampling results obtained in deep borings also suggest that soil contamination may occur at considerable depth.

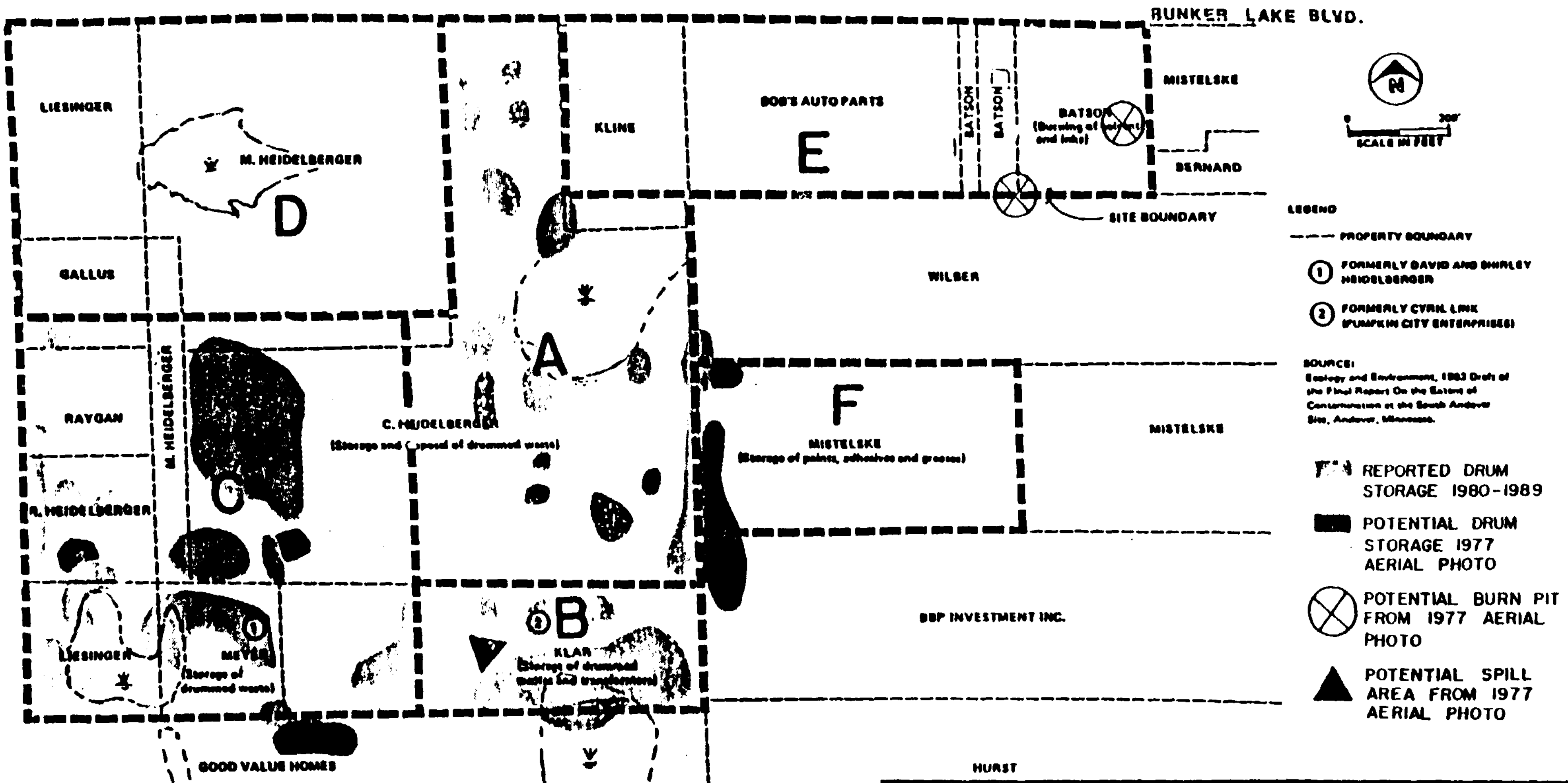
As discussed above, the RI field program will be accomplished with a variety of investigative techniques. This includes geophysical surveys, a geomorphologic characterization study, soil borings, trenching operations, and field screening and chemical sampling activities. The program will focus on identifying areas across the site where the potential for significant buried contamination or surficial soil contamination exists. In addition, surface water and sediment samples from select areas of the site will be collected.

The size of the site, inherent uncertainties, apparent contradictions, and known complexities identified during the historical data review require a phased and cost-effective approach for the field program. An investigation involving extensive soil sampling and analysis would be necessary to satisfy statistical confidence level criteria for delineating "hot spots" as discussed in an EPA guidance document (Section 9) entitled "Methods of Evaluating Attainment of Cleanup Standards" (February, 1989). However, we believe the approach developed for this program will identify major areas of contamination across the site where further investigation is merited.

The field program for the South Andover Remedial Investigation has been strongly influenced by Donohue's review of available historical data. The proposed approach will allow results from initial field activities to be used for determining subsequent operations that are appropriate for the site. In addition, the chemical sampling program will be biased. A higher sampling frequency will occur in areas where known or suspected soil contamination exists, with proportionally less sampling occurring in other areas of the site. Accordingly, the degree of uncertainty associated with identifying and characterizing contaminant sources will be dependent upon the sampling frequency used. Donohue will be unable to determine whether contamination exists at other areas of the site where chemical sampling is not performed.

As shown on Figure 4-1, the South Andover Site has been subdivided into six areas (Area A through Area F). The extent of each area has been determined from available file information concerning prior land uses, historic aerial photos, and the results of previous investigative studies. A description of potential contaminant sources for each area is given below:

Area	Approximate Size (Acres)	Description
A	11.4	Known waste storage and dumping, drum staging and burial. Field observation of drums, waste, surficial soil staining and stressed vegetation. North and northeast portion of Area A is former wetland. A portion of Area A was covered by tires, and a tire fire has occurred across this area. Surficial soils reportedly contaminated by organics, including PCBs, phthalates, chromium, and lead.
B	3.9	Field observation of scattered drums, known drum staging, and drum removal. Known smelter and transformer salvaging operations. Surficial soils reportedly contaminated by organics and inorganics, including PCBs, phthalates, chromium, copper, zinc, and lead.
C	13.4	Field observation of drum staging areas, known solvent recovery, and drum removal. Surficial soils reportedly contaminated by organics and inorganics, including PCBs, phthalates toluene, phenanthrene, chloroform, chromium, copper, and lead.
D	10.7	Known auto salvage operations. Field observations of scattered used autos, auto parts, and miscellaneous junk and debris. Field observation of scattered drums. No known waste disposal. No previous soil sampling performed.
E	8.0	Known auto salvage operations. Known waste storage and dumping. Drum staging and open-pit burning of solvents. Western half of area was former wetland. Field observation of used autos, auto parts, and miscellaneous junk and



Donohue

DEC 1989

Engineers • Architects • Scientists

FIGURE 4-1
SITE BOUNDARIES AND INVESTIGATIVE AREAS
SOUTH ANDOVER

		debris. Surficial soils reportedly contaminated by organics and inorganics, including anthrenes, pyrene, anthracene, heptachlor, dieldren, 4, 4-DDT, 4,4-DDE, chromium, and lead.
F	5.5	Known auto salvage operations. Field observations of scattered used autos, auto parts, and miscellaneous junk and debris. No known waste disposal. No previous soil sampling performed.

Specific program elements to be completed by Donohue during the South Andover RI/FS field investigation are presented in Table 4-1 and summarized below in their anticipated order of occurrence. The relationship and interdependence between program tasks is also illustrated in the attached logic diagram (see pocket). The following sections also discuss the general approach, applicability, and objectives of each investigative method.

Field activities will be initiated by performing a site survey across portions of Areas A, B, and C (approximately 20-acres) in areas of known or suspected drum burial or waste disposal. The objectives of the survey are to establish a grid coordinate system for orienting a geophysical reconnaissance program, and to provide reference locations for subsequent soil boring and chemical sampling programs. A permanent survey control monument will be installed at the site to provide a control reference point for subsequent field activities.

A geophysical program will be initiated in Areas A, B, and C upon completion of the site survey. An initial evaluation will be conducted to determine the applicability of conducting terrain conductivity and magnetometer surveys in areas away from obvious surface metal debris and other potential electrical interferences. Terrain conductivity will be used to identify for the possible presence of buried metallic and nonmetallic wastes, contaminated soils, and possible fill areas (to maximum 15 foot depth). The magnetometer survey will be conducted across the same area of the site as the terrain conductivity survey to assess whether the potential exists for buried drums or metal debris to occur at recognized terrain conductivity anomalies. Geophysical anomalies will be mapped, and evaluated to determine whether additional investigative effort is needed. At a minimum, soil borings and trenching operations will be performed to further determine the nature and extent of any observed geophysical anomalies.

To reduce program duration, other field activities will occur simultaneously with the the geophysical program. Tasks to be completed include a limited surface water and sediment chemical sampling program, and completing a shallow soil boring and chemical sampling program. The objective of each identified investigative method is discussed more fully below.

Surface water and sediment samples will be collected from four surface water bodies (ponds or wetlands) that occur in Areas A, B, C, and D. The purpose of this limited chemical sampling program is to determine whether potential contamination of these media is indicated, and to provide information to the EPA and MPCA so these agencies can make an informed decision on (1) whether additional chemical sampling of surface water or sediment is merited, and (2) to determine whether additional study is required to determine the interconnection between the surface water and groundwater systems. While it is anticipated that the sampling of each of the identified surface water bodies can be accomplished, previous information suggests that their occurrence is intermittent. Consequently, the scope of this investigation will be determined by on-site personnel at the time the work is scheduled to be performed.

Surface water and sediment sampling will coincide with one another. Sampling locations will be chosen at equally spaced intervals around the margins of each pond or wetland by on-site personnel (maximum of four locations for each pond). Samples will be analyzed by a CLP for TCLP metals and RAS organics. Samples for VOCs analysis will be collected as a grab sample from one location at each wetland area. Samples collected for the remaining analyses will be derived by compositing subsamples collected from each location.

A shallow boring program, to include a geomorphological investigation, and the chemical screening and sampling of surficial soils will also be completed during the early stages of the RI program. A maximum of 52 borings will be advanced to an average depth of five feet (Areas A through F). A manually-driven soil probe will be used to obtain samples at 1.5-foot depth increments. Based on visual observations and field screening methods, two of the three samples collected at each shallow boring location will be selected for subsequent chemical analysis at the close support laboratory.

The distribution of sampling locations for the shallow boring program for each investigative area is summarized in Table 4-1. The proposed RI field program is based on historical information pertaining to known or suspected drum storage or waste disposal areas. However, the actual program implemented by Donohue may be modified to further investigate areas of concern recognized during the geophysical program. In addition, a close-support laboratory capable of overnight turnaround will be used to field-screen soil samples for PNAs and metals to identify areas meriting further investigation. A maximum of 26 soil samples from depth increments exhibiting the most contamination based on visual observations or field screening methods will be analyzed for total organic carbon (TOC). TOC sampling will provide additional information for evaluating various remedial alternatives that may be appropriate during the remedial design phase of the feasibility study (Table 4-2).

The field screening approach is critical for the successful completion of the project. This technique will provide on-site personnel with needed flexibility for determining whether contamination is indicated, and for the selection of samples which merit CLP analyses for RAS organics and inorganics. Field screening will also ensure that the chemical sampling program undertaken by Donohue is appropriate, and will provide information for characterizing the nature and extent of surficial soil contamination, completing a baseline risk assessment, and which allows for the screening of potential remedial alternatives.

The recognition of significant geophysical anomalies, or surficial soil contamination (determined by field screening) will result in further action to investigate the nature and extent of potential buried contamination. This will be accomplished by advancing 15-foot long trenches at approximately 20 locations. Trenching will occur to an average depth of 15 feet, or until buried drums (or waste) are encountered.

Field screening for volatile organic compounds with a photoionization detector will occur during trenching operations. Two soil samples from each trench either showing the highest instrument reading, or which visually indicate contamination, will undergo CLP analyses for RAS organics and TCLP inorganics. Furthermore, waste characterization data (and other analyses) will be obtained for selected samples to provide information useful during remedial alternatives screening.

Efforts will be made during on-site trenching operations to obtain a sample which underlies buried waste or drums (if encountered). However, no effort will be made to remove or sample any drums. Rather, such an occurrence will cause on-site personnel to notify EPA/MPCA Spill Response staff for further direction. Each excavation will be backfilled after completing documentation and field sampling activities.

Field and analytical data obtained during the RI field program will be documented as each program task is completed. Final field technical memos will be forwarded to the EPA and MPCA for review to ensure that agency goals are satisfied. Additional data needs and objectives will be determined upon completion of the RI field program. This information will be presented in a summary technical memorandum to EPA. A joint meeting with EPA and MPCA to discuss program results will then be conducted prior to the preparation of the RI report.

4.3 FEASIBILITY STUDY APPROACH

4.3.1 Feasibility Study Evaluation

General response actions and preliminary applicable remedial technologies have been identified for this site based on available historical information. Data needs related to alternative evaluation have been identified as discussed previously. The FS portion of the project approach is also presented in the South Andover RI/FS logic diagram (Exhibit A).

The size and uncertainties pertaining to the site has resulted in the development of a phased and integrated approach to the RI/FS. The scope of the RI is designed to answer data needs in three main areas: the risk assessment, the alternatives evaluation, and enforcement activities. By designing the RI to address these areas, we are attempting to focus and streamline the RI/FS so that adequate data is collected and the number of technologies and alternatives to be considered in the FS can be minimized. When the RI data are available, the level of uncertainty in the site conceptual model will be evaluated. Potential additional data needs may be identified and uncertainties will be evaluated during the FS development, screening phase, and detailed analysis. These items will be incorporated in the FS and their effects on the alternative evaluation documented.

5.0 REMEDIAL INVESTIGATION/FEASIBILITY STUDY TASKS

The South Andover RI/FS will be implemented using a phased approach involving performance of the ten standard tasks identified in the EPA Statement of Work. These tasks are described in the following sections.

5.1 TASK 1 - PROJECT PLANNING

The project planning task includes activities from project initiation through completion of the project plans. The following project activities have been completed:

- A project kickoff meeting involving the EPA Remedial Project Manager, Donohue Site Manager, and Minnesota Pollution Control Agency personnel.
- A project scoping meeting involving technical specialists.
- A site visit.
- A Data Quality Objectives scoping meeting.
- Collection and evaluation of existing information. (It is anticipated that collection and evaluation of existing data will continue throughout the RI.)
- Identification of preliminary remedial action alternatives.
- Preliminary determination of ARARs.
- Preparation of RI/FS draft project plans including the Work Plan, Quality Assurance Project Plan, Field Sampling Plan, and Health and Safety Plan.

5.2 TASK 2 - FIELD INVESTIGATION

The field investigation will include the following activities: subcontracting, mobilization and demobilization, geophysical investigation, soil, surface water and sediment sampling, surveying, trenching, and quality control review of all activities. These activities are described in detail in the Field Sampling Plan (Volume 2).

5.3 TASK 3 - SAMPLE ANALYSIS AND DATA VALIDATION

This task includes analysis of samples collected during the field investigation and validation of data. As indicated in the QAPP and FSP, samples collected during the field investigation will be analyzed through Contract Laboratory Program (CLP) laboratories, and data validation will be performed by the EPA Region V Environmental Service Division. Information from this task will be included in RI Report appendices.

5.4 TASK 4 - DATA EVALUATION

This task will include analysis of chemical and physical data after the data are verified to be of acceptable accuracy and precision. Data evaluation will be initiated upon receipt of validated field data from the field investigation (Task 2) and after sample analysis and data validation of laboratory parameters are performed (Task 3). Data evaluation activities may include data reduction and tabulation, statistical analysis, determination of metal speciation in soil, environmental fate and transport modeling, and mapping. The results of this task will be summarized in technical memoranda which will be used in subsequent tasks and which will be incorporated into the RI report.

5.5 TASK 5 - RISK ASSESSMENT

This task includes assessment of risks to human health and the environment. This task will include those tasks listed in the Baseline Risk Assessment Plan, included as Appendix A to this Work Plan. A detailed baseline public health evaluation and a qualitative assessment of potential ecological risks will be performed using current guidance from EPA (US EPA, 1989b).

5.6 TASK 6 - TREATABILITY STUDIES

The necessity and specific requirements for bench-scale and/or pilot treatability studies will be assessed after evaluation of data from the field investigation, and after completion of the development and screening of alternatives.

5.7 TASK 7 - RI REPORT

A draft RI Report will be prepared which summarizes the activities performed, data collected, and conclusions drawn from on-site and off-site investigations. The report will include an updated site description, results of field investigation and laboratory analyses, a discussion of potential routes of contaminant migration, and a baseline risk assessment. Comments received from EPA and MPCA will be addressed in completing the final RI report.

Monthly reports will be submitted to the EPA describing the technical progress and the financial and schedule status of the South Andover RI/FS.

5.8 TASK 8 - REMEDIAL ALTERNATIVES DEVELOPMENT AND SCREENING

The Superfund Amendment and Reauthorization Act (SARA) of 1986, Section 121, specifies consideration of remedial alternatives that reduce the toxicity, mobility, or volume of waste. SARA states a preference for treatment technologies that meet the reduction requirement and provide permanent solutions.

General response actions and appropriate remedial technologies have been identified for the South Andover Second Operable Unit based on current knowledge of the site from historical information. These general response actions will be reviewed and may be expanded or reduced.

5.8.1 Development of Remedial Action Objectives

Identification of remedial technologies depends on establishment of remedial action objectives (RAOs). The RAOs are based on:

- The description of the current situation including review of existing data.
- Information gathered during the RI.
- Public health and environmental concerns in terms of exposure routes and receptors.
- Identification of an acceptable level or range of levels for each exposure route.
- The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) guidance governing remedial action, 40 CFR 300, Section 300.68.
- Interim and draft guidances from EPA.
- Any other applicable cleanup standards defined in SARA, Section 121.

The preliminary RAOs, expressed in terms of medium of interest and target cleanup levels, are discussed in Work Plan Section 3.3. Preliminary cleanup objectives will be confirmed in formal consultation with the EPA and MPCA following completion of the baseline risk assessment.

5.8.2 Development of General Response Actions

Following the establishment of the RAOs, general response actions that may be taken to achieve exposure limits specified by the RAOs will be determined. General response actions are medium-specific and may include containment, treatment, or removal actions. Preliminary general response actions are discussed in Section 3.3 of the Work Plan.

5.8.3 Identification of Volumes or Areas of Media

During the development of alternatives, an initial determination of areas or volumes of contaminated soils, groundwater, and sediments will be made to which general response actions might be applied. Response actions or volumes may be refined after further information becomes available. The volumes or areas addressed by the alternatives will be reviewed with respect to the remedial action objectives to ensure that alternatives can be assembled to reduce exposure to protective levels.

5.8.4 Identification and Screening of Remedial Technologies and Process Options

Alternatives developed from the RAOs include the following:

- Source control treatment alternatives that would eliminate the need for long-term management (including monitoring).
- Treatment that reduces the toxicity, mobility, or volume of the hazardous waste.
- Containment of waste with little or no treatment.
- No-action alternative.

Potential media-specific treatment and disposal technologies and process options identified for the general response actions are screened solely on the basis of technical implementability. During this screening step, process options and entire technology types may be eliminated from further consideration.

5.8.5 Evaluation of Process Options

The evaluation of process options will incorporate considerations from three broad criteria: effectiveness, implementability, and cost, as discussed below. The review will place greater emphasis on effectiveness with less effort at implementability and cost to preserve a range of alternatives for further analysis. Whenever appropriate, innovative technologies will be carried through this phase of the screening. The rationale for eliminating a process option will be documented in the FS report.

Effectiveness

The considerations important in the evaluation of process options are as follows:

- Potential effectiveness in attaining identified contaminant goals and in handling the estimated areas or volumes.

- Adequate protection of human health and the environment.

- How proven and reliable the process is with respect to the contaminants and conditions at the site.

Implementability

Each process option will be evaluated for:

- Availability of the technologies employed by the solution.

- Availability of storage and disposal services.

- Availability of necessary skilled workers to implement the technology.

- The administrative feasibility of implementing the alternative.

Cost Evaluation

Cost evaluation will play a limited role in this evaluation process, since it is based on relative capital and operation and maintenance (O&M) costs rather than detailed estimates.

The costs of construction and any long-term O&M costs will be based on present-worth analysis. Financial considerations during this evaluation will only be used to screen between process options relative to other process options in the same technology type. Cost factors will not be used to distinguish between treatment and nontreatment options.

5.8.6 Assembly of Alternatives

Following the evaluation of process options, general response actions and the process options chosen to represent the various technology types for each media type will be combined for the site as a whole. Assembly of alternatives may include remediation of different volumes and/or areas of the South Andover site and one or more general response actions for each medium. General response actions are combined to form a range of site-wide alternatives. A description of each alternative will be included in the FS report. These descriptions may include the following information:

- Locations of areas to be excavated or contained.

- Approximate volumes of soil and/or groundwater to be excavated and collected.

- Approximate location of interceptor trenches, potential water hook-ups, and connections to local publicly owned treatment works (POTW).

- Management options for treatment residuals.

5.8.7 Alternatives Definition

The following considerations will be defined and developed as they apply to each alternative:

- Extent or volume of contaminated soil and sediment.

- Size and configuration of on-site extraction and treatment systems or containment structures.

- Time frame in which treatment, containment, or removal goals can be achieved.

- Rates or flows of treatment.

- Spatial requirements for constructing treatment or containment technologies or for staging construction materials or excavated soil or waste.

- Distances for disposal technologies.

- Required permits for off-site actions and imposed limitations including action-, location-, and chemical-specific ARARs.

5.8.8 Screening Evaluation of Alternatives

The number of alternatives that will undergo a more thorough and extensive analysis may need to reduced. The screening evaluation of alternatives provides a final opportunity prior to the detailed analysis to make this determination. If needed, the alternatives will be evaluated on a general basis to determine their effectiveness, implementability, and cost. Evaluation performed at this time will be sufficiently detailed to distinguish among alternatives.

Effectiveness

The following considerations will be evaluated for each alternative:

- Protectiveness.

- Reduction in toxicity, mobility, or volume.

- Short-term and long-term components of protectiveness.

Implementability

The evaluation will consist of the following components:

- Technical feasibility.
- Administrative feasibility.

Cost

The following cost estimates will be considered:

- Comparative cost estimates for alternatives with relative accuracy.
- Capital and O&M costs including costs that will be incurred over the duration of the remedial action.
- Present-worth analysis.

Innovative Technologies

Innovative technologies will be carried through the screening phase if the alternative offers a potential for:

- Better treatment performance or implementability.
- Fewer adverse impacts than other available approaches.
- Lower costs.

5.8.9 Selection of Alternatives for Detailed Analysis

A decision will be made, based on the screening evaluaticn, as to which alternatives should be retained for further analysis. Alternatives selected for further evaluation should preserve a range of treatment and containment technologies initially developed. The alternatives selected for further evaluation will be presented in the Alternatives Array Document and will be agreed upon by the EPA and MPCA in a formal consultation. Procedures for evaluating, defining, and screening alternatives will be documented in the FS report showing the rationale behind the selection process.

5.8.10 Post-Screening Tasks

As a consequence of SARA, remediation of a site on the National Priorities List (NPL) is subject to cleanup standards as promulgated under all applicable or relevant and appropriate federal and state requirements (ARARs). An array of the alternatives that pass the screening level evaluation will be submitted to EPA and MPCA to elicit the identification of ARARs so that detailed analysis of the individual alternatives may continue in the FS.

5.9 TASK 9 - Detailed Analysis of Alternatives

The detailed analysis of alternatives will provide a presentation of relevant information needed to allow a selection of a site remedy.

5.9.1 Alternative Definition

If necessary, each alternative will be defined with respect to the volumes or areas of contaminated soil, groundwater, and sediment to be addressed, the technologies to be used, and any performance requirements associated with those technologies.

5.9.2 Individual Analysis of Alternatives

The alternatives that remain after the preliminary evaluation will be subjected to detailed analysis. The analysis will take into account overall protection to human health and the environment, compliance with ARARs, long-term effectiveness and permanence, reduction of toxicity, mobility, or volume, short-term effectiveness, implementability, cost, State acceptance, and community acceptance. These factors are discussed in more detail below. For purposes of budget development, it is assumed that up to three treatment/containment alternatives and the no-action alternative will be evaluated in the detailed analyses described in Task 8 and Task 9.

Overall Protection of Human Health and the Environment

A final assessment will be made to check whether each alternative meets the requirements that it is protective of human health and the environment. The emphasis of this analysis is on long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Compliance with ARARs

Federal and State responses to the alternatives array submittal will be considered in the detailed analysis of alternatives. Each alternative will be analyzed in view of the contaminant-specific, action-specific, and location-specific requirements identified during ARAR review.

Long-Term Effectiveness and Performance Evaluation

Long-term effectiveness addresses the results of the remedial action in terms of residual risk after response objectives have been met. The components of long-term effectiveness will be identified for each alternative as follows:

- Magnitude of remaining risk from untreated waste or treatment residuals.

- The adequacy and suitability of controls that are used to manage treatment residuals or untreated wastes.

- The long-term reliability of management controls for providing continued protection from residuals.

Reduction of Toxicity, Mobility, or Volume through Treatment

Contaminant reduction will aim to reduce the mobility, toxicity, or volume of the contaminants. The analysis should favor treatment technologies that produce permanent solutions, such as alternative treatment technologies or resource recovery technologies.

Short-Term Effectiveness Evaluation

Short-term effectiveness includes the effectiveness of the alternatives during construction and implementation phases until remedial response objectives are met.

Protective measures will be evaluated for the following areas of concern:

- Protection of surrounding community and environment and site workers during construction of the alternative.

- Protection of community and environment from hazardous substances remaining after implementation of the alternative.

- Protection of workers during operation and maintenance of the alternative.

Implementability

In the implementation analysis will review the technical and administrative feasibility of the alternative will be reviewed along with the availability of the system.

Technical Feasibility

Technical feasibility will consider:

- Constructability of the technology.

- Relation to additional remedial action.

- Ability to monitor the effectiveness of the remedy.

- Maintainability of equipment.

Administrative Feasibility

Administrative feasibility will examine the likelihood of favorable community response and the ability of related agencies to obtain approval for site access and to coordinate activity related to the project.

System Availability

The review of system availability will indicate whether or not the necessary equipment and specialists are available. If the solution requires long-term operation of a treatment, storage, and disposal (TSD) service, then the review must assure that long-term capacity will be available.

Cost

The financial analysis will consider the cost associated with the following aspects of the project:

- Capital costs associated with development and construction.

- Operation and maintenance.

- Present worth analysis.

State Acceptance

This section of the detailed evaluation is limited to the analysis of formal comments made by the MPCA during previous phases of the RI/FS. Documentation in the FS report will include such details as meetings, opportunities for agency review, and transmittal of comments between the EPA and MPCA.

Community Acceptance

This section is used to address those features of the alternatives the community supports, has reservations about, or opposes.

5.9.3 Comparative Evaluation of Acceptable Alternatives

The analysis performed for each alternative will be aggregated in order to rank alternatives and support a recommendation. The relative performance of each alternative will be evaluated in relation to each specific evaluation criterion. The advantages and disadvantages of each alternative relative to one another will be identified. The comparative analysis of the alternatives will be presented in a narrative discussion and will include a description of the following:

- Strengths and weaknesses of the alternatives relative to one another with respect to each criterion.
- How reasonable variations of key uncertainties could change the expectations of their relative performance.
- Differences between the alternatives measured either qualitatively or quantitatively.
- Substantive differences among the alternatives.

Innovative technologies shall include a description of their potential advantages in cost or performance and the degree of uncertainty in their expected performance.

The ranking system provides each consideration a weight to allow a cost/benefit analysis to be performed. Incremental cost/benefit analysis and decision analysis are each described below.

5.9.4 Cost-Effectiveness Analysis

A cost/benefit (C/B) analysis may be performed on the alternatives so that selection of an alternative can be made that provides the most cost-effective alternative with a favorable balance between protection of public health, welfare, and the environment. The C/B analysis contains potential synergistic considerations of the sensitivity analysis.

5.9.5 Decision Analysis (Sensitivity Analysis)

A sensitivity analysis in conjunction with a C/B analysis may be used to screen the alternatives for selection. The variables evaluated for selection of the alternatives are analyzed as to their weight (criticalness) in allowing an alternative to be viable.

5.10 TASK 10 - FEASIBILITY STUDY (FS) REPORT

5.10.1 Draft FS Report

The draft FS report will summarize data developed during the alternative remedial actions assessment process. The project team will recommend a combination of alternatives for implementation at the site.

The draft FS report will be submitted to EPA and other appropriate agencies for comment. The draft FS report will support EPA needs during the public comment period before EPA development of the Record of Decision (ROD).

5.10.2 Public Meeting

There will be a period for public comment on the draft FS report. EPA Region V staff may hold a public meeting during this comment period to receive comments and answer questions on the recommended remedial alternative. Donohue will assist EPA in answering questions received during the public hearing and review phase and will consider the questions in the final report.

5.10.3 Final FS Report

Following the public comment period, and only if public comments require additional changes to the draft FS report, the final FS report will be submitted for EPA approval.

5.10.4 Monthly Reports

Monthly reports will be submitted to the EPA describing the technical progress and the financial and schedule status of South Andover RI/FS.

6.0 COSTS AND KEY ASSUMPTIONS

Volume 1A, "Contract Pricing Proposal," presents estimated costs and level of effort (LOE) for performance of RI/FS standard tasks as defined in the EPA Statement of Work. Costs and LOE associated with project and task management and with technical quality assurance are included in each standard task. Costs and LOE associated with procuring subcontractors are included in the task in which the subcontractor will perform work. No costs or LOE are included at this time for Task 6, "Treatability Studies"; the necessity for treatability studies will be determined after the RI results are evaluated.

Cost estimates are based on the assumption that health and safety personal protective equipment requirements for sampling activities, except for trenching, will utilize Level D protection with upgrade to Level C. Trenching will require Level B and Level C protection, as discussed in the Health and Safety Plan (Volume 4). If the level of protection must be upgraded, increased costs will be incurred.

The cost estimates are based on the assumption that the proposed project schedule can be realized. If climatic, budgetary, or technical circumstances require separate mobilizations for activities presently scheduled to occur concurrently, increased costs will be incurred. Likewise, if EPA authorization to proceed or legal access to sampling locations are not provided such that premobilization subcontracting arrangements and/or sampling plan modifications can be accomplished, the schedule will be affected and additional costs may be incurred.

Volume 1A of this Work Plan contains all cost details, including:

1. Detail descriptions of cost elements (Optional Form 60).

2. Estimated dollar costs for the South Andover RI/FS broken down by subtask as well as by labor, travel, equipment, computer, reports, miscellaneous, and subcontractor categories (Detailed Cost Estimate Distributions).

3. Tabulations of estimated hours for the South Andover RI/FS by labor category apportioned by subtask (Labor Workhour Distribution Tables).

4. Key assumptions.

Work on this project will be performed by Donohue, with assistance from team and pool subcontractors. Team subcontractors anticipated to perform work on this assignment include Life Systems, Inc., and EBASCO Services, Inc. Subcontracts anticipated for the South Andover RI/FS are summarized in Table 6-1.

TABLE 6-1

ANTICIPATED SUBCONTRACTS
South Andover RI/FS

Activity	Team Subcontractor	Pool Subcontractor
Close-Support Laboratory	X	X
Soil Borings		X
Trenching		X
Baseline Risk Assessment	X	

7.0 SCHEDULE

The schedule for the South Andover RI/FS is presented in Appendix B. This schedule shows activities for standard tasks as defined in the EPA Statement of Work. No activities are scheduled at this time for Task 6, "Treatability Studies"; the necessity for treatability studies will be determined after the RI results are evaluated.

This schedule has been developed to accomplish the proposed field investigations using an efficient and cost-effective strategy. Mobilization, sampling sequences, and field team responsibilities have been planned to maximize efficiency of personnel use, premobilization arrangements, and field data prerequisites.

The project schedule is based on the following assumptions:

- Access to specific sampling sites will be provided by EPA before the start of the scheduled field work.
- Donohue will be able to secure a six-week turnaround time for sample analysis. Donohue will be provided with all analytical results after they are validated by EPA. The schedule is based on a CLP analysis time of 40 days and a CLP validation time of 3 weeks.

8.0 PROJECT MANAGEMENT

8.1 ORGANIZATION

The proposed project organization is shown on Figure 8-1. The Donohue Project Manager (PM), Mr. Roman Gau, is responsible for the quality of all ARCS work performed by Donohue in Region V. He monitors the progress of each work assignment to ensure that adequate resources are available and that major problems are prevented or minimized. Mr. Gau implements the program standard of quality for work in the Region. The PM's review concentrates on the technical quality, schedule, and cost for all work assignments.

The Site Manager (SM), Mr. David Voight, has primary responsibility and authority for implementing and executing the RI/FS. Supporting the SM are the RI Leader, FS Leader, QA Team Leader, and the Health and Safety Officer (HSO). The RI Leader is responsible for performance of the RI and for the preparation of the RI report. The FS Leader is responsible for performance of the FS, treatability studies if required, and the preparation of the FS report. The HSO is responsible for all health and safety activities at the site, including site safety inspections, procuring safety equipment, and preparing the site-specific Health and Safety Plan.

8.2 REPORTING

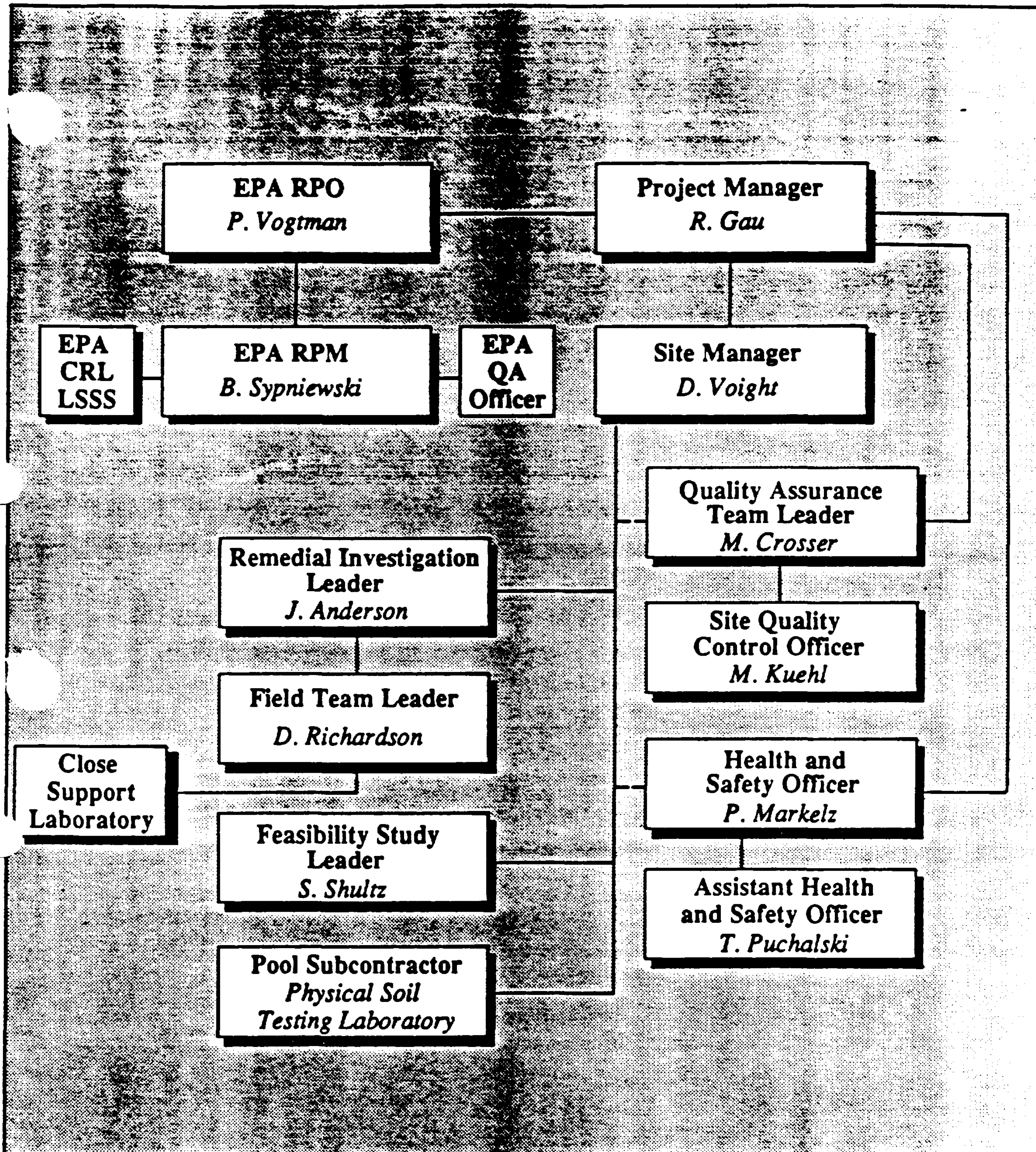
The Donohue ARCS Draft Project Management Plan (Donohue 1988) provides for planning and monitoring of team activities and coordination with EPA. Frequent and regular contact with the EPA RPM will be maintained by Donohue's SM to assure full communication throughout the project. In addition, this plan describes appropriate review of the financial, schedule, and technical status of the work assignment.

Monthly progress reports will be prepared and submitted to EPA outlining target and actual completion dates, and discussing problems and resolutions regarding both technical and financial issues. The monthly progress reports will be submitted to the EPA within 20 calendar days after the end of each reporting period and will consist of a summary of work completed during that period, current and anticipated costs, and scheduling information.

The task numbering system for the South Andover RI/FS will follow the standard tasks listed in the EPA Statement of Work. Each of these tasks will be scheduled and tracked separately during the course of the RI/FS. The tasks are numbered as follows:

Task 1 Project Planning

Task 2 Field Investigations



Donohue
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PROJECT ORGANIZATION
SOUTH ANDOVER SITE
OPERABLE UNIT II RI/FS
ANDOVER, MINNESOTA

Engineers■ Architects ■Scientists

FIGURE 8–1

ANDOVER FIG 4-1

Task 3	Sample Analyses/Validation
Task 4	Data Evaluation
Task 5	Risk Assessment
Task 6	Treatability Studies
Task 7	Remedial Investigation Report/Monthly Reports
Task 8	Remedial Alternatives Development and Screening
Task 9	Detailed Analysis of Alternatives
Task 10	Feasibility Study Report/Monthly Reports

Project control meetings will be held, as needed, to evaluate project status, discuss current items of interest, and review major deliverables.

8.3 QUALITY ASSURANCE AND DOCUMENT CONTROL

Quality control will be maintained by a Donohue Technical Advisory Committee (TAC) composed of senior technical advisors who have been organized under the direction of the Technical Services/Quality Assurance Manager (TSQAM). Appropriate members of the TAC will be involved in all phases of the work assignment, from planning through execution and delivery. The TAC will review all deliverables and will be available to the SM and project team personnel, as necessary, particularly to communicate changes resulting from revised EPA guidance, or relevant advances in technology applicable to the South Andover site.

Site-specific quality assurance requirements will be in accordance with the Quality Assurance Project Plan for the ARCS Program as approved by EPA.

Document control aspects of the project pertain to controlling and filing documents. Internal ARCS program filing system guidelines have been developed that conform to the requirements of the EPA to ensure that documents are properly stored and filed. This guideline will be implemented to control and file all documents associated with the South Andover RI/FS. The system includes document receipt control procedures, a file review and inspection system, and security measures.

9.0 REFERENCES

Donohue & Associates, Inc. September 1989. South Andover Design Investigation Final Site Investigation Plan.

CH2M-HILL, 1988, Final Report Remedial Investigation Report, South Andover, Minnesota.

Ericson, S.W. et al., 1974, Water Resources of the Rum River Watershed, East-Central Minnesota, U.S.G.S. Atlas HA-509.

Farnham, R.S., 1956, Geology of the Anoka Sandplain in 1956 Annual Meeting Guidebook for Field Trips, G.M. Schwartz, Editor, Geological Society of America.

Jirsa, M.A., Olsen, B.M. and Bloomgren, B.A., 1986, Bedrock Geologic and Topographic Maps of the Seven-County Twin Cities Metropolitan Area, Minnesota. Miscellaneous Map Series M-55, Minnesota Geological Survey.

Kanivetsky, 1979, Hydrogeologic Map of Minnesota, Quaternary Hydrogeology, Map S-3 and text, Minnesota Geological Survey, University of Minnesota, St. Paul.

Oskvarek, J.D., 1983, Draft of the Final Report on the Extent of Contamination at the South Andover Sites, Andover, Minnesota, TDD No. R05-8105-10A, Region V Superfund, U.S. Environmental Protection Agency.

Pace Laboratories, Inc., 1984, Work Plan for Removal of Drums and Contaminated Soils from South Andover Hazardous Waste Site.

Residuals Management Technology, Inc., 1981, Technical Assistance to Andover, Preliminary Hydrogeologic Report on Heidelberger Site, Contract No. 68 01 6005, U.S. Environmental Protection Agency.

Ruffner, J.A., 1980, Climates of the States, Volume 1, Gale Research Company, Detroit, Michigan, 588p.

Soil Conservation Service, 1977, Soil Survey of Anoka County, Minnesota: U.S. Department of Agriculture, pg. 92

Subterranean Engineering, Inc., 1978, Soil Investigation, Tire Recycling Building Behind 2050 1/2 Bunker Lake Blvd. N.W., Andover, Minnesota.

US EPA, 1989, Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soil and Solid Media; U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation, EPA 230/02-89-042.

US EPA, 1989b, Risk Assessment Guidance for Superfund. Human Health Evaluation Manual, Part A (pre-Publication copy), Washington D.C., U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. OSWER Directive 9285.701A.

ARCS/P/SANDRIFS/AD1

APPENDIX A

BASELINE RISK ASSESSMENT PLAN

Submitted to:

Donohue & Associates, Inc.
4738 North 40th Street
Sheboygan, WI 53083

Attention: Mr. James Garvin, Project Manager (1 copy)
Mr. David Voight, Site Manager (1 copy)

TR-1107-10

BASELINE RISK ASSESSMENT WORK PLAN

Second Operable Unit RI/FS South Andover Site,
Andover, Michigan

Prepared Under

Program No. 1522

for

Subcontract No. 68-W8-0093-D

Under

Contract No. 68-W8-0093

for

ICAIR Work Assignment No. 121522

Donohue Work Assignment No. 20-5F45

December 18, 1989

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LIST OF TABLES

LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DQO	Data Quality Objective
EPA	Environmental Protection Agency
HEAST	Health Effects Assessment Summary Tables
HHEM	Human Health Evaluation Manual
IRIS	Integrated Risk Information System
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
RI/FS	Remedial Investigation/Feasibility Study

1.0 INTRODUCTION

This Baseline Risk Assessment Work Plan is a detailed approach for evaluating human health risks at the South Andover Site, Operable Unit #2 throughout the Remedial Investigation/Feasibility Study (RI/FS) process. This work plan addresses all areas where tasks related to risk assessment are important and critical. There are tasks and subsequent decisions that are made prior to performing the actual risk assessment which, therefore, affect the risk assessment phase. These have been documented in the following sections and cross-referenced (in parentheses) to the standard work plan tasks described in the Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (USEPA 1988a). The tasks described in this work plan will be performed by ICAIR, Life Systems.

The risk assessment tasks included in this work plan will be conducted according to guidance found in the following documents:

- Risk Assessment Guidance for Superfund. Human Health Evaluation Manual (USEPA 1989b)
- The Superfund Exposure Assessment Manual (USEPA 1988b)
- The Exposure Factors Handbook (USEPA 1989a)

This work plan is organized into five sections (in addition to this Introduction). Sections 2.0 through 5.0 address individual RI/FS work plan tasks. Section 6.0 provides a listing of references used in preparation of this work plan.

2.0 PROJECT PLANNING (RI/FS TASK 1)

Addressing risk assessment requirements during Project Planning for the RI/FS is an essential element in the planning process. It is necessary to plan site data collection activities with a focus on human health, utilizing the minimum amount of sampling and environmental information while assuring that adequate information is being collected. Sampling decisions made during this part of the project can affect and impact subsequent risk assessment decisions. Lack of data or incomplete data for all complete pathways can dramatically increase the uncertainty of risk estimates. These estimates may be difficult to defend if challenged by public or private parties, possibly resulting in resampling and analysis and severely impacting cost and schedule.

To address these issues, input from ICAIR will be provided during both project scoping and in discussions and meetings with the site manager throughout the RI/FS process. Critical topics to be addressed include:

- Development of the site conceptual model
- Development of site sampling and analysis strategies
- Establishment of Data Quality Objectives (DQOs)

Project scoping culminates in the development of the sampling and analysis plan (including the field sampling plan and the quality assurance project plan). It is critical that these be reviewed by the risk assessors prior to implementation. This review will focus on the adequacy of site sampling to support risk assessment data needs (i.e., for identifying contaminants of potential concern, fate and transport modeling inputs, determination of background, determination of exposure point calculations, etc.).

Subsequent revisions to these plans will also require input from the risk assessors to assure that risk assessment needs are met and not compromised. At South Andover, Unit #2, a phased approach to sampling is proposed; therefore, input and review are particularly important as site conditions become better characterized.

As part of project planning a site visit by the risk assessors is proposed between Phase I and Phase II sampling. The purpose of the site visit will be to evaluate the scope of the risk assessment and to orient the personnel designing the risk assessment study to important site features. Human activity patterns involving potentially exposed populations can be either observed or inferred from site conditions. Information from the site visit is important in the subsequent development of exposure scenarios (i.e., a specific human activity combined with a specified route of exposure).

3.0 ASSESSMENT OF RISKS (RI/FS TASK 6)

This task includes efforts to conduct a baseline human health assessment for the South Andover (OU #2) site. The objective of this evaluation is to characterize and quantify the impact of site contamination upon the human population under the assumption of no remedial action. This assessment is composed of four major analyses:

- Data Evaluation
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization

Each is discussed in the following sections.

3.1 Data Evaluation

Once field investigation activities are complete, the data evaluation task begins. The task begins with data gathering and ends with a set of data for use in the baseline risk assessment. While there are data evaluation efforts that must be performed by other members of the RI/FS team, there are also data evaluation steps that must be performed in the context of the risk assessment. Once monitoring and other site data are received from Donohue (including any descriptive or tabular summaries and mapping of qualified data), the data will be reviewed by the risk assessors to:

- Evaluate analytical methods to determine which data are appropriate for use in quantitative risk assessment,
- Evaluate quantitative limits with regard to health-based reference concentrations,
- Eliminate chemicals for which there are no positive data,
- Determine data quality with respect to laboratory qualifiers to eliminate data points which are unusable for quantitative risk assessment,
- Compare blank data with associated sample results to eliminate nonsite contamination,
- Evaluate tentatively identified compounds for possible inclusion in the risk assessment,
- Compare potential site related contamination with background concentrations from the site or in the vicinity of the site.

Once these steps have been completed, a set of site-related chemicals, accompanied by reported concentrations of acceptable quality, will be available for use in the risk characterization.

Because the site RI is phased, data evaluation steps will be repeated for each sampling phase. In addition, after Phase I, a data-needs report will be prepared which will detail risk assessment requirements that remain unaddressed or are now indicated by the results of Phase I sampling.

The last step within data evaluation is concurrence among the project team members on source areas, exposure points, populations exposed and exposure scenarios. A team meeting is, therefore, proposed to discuss the site data and reach such agreement.

The list of potential contaminants of concern may be lengthy. An inordinate number of chemicals carried through the risk assessment process could result in an unwieldy, unfocused report. Several techniques (utilizing chemical classes, frequency of detection, essential nutrient information and a concentration-toxicity screen) may be used to further reduce the potential contaminants of concern. Concurrence of the EPA Remedial Project Manager will be obtained before any chemicals are eliminated by these techniques.

3.2 Exposure Assessment

The exposure assessment estimates the type and magnitude of exposures to those chemicals (either on site or migrating from the site) identified as contaminants of potential concern. Assessing exposure involves:

- Characterizing the exposure setting,
- Identifying complete exposure pathways, and
- Quantifying the magnitude, duration and frequency of exposures.

The exposure-setting step uses information gathered during the site visit and from other sources to describe general site characteristics, potentially exposed populations (including sensitive subpopulations) and land uses (including potential future uses). Identifying exposure pathways involves (1) an evaluation of sources, releases, types and locations of site chemicals, (2) their likely environmental fate and (3) the location and activity patterns of potentially exposed populations. Exposure points and routes are identified with each complete pathway. Exposures are quantified by estimating exposure point concentrations (from monitoring data and/or fate and transport modeling) and chemical intakes. Chemical intakes will be calculated using EPA guidance on assumptions for body weight, contact rate, ingestion rate and exposure averaging time. As suggested in EPA guidance, intake levels will be calculated for a reasonable maximum exposure (USEPA 1989b). The South Andover site has been divided into six areas of concern, based primarily on past uses and waste practices. It is difficult at this time, with limited site information, to determine whether the six areas will be treated separately in the exposure assessment. If appropriate, they may be grouped. Exposure pathways analysis will include, but not be necessarily limited to, those described in the conceptual model developed for the site.

3.3 Toxicity Assessment

The toxicity assessment weighs available evidence for the potential of each contaminant to cause adverse health effects. This assessment also attempts to describe the relationship between the extent of exposure and the increased likelihood or severity of adverse effects.

Each chemical's noncarcinogenic and carcinogenic effects will be described in tabular format. A summary of toxicity values will be prepared for both carcinogens and noncarcinogens. These values will reflect the most up-to-date information available on each contaminant of concern and will use EPA's recommended hierarchy of toxicity information (i.e., EPA's Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), other EPA values).

3.4 Risk Characterization

The final step of the baseline risk assessment characterizes risk. Toxicity and exposure assessments are integrated into a quantitative expression of risk. For noncarcinogens, estimated intakes are compared to appropriate toxicity values (i.e., reference doses) for each contaminant of concern over a specified time period. If the ratio of exposure to toxicity (the hazard quotient or index) exceeds one (1.0), there may be a concern for potential noncancer effects. At the South Andover site, more than one noncarcinogenic chemical must be assessed. Assessing risks one chemical at a time may underestimate risks associated with simultaneous exposures. Therefore, additivity of toxic effects by the same mechanism will be assumed.

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. Estimated intakes are multiplied by each chemical's slope factor and summed across populations. Cancer risk estimates will be compared to EPA's recommended target risk range of 10^{-4} to 10^{-7}.

The risk characterization will be completed with a discussion of the numerical risks and an explanation and interpretation of those results.

3.5 Documentation of the Baseline Risk Assessment

The documentation of the baseline risk assessment will be a report which addresses the objectives of the risk assessment process that is, (1) to determine whether remedial action is warranted, (2) to provide a basis for chemical levels protective of human health and (3) to provide a basis for comparing remedial alternatives. The baseline risk assessment report must also communicate relevant results clearly and concisely. A discussion of the uncertainties related to risk assessment will be presented. The outline in Table 1 is proposed as the framework for the baseline risk assessment report for the South Andover site. It is assumed that this report will be approximately 50 pages in length.

3.6 Ecological Assessment

The current or potential effects of the site and site contaminants on environmental receptors (plants and animals) will be described in a qualitative manner. At this planning stage, it is assumed that the potential for risks to environmental populations is minimal, based on the contaminants identified in the site, background materials and the urban nature of the site. This ecological assessment will be submitted as an appendix to the baseline risk assessment report.

4.0 REMEDIAL ALTERNATIVES SCREENING (RI/FS TASK 9)

In this task remedial alternatives are selected to undergo full evaluation. During this screening process, risk must be addressed. Candidate remedial alternatives will be evaluated to determine the extent to which each is protective of human health and the environment. This is accomplished through the development of clean-up goals, based on the baseline risk assessment for the no-action alternative conducted in Task 3.0 - Assessment of Risks. The procedure for this includes:

- Determination of clean-up goals based on exposure scenarios developed in the baseline risk assessment.
- A qualitative reevaluation of chemicals of potential concern to address possible releases of new compounds during remediation.
- Review of changes in exposure pathways for each remedial alternative under consideration (identify new exposure pathways, populations and durations of exposure).
- Evaluation of alternatives by screening the effectiveness of each in protecting human health and the environment. Both the short-term (construction and implementation period) and long-term (after remedial action is completed) effectiveness are evaluated.

TABLE 1 OUTLINE FOR BASELINE RISK ASSESSMENT REPORT

X.X FRONT MATTER

- X.1 Title Page
- X.2 Foreword
- X.3 Table of Contents
- X.4 List of Figures
- X.5 List of Tables
- X.6 List of Acronyms

0.0 EXECUTIVE SUMMARY

1.0 INTRODUCTION

- 1.1 Overview
- 1.2 Site Background
- 1.3 Scope of Assessment
- 1.4 Organization of Risk Assessment Report

2.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

- 2.1 General Site-Specific Data Collection Considerations
- 2.2 General Site-Specific Data Evaluation Considerations
- 2.3 Chemicals of Potential Concern in Soils
- 2.4 Chemicals of Potential Concern in Ground Water
- 2.5 Chemicals of Potential Concern in Surface Water/Sediments
- 2.6 Chemicals of Potential Concern in Air
- 2.7 Summary of Chemicals of Potential Concern

3.0 EXPOSURE ASSESSMENT

- 3.1 Characterization of Exposure Setting
- 3.2 Identification of Exposure Pathways
- 3.3 Quantification of Exposure
- 3.4 Identification of Uncertainties
- 3.5 Summary of Exposure Assessment

4.0 TOXICITY ASSESSMENT

- 4.1 Toxicity Information for Noncarcinogenic Effects
- 4.2 Toxicity Information for Carcinogenic Effects
- 4.3 Chemicals for Which No EPA Toxicity Values are Available
- 4.4 Uncertainties Related to Toxicity Information
- 4.5 Summary of Toxicity Information

continued-

Table 1 - continued

At this time, clean-up goals will be calculated according to guidance presented in the Superfund Public Health Evaluation Manual (USEPA 1986, Chapter 8). It is anticipated that new guidance presently under development by EPA will be issued sometime during the period of performance. At that time, this task may have to be refined and rescoped in order to comply with EPA guidelines.

The results of this effort will be documented in a summary report (estimated at ten pages in length).

5.0 REMEDIAL ALTERNATIVES EVALUATION (RI/FS TASK 10)

Efforts under this task include the detailed analysis of each alternative that survived the screening process. Again, each alternative being considered (three assumed) must be protective of both human health and the environment. Each alternative is assessed against specific evaluation criteria which address statutory requirements as well as technical and policy considerations important in selecting remedial actions.

Detailed risk assessments will be performed to account for changes from the no-action-alternative assessment. New compounds and new pathways associated with each alternative will be identified and potential exposures and risks evaluated. Of the nine evaluation criteria, the following will be considered from a risk assessment perspective:

- Overall protection of human health and the environment,
- Long-term effectiveness in maintaining protection of human health and the environment after response objectives have been met, and
- Short-term effectiveness in protecting human health and the environment during implementation until responses objectives are met.

The potential for acute exposures to workers and the surrounding community during remediation and the magnitude of residual risk from treated and untreated contaminants will be evaluated as well as potential impacts should a remedy fail.

During this time, the risk assessment team must work closely with the FS design team, therefore, team meetings and teleconferences are proposed. The end product of this task will be a summary of analyses for inclusion into the FS.

Part C of the EPA's Risk Assessment Guidance for Superfund, currently under development, will address detailed analyses of remedial alternatives. It is anticipated that this document will be released prior to performing this task for the South Andover site. When guidance becomes available, this task may have to be refined and rescoped in order to comply with EPA guidance.

6.0 REFERENCES

USEPA. 1989a. U.S. Environmental Protection Agency. Exposure factors handbook. Washington, DC: U.S. Environmental Protection Agency, Office of Health and Environmental Assessment. EPA/600/8-89/043.

USEPA. 1989b. U.S. Environmental Protection Agency. Risk assessment guidance for Superfund. Human health evaluation manual. Part A. Pre-Publication copy. Washington, DC: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. OSWER Directive 9285.701A.

USEPA. 1988a. U.S. Environmental Protection Agency. Guidance for conducting remedial investigations and feasibility studies under CERCLA. Review Draft. Washington, DC: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. OSWER Directive 9355.3-01.

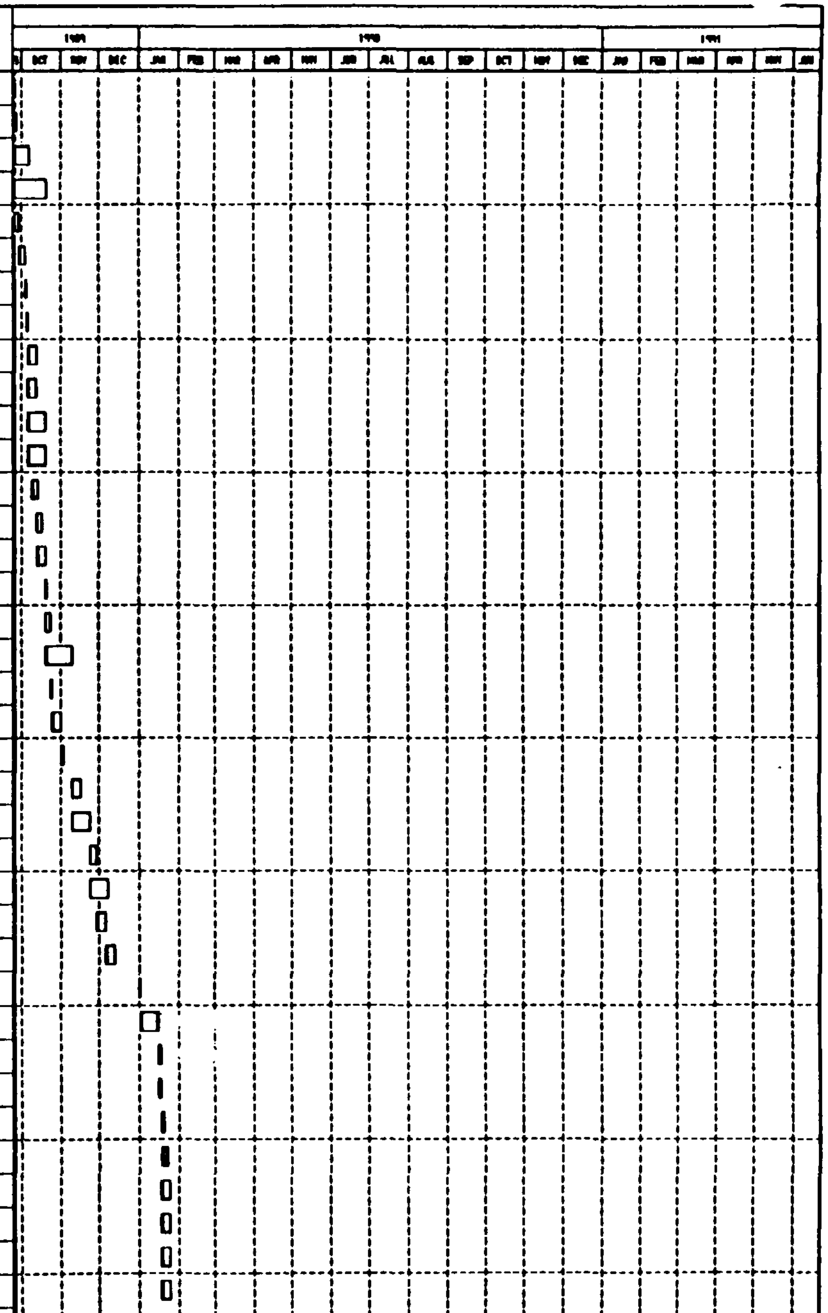
USEPA. 1988b. U.S. Environmental Protection Agency. Superfund exposure assessment manual. Washington, DC: U.S. Environmental Protection Agency, Office of Remedial Response. EPA/540/1-88/001.

USEPA. 1986. U.S. Environmental Protection Agency. Superfund public health evaluation manual. Washington, DC: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA/540/1-86/060.

APPENDIX B

PROJECT SCHEDULE

ACTIVITY ID	ACTIVITY DESCRIPTION	ORIG DUR	EARLY START	EARLY FINISH
101.0	PROJECT INITIATION	1	25SEP89	25SEP89
279.0	CONTACT LANDOWNERS	2	25SEP89	26SEP89
218.0	EPA CONSENT APPROVAL	10	25SEP89	6OCT89
20E.	CONDUCT BIDDING FACILITIES	20	25SEP89	20OCT89
105.0	SCHEDULE/MEET WITH EPA RPM	3	26SEP89	28SEP89
103.0	BACKGROUND DATA REVIEW	3	29SEP89	3OCT89
104.0	DEVELOP SITE CONCEPTUAL MODEL	1	4OCT89	4OCT89
102.0	EPA/MPCA PROJECT SCOPING MEETING	1	5OCT89	5OCT89
110.0	SCHEDULE / CONDUCT DQO MEETING	5	6OCT89	12OCT89
123.0	SCHEDULE / CONDUCT SITE VISIT	5	6OCT89	12OCT89
11C	PREPARE DRAFT RISK ASSESSMENT PLAN	10	6OCT89	19OCT89
122.0	REQUIRE & REVIEW BACKGROUND DATA REVIEW	10	6OCT89	19OCT89
219.1	AWARD SUPPORT LAB CONTRACT	5	9OCT89	13OCT89
124.0	SITE STATUS SUMMARY MEMO	2	13OCT89	16OCT89
111.0	PROJECT APPROACH DEVELOPMENT	5	13OCT89	19OCT89
113.0	PRELIMINARY IDENTIFICATION OF RA'S, ARAR'S	1	20OCT89	20OCT89
112.0	PRE-QAPP PREPARATION	2	20OCT89	23OCT89
114.0	PREPARE DRAFT WORK PLAN/PROJECT PLANS	15	20OCT89	9NOV89
116.0	PRE-QAPP MEETING	1	24OCT89	24OCT89
119.0	PREPARE QAPP	5	25OCT89	31OCT89
118	DATA MANAGEMENT PLAN	2	1NOV89	2NOV89
117.0	PREPARE HEALTH & SAFETY PLAN	5	10NOV89	16NOV89
118.0	PREPARE FIELD SAMPLING PLAN	10	10NOV89	23NOV89
131.0	DRAFT WORK PLAN ASSEMBLY & PRINTING	3	24NOV89	28NOV89
11A.0	PREPARE COST & SCHEDULE PLAN	10	24NOV89	7DEC89
132.0	QC REVIEW	5	29NOV89	5DEC89
133.0	REVISIONS & EDITING	5	6DEC89	12DEC89
134.0	SUBMIT DRAFT DELIVERABLES TO EPA	1	1JAN90	1JAN90
135.0	JOINT EPA/MPCA REVIEW	10	2JAN90	15JAN90
148.0	EPA COMMENT MEETING	2	16JAN90	17JAN90
151.0	SUBMIT REQUEST FOR ADVANCED FUNDING	2	16JAN90	17JAN90
141.0	REVISE DRAFT WORK PLAN	2	18JAN90	19JAN90
147.0	REVISE DRAFT COST & SCHEDULE PLAN	3	18JAN90	22JAN90
142.0	RISK ASSESSMENT PLAN	5	18JAN90	24JAN90
143.0	DATA MANAGEMENT PLAN	5	18JAN90	24JAN90
144.0	REVISE QAPP	5	18JAN90	24JAN90
145.0	FIELD SAMPLING PLAN	5	18JAN90	24JAN90



Activity Bar/Early Dates
Critical Activity
Progress Bar

Primavera Systems, Inc.

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CURRENT SCHEDULE

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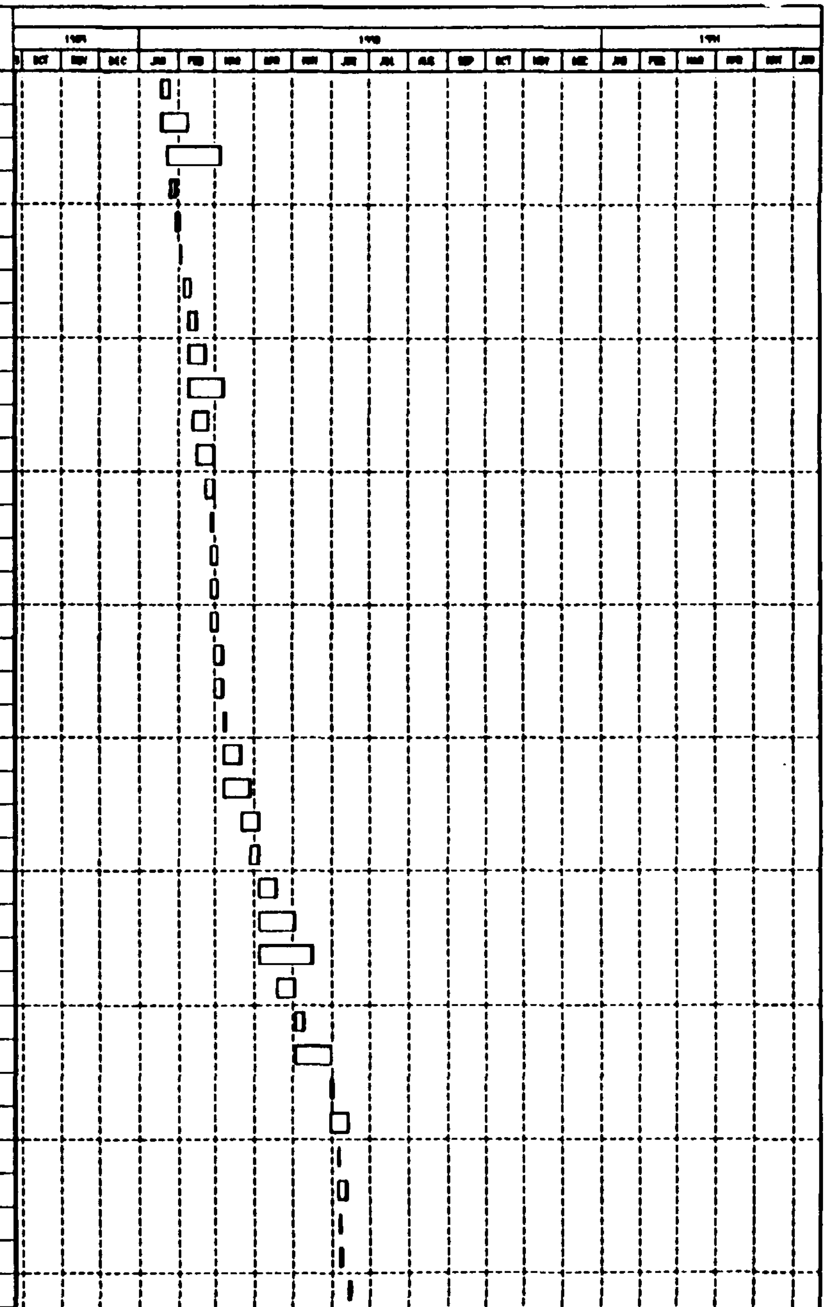
ACTIVITY ID	ACTIVITY DESCRIPTION	ORIG DUR	EARLY START	EARLY FINISH
146.0	HEALTH & SAFETY PLAN	5	18JAN90	24JAN90
152.0	RECIEVE ADVANCED FUNDING FROM EPA	15	18JAN90	7FEB90
166.0	RECEIVE CPP APPROVAL	30	23JAN90	5MAR90
161.0	CONDUCT INTERVAL QC REVIEW	3	25JAN90	29JAN90
162.0	REPORT ASSEMBLY TO PRINTING	3	30JAN90	1FEB90
163.0	SUBMIT FINAL WORK PLAN/PROJECT PLANS TO EPA	1	2FEB90	2FEB90
164.0	JOINT EPA/MPCA REVIEW	5	5FEB90	9FEB90
170.0	PREPARE FACILITIES REQUISITION CONTRACT DOC.	5	8FEB90	14FEB90
201.1	PREPARE SUBCONTRACT SOW - TRENCHING/BORINGS	10	8FEB90	21FEB90
210.0	PREPARE BID DOCS FOR CLOSED SUPPORT LAB	20	8FEB90	7MAR90
166.1	EPA APPROVALS FINAL WORK PLANS	10	12FEB90	23FEB90
174.0	CONDUCT BIDDING FOR FACILITIES	10	15FEB90	28FEB90
202.1	PREPARE BID PACKAGE TRENCHING BORINGS	5	22FEB90	28FEB90
263.0	SLP LAB COORDINATION - SOILS	2	26FEB90	27FEB90
250.0	CLP LAB COORDINATION TRENCHING	5	26FEB90	2MAR90
278.0	CLP COORDINATION - SURFACE WATER	5	26FEB90	2MAR90
283.0	CLP COORDINATION DEEP BORINGS	5	26FEB90	2MAR90
176.0	AWARD FACILITIES SUBCONTRACT	5	1MAR90	7MAR90
204.1	QC REVIEW & REVISE BID DOCUMENTS - TRENCHING	5	1MAR90	7MAR90
206.1	PRECONSTRUCTION CONFERENCE - TRENCHING	2	8MAR90	9MAR90
205.1	CONDUCT BIDDING - TRENCHING	10	8MAR90	21MAR90
216.0	CONDUCT BIDDING CLOSED SUPPORT LAB	15	8MAR90	28MAR90
207.0	BID ANALYSIS & NEGOTIATIONS - TRENCHING	10	22MAR90	4APR90
217.0	BID ANALYSIS NEGOTIATIONS SUPPORT LAB	5	29MAR90	4APR90
21B	DEVELOP METHOD VALIDATION STUDY APPROVAL	10	5APR90	18APR90
20X	EPA CONSENT APPROVAL	20	5APR90	2MAY90
208.0	EPA REVIEW & APPROVAL TRENCHING/BORINGS	30	5APR90	16MAY90
21C	EPA REVIEW	10	19APR90	2MAY90
209.1	AWARD OF CONTRACT TRENCHING/ BORINGS	5	3MAY90	9MAY90
21D	CONDUCT METHOD VALIDATION STUDT WRITE SOP'S	20	3MAY90	30MAY90
241.0	PREFIELD PLANNING GEOPHYSICS	2	31MAY90	1JUN90
21E	EPA APPROVAL OF METHOD VALIDATION & SOP;S	10	31MAY90	13JUN90
24Z	SURVEY PREFIELD PLANNING	1	6JUN90	6JUN90
242.1	EQUIPMENT RENTAL & PREPARATION - GEOPHYSICS	5	6JUN90	12JUN90
232.0	EPA ARRANGE ACCESS AND SECURITY	1	7JUN90	7JUN90
24P	PREFIELD MEMOS & MEETING SURVEY	2	7JUN90	8JUN90
230.0	INITIATE PHASE-1 FIELD PROGRAM	2	14JUN90	15JUN90



Activity Early Dates
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CURRENT SCHEDULE

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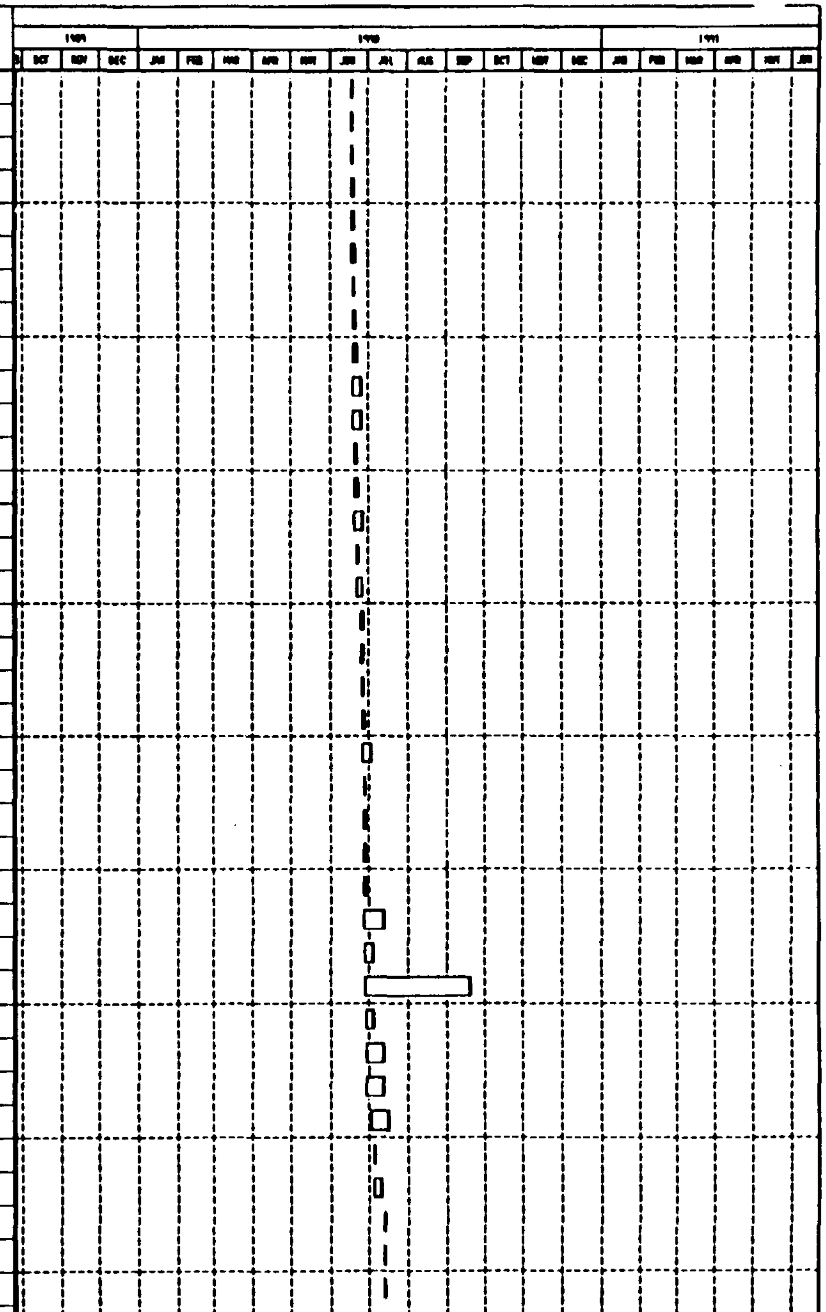
ACTIVITY ID	ACTIVITY DESCRIPTION	ORIG DUR	EARLY START	EARLY FINISH
235.1	MOBILIZE SURVEY	1	18JUN90	18JUN90
24A	GEOMORPH PREFIELD PLANNING	1	18JUN90	18JUN90
24C.1	PREFIELD PLANNING - DEEP BORINGS	1	18JUN90	18JUN90
24D	EQUIPMENT PREPARATION - SURFACE WATER	2	18JUN90	19JUN90
29B	PRE-FIELD MEETING - TRENCHING I	2	18JUN90	19JUN90
24H	SUBCONTRACTOR COORDINATION - DEEP BORINGS	3	18JUN90	20JUN90
245.1	FACILITIES ARRANGEMENTS	1	19JUN90	19JUN90
243.1	PREFIELD NOTEBOOK	2	19JUN90	20JUN90
235.0	FIELD SURVEY ACTIVITIES	3	19JUN90	21JUN90
24C	EQUIPMENT PREPARATION - GEOMORPH	5	19JUN90	25JUN90
24F	EQUIPMENT RENTAL & PREPARATION	5	19JUN90	25JUN90
24E	EQUIPMENT CALIBRATION - TRENCHING	2	20JUN90	21JUN90
29G	PREPARE NOTEBOOK/PREFIELD MEMO - TRENCHING	3	20JUN90	22JUN90
244.1	SUBCONTRACTOR COORDINATION - TRENCHING	5	20JUN90	26JUN90
250.0	MOBILIZE - GEOPHYSICS	1	22JUN90	22JUN90
23C	DATA ANALYSIS & TECH MEMO - SURVEY	2	22JUN90	25JUN90
251.0	EM-31 DATA COLLECTION	2	25JUN90	26JUN90
252.0	MAGNETOMETER DATA COLLECTION	2	25JUN90	26JUN90
267.0	MOBILIZE GEOMORPH & SURFACE WATER	1	26JUN90	26JUN90
23G	SUBMITTAL OF GEOPHYSICAL COORDINATES MAP	2	26JUN90	27JUN90
289.0	PREFIELD PLAN & MOBILIZATION - DEEP BORINGS	5	26JUN90	2JUL90
276.0	FIELD DATA COLLECTION - SURFACE WATER & SEDIMENT	1	27JUN90	27JUN90
253.0	EM-31 DATA REDUCTION	2	27JUN90	28JUN90
254.0	MAGNETOMETER DATA REDUCTION	2	27JUN90	28JUN90
29J	MOBILIZATION & UTILITIES CLEARENCE TRENCHING	2	27JUN90	28JUN90
268.0	FIELD DATA COLLECTION GEOMORPH	12	27JUN90	12JUL90
273.0	FIELD TECH MEMO - SURFACE WATER & SEDIMENT	5	28JUN90	4JUL90
302.0	LAB ANALYSIS & DATA VALIDATION - SURFACE WATER	60	28JUN90	19SEP90
255.0	DATA ANALYSIS & TECH MEMO - GEOPHYSICS	4	29JUN90	4JUL90
259.1	GEOPHYSICAL EVALUATION	10	29JUN90	12JUL90
293.0	TRENCHING/SOIL SAMPLING PROGRAM	10	29JUN90	12JUL90
289.	SOIL BORING/CHEMICAL SAMPLING	10	3JUL90	16JUL90
25A	GEOPHYSICS DEMOBILIZATION	1	5JUL90	5JUL90
25G	SUBMITTAL OF GEOPHYSICAL ANOMALY MAP	4	5JUL90	10JUL90
259.0	DEMOBILIZATION - TRENCHING	1	13JUL90	13JUL90
26A	PREPARE MAP FOR TRENCH BORING LOCATIONS	1	13JUL90	13JUL90
26Q.	DEMOBILIZATION GEOMORPH	1	13JUL90	13JUL90



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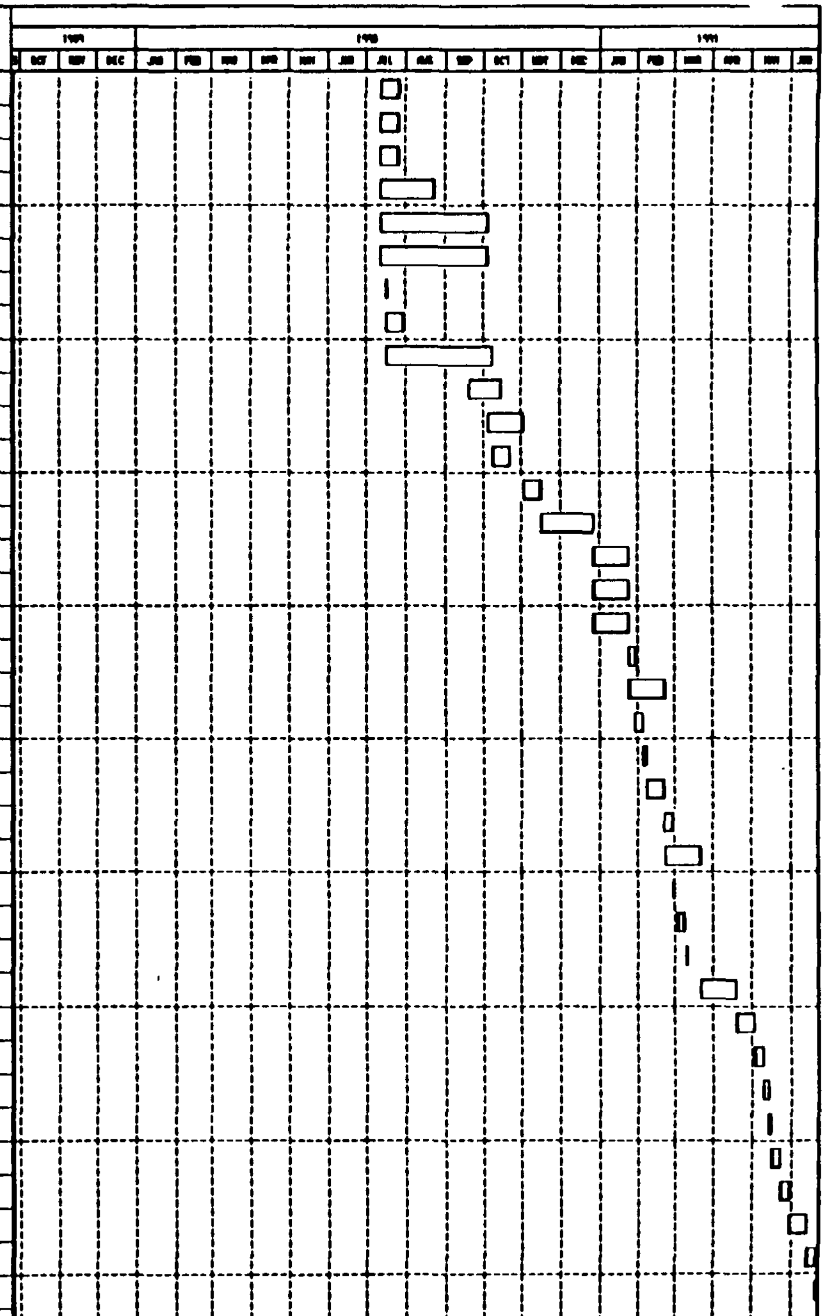
ACTIVITY ID	ACTIVITY DESCRIPTION	ORIG DUR	EARLY START	EARLY FINISH
269.0	DATA ANALYSIS & FIELD TECH MEMO - GEOMORPH	10	13JUL90	26JUL90
296.1	FIELD MEMO TRENCHING	10	13JUL90	26JUL90
431.0	REPORT TECH MEMO - TRENCHING	10	13JUL90	26JUL90
401.0	REPORT TECH MEMO GEOPHYSICS	30	13JUL90	23AUG90
301.1	LAB ANALYSIS & DATA VALIDATION - SOILS	60	13JUL90	4OCT90
303.0	LAB ANALYSIS & DATA VALIDATION TRENCHING	60	13JUL90	4OCT90
301.0	DEMOBILIZATION DEEP BORINGS	1	17JUL90	17JUL90
28J	PREPARE FIELD TECH MEMO - DEEP BORINGS	10	17JUL90	30JUL90
304.0	LAB ANALYSIS & DATA VALIDATION/ DEEP BORINGS	60	17JUL90	8OCT90
421.1	REPORT TECH MEMO SURFACE WATER & SEDIMENTS	18	20SEP90	15OCT90
421.0	REPORT TECH MEMO - GEOMORPH	20	5OCT90	1NOV90
441.0	REPORT TECH MEMO - DEEP BORINGS	10	9OCT90	22OCT90
461.0	EVALUATE PHASE I DATA	10	2NOV90	15NOV90
501.0	BASELINE RISK ASSESSMENT DATA EVALUATION	30	16NOV90	27DEC90
502.0	RISK ASSESSMENT EVALUATION - FS	20	28DEC90	24JAN91
750.0	PREPARE DRAFT RI REPORT	20	28DEC90	24JAN91
804.0	REMEDIAL ALTERNATIVES SCREENING	20	28DEC90	24JAN91
752.0	REPORT ASSEMBLY/PRINTING	2	25JAN91	28JAN91
805.0	REMEDIAL ALTERNATIVES EVALUATION	20	25JAN91	21FEB91
753.0	QC REVIEW & REVISIONS	5	29JAN91	4FEB91
75D	REPORT PRINTING & ASSEMBLY	2	5FEB91	6FEB91
754.0	EPA REVIEW MEETING	10	7FEB91	20FEB91
755.0	REVISE RI REPORT	5	21FEB91	27FEB91
902.1	DETAILED ANALYSIS OF ALTERNATIVES	20	22FEB91	21MAR91
757.0	QC REVIEW	2	28FEB91	1MAR91
758.0	REPORT ASSEMBLY/PRINTING	5	4MAR91	8MAR91
75C	FINAL RI REPORT	1	11MAR91	11MAR91
911.0	REMEDIAL ALTERNATIVES EVALUATION	20	22MAR91	18APR91
1001.0	REPORT ASSEMBLY & PRINTING	10	19APR91	2MAY91
1010.0	QC REVIEW	5	3MAY91	9MAY91
1011.0	SUBMIT DRAFT FS REPORT TO EPA	2	10MAY91	13MAY91
1020.0	EPA COMMENT MEETING	2	14MAY91	15MAY91
1030.0	REVISE DRAFT FS REPORT	5	16MAY91	22MAY91
1040.0	REPORT ASSEMBLY & PRINTNG	5	23MAY91	29MAY91
1050.0	QC REVIEW	10	30MAY91	12JUN91
1060.0	SUBMIT FINAL FS REPORT TO EPA	5	13JUN91	19JUN91
75E	PROJECT COMPLETE	1	20JUN91	20JUN91



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