RECORD OF DECISION
OPERABLE UNIT 2

SHERWOOD MEDICAL NPL SITE

DeLand, Volusia County, Florida

Prepared By:

Environmental Protection Agency

Region IV

Atlanta, Georgia

Concurrence Sign-off Sheet

SHERWOOD MEDICAL

RECORD OF DECISION

4WD-SSRB	4WD-SSRB	4WD-SSRB	ORC
LUETCHENS	ABBOTT	MUNDRICK	COBB
9.10.92	9/18/92	9/21/92	9/17/92

RISK	GROUNDWATER	HQ	CRC
POLLARD	O'STEEN	WINGFIELD	WINTER
9-22-92	9/21/92	9-16-92	9/22/92

WD	WD	4DRA
GREEN	FRANZMATHES	TOBIN
9/22/92	9/22/92	

The State of Florida Department of Environmental Regulation has reviewed this ROD and submitted comments. These comments have been incorporated and State has concurred with the selected remedy.

Record of Decision
Operable Unit 2
Declaration

SITE NAME AND LOCATION

Sherwood Medical Industries Site
DeLand, Volusia County, Florida

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Sherwood Medical Site in DeLand, Florida, which was chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site.

The State of Florida, as represented by the Florida Department of Environmental Regulation (FDER), has been the support agency during the Remedial Investigation and Feasibility Study process for the Sherwood Medical Site. In accordance with 40 CFR 300.430, FDER, as the support agency, has provided input during this process. Based upon comments received from FDER, it is expected that concurrence will be forthcoming; however, a formal letter of concurrence has not yet been received.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

The remedy selected in this ROD addresses site soils and groundwater that have been contaminated as a result of past waste disposal activities at the Sherwood Medical Site. The selected remedy continues operation of the pump and treat system installed as part of the previous action and adds additional requirements. An additional Operable Unit is planned to address contaminated sediments in Lake Miller, a small Lake which is partially on-site and historically received runoff from the Sherwood Site.

The primary components of the selected remedy will provide protection of human health and the environment at the Sherwood Site through. The components of this ROD include:

- Groundwater pump and treat system for remediation of the surficial aquifer;
- Discharge of treated effluent to Lake Miller, a 12 acre lake located partially on the Sherwood Site;
- Groundwater monitoring program encompassing the surficial, Upper and Lower Floridan aquifers;
- Residential Well monitoring to ensure that no contamination exists in wells immediately to the east and west of the Site;
- Requirement for continued operation of the Floridan Aquifer Water Supply well and the associated treatment system to ensure capture and treatment of any migrated contamination;
- Requirement that soil excavated following building or parking lot removal meet TCLP criteria or contain less than 520 mg/kg chromium. Soils exceeding these standards would be required to be remediated or disposed of in an appropriate waste facility.
- Land use restrictions allowing only industrial use of the site in the future.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State applicable or relevant and appropriate requirements directly associated with this action, and is cost-effective. This action utilizes permanent solutions and alternative treatment technologies (or resource recovery), to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this final remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted at least every five years after commencement of the remedial action, to ensure that this remedy continues to provide adequate protection of human health and the environment.

Patrick M Tobin for Greer C. Tidwell
Regional Administrator
U.S. Environmental Protection Agency
Region IV

10-8-92
Date

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The Decision Summary

Sherwood Medical Site

DeLand, Volusia County, Florida

1.0 INTRODUCTION

The Sherwood Medical Site (the Site) was proposed for inclusion on the National Priorities List (NPL) in December 20, 1982 with a Hazard Ranking System score of 39.83. The State of Florida was designated the lead agency for the Site and remained in that capacity until November of 1990, when both agencies agreed that EPA should complete actions at the Site.

The Sherwood Medical Site was first the subject of an Interim Remedial Measures Report performed by the responsible party, Sherwood Medical, Inc., (Sherwood) under the direction of the Florida Department of Environmental Regulation (FDER). In July 1988, Sherwood retained Roy F. Weston, Inc. (Weston) to perform Interim Remedial Measures (IRM) activities recommended as a result of the IRM study and, concurrently, initiate the Remedial Investigation and Feasibility Study (RI/FS) according to an Administrative Order on Consent entered into in October 1987 with the U.S. EPA Region IV.

Based on the conclusions of the IRM report, EPA presented the Proposed Plan for Interim Action to the public on January 31, 1991. A Record of Decision for Interim Action at the Sherwood Medical Site was signed by the EPA Regional Administrator in March 1991. In July 1991 Sherwood Medical signed a Consent Decree for performance of design and construction of the Interim Action treatment system specified in the Record of Decision. Final Inspection of the system was held on July 29, 1992, and start up occurred on July 31, 1992.

The Final Remedial Investigation/Feasibility Study Report and the Proposed Plan for additional Remedial Action was made available to the public on July 23, 1992. A Proposed Plan public meeting was held on July 30, 1992.

2.0 SITE NAME, LOCATION, AND DESCRIPTION

The Sherwood Medical Industries Site (Sherwood) is located approximately three miles northeast of Deland, Florida. The Site lies outside the city limits in an unincorporated area of Volusia

County located in northeast Florida. Figure 1 shows the geographic location of the Site within Volusia County. Figure 2 is a United States Geological Survey (USGS) 7.5 minute series quadrangle map of De Land showing the location of the Sherwood site.
The Site occupies approximately 42 acres, including a section of Lake Miller along the Sites western boundary. U.S. Highway 92 runs along the northern boundary of the site while a wooded, swampy area lies to the south. A commercial and residential area along Kepler Road is located directly east of the Site. The Sherwood property is currently occupied by several manufacturing buildings, a biological laboratory, sizeable parking areas, plus additional structures, including an industrial wastewater treatment facility. Figure 3 is a map of the Sherwood Medical Site depicting site buildings, waste management areas, and Lake Miller along the western boundary of the Site.

3.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Sherwood Medical Industries has occupied the property since 1959 for the manufacturing of medical supplies, primarily hypodermic needles. Industrial operations currently include grinding, hub processing, and cleaning of stainless steel and aluminum parts used to manufacture hypodermic needles. Sherwood also molds plastic syringes and conducts in-house quality assurance and quality control.

The Sherwood facility pumps approximately 175,000 gallons of water per day from the underlying Floridan Aquifer. Approximately 150,000 gallons of the water is used for industrial processes and the remaining 25,000 gallons is used for domestic purposes. Water drawn for industrial needs is used for cleaning, manufacturing, and cooling processes. Several manufacturing steps result in wastewater which must be treated. An industrial wastewater treatment plant (IWTP) was constructed in July 1983 to meet the Florida Drinking Water Standards. This facility is permitted by FDER to receive and treat wastewater from the plant, and to discharge the resulting effluent. The treated effluent is currently disposed of by percolation and evaporation in the denitrification fields and perimeter percolation pond. In late 1985, Sherwood installed an air stripper to pretreat production water used on-site in the facility's operations. The air stripper removes chlorinated solvent compounds existing in the water pumped from the Floridan Aquifer production wells on-site.

Between 1971 and 1980, the company disposed of approximately two tons of liquid and sludge waste into two unlined percolation ponds. During this time, solids were removed from the ponds and placed into on-site, unlined impoundments. From 1980 through 1982 Sherwood analyzed the contents of the impoundments and disposed of the wastes in an off-site landfill.

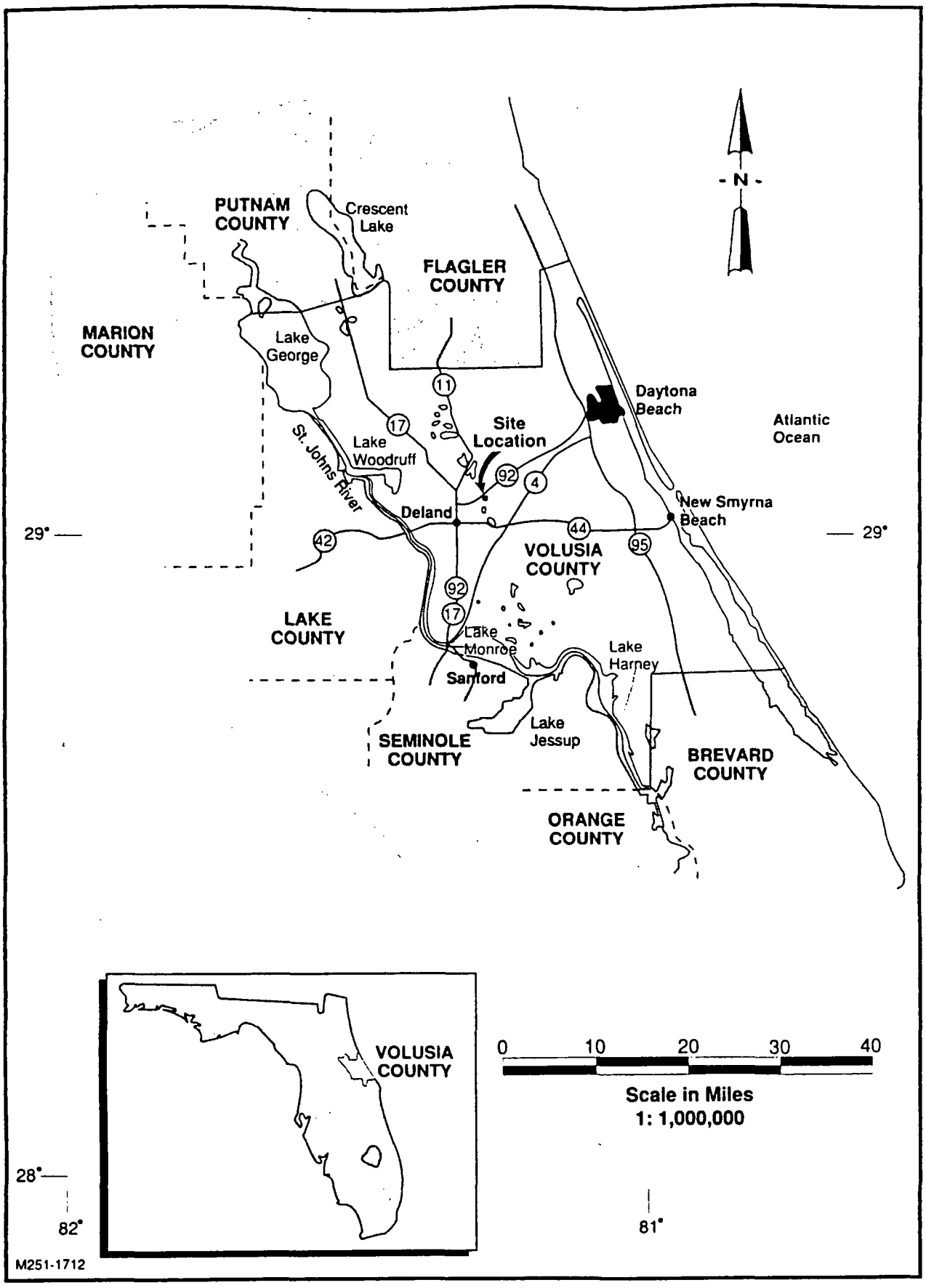


Figure 1 GEOGRAPHIC LOCATION MAP
SHERWOOD MEDICAL COMPANY
DELAND, FLORIDA

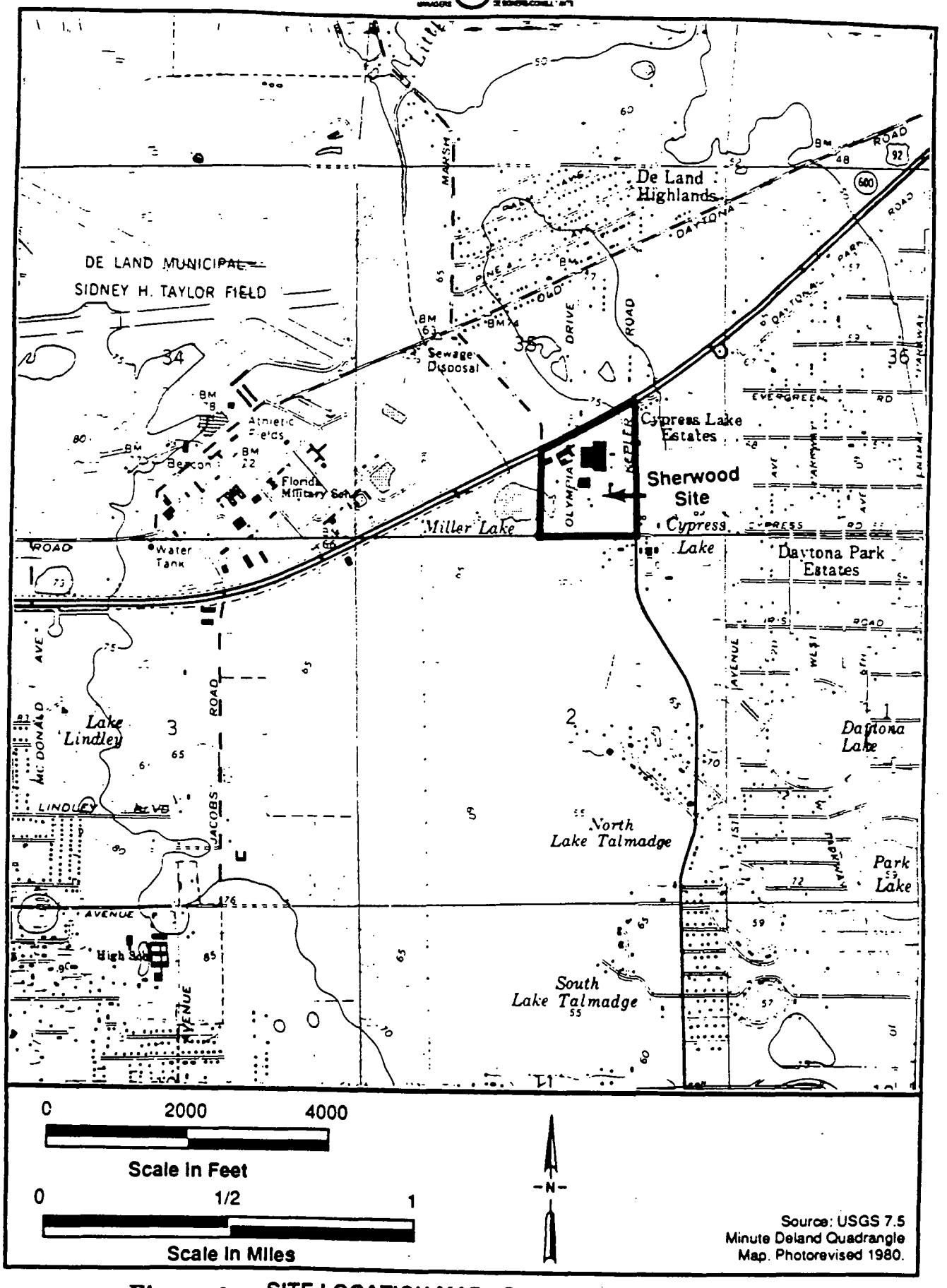


Figure 2 SITE LOCATION MAP - SHERWOOD MEDICAL SITE

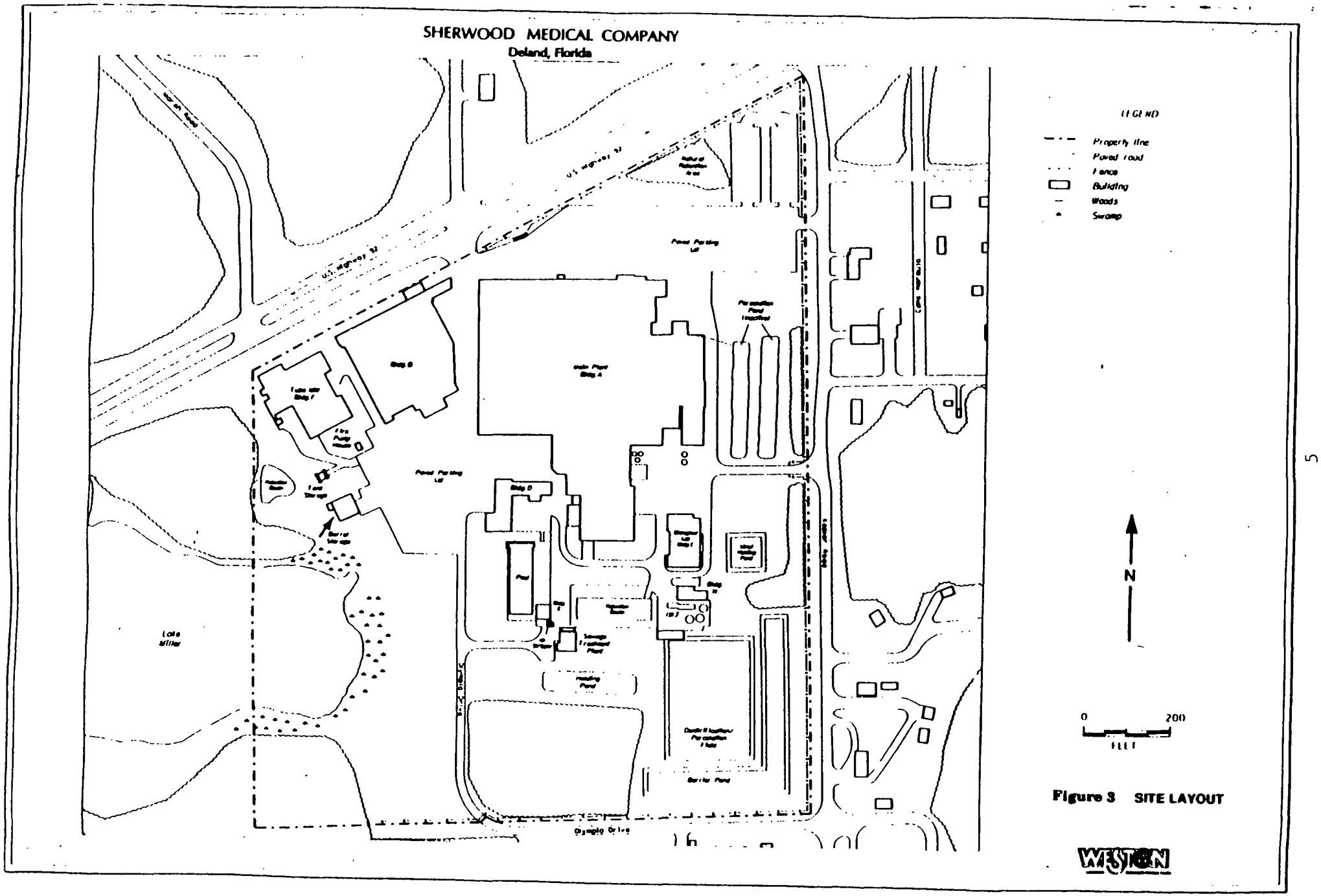


Figure 3 SITE LAYOUT

WESTON

In December 1982, the Sherwood site was proposed for inclusion on the National Priorities List at the request of FDER because of the threat of contamination from wastes in the holding ponds and

surface impoundments. FDER assumed the lead role for activities at the Sherwood Site. FDER initially believed that the removal of wastes from on-site storage areas was sufficient to eliminate the threat of contamination. However, subsequent testing conducted by Sherwood and FDER revealed groundwater contamination in on-site wells.

In October 1985, Sherwood Medical notified EPA that they would perform a focused Remedial Investigation (RI) at the Site. During EPA's negotiations with Sherwood to conduct the RI, FDER and the Florida Department of Health and Rehabilitation Services (HRS) received health related complaints about private wells from nearby residents. Water samples were collected and analyzed in September 1986 from off-site private wells and Sherwood's on-site supply wells, but no violations of drinking water standards were found in private well samples. However, additional samples collected in October 1986 from on-site Floridan Aquifer wells confirmed on-site contamination of trichloroethylene (TCE) and tetrachloroethylene (PCE) in the Floridan Aquifer. These compounds were historically used by Sherwood for degreasing purposes. In light of this new information, it was agreed that a full scale Remedial Investigation/Feasibility Study (RI/FS) would be conducted at the Site. In October 1987 Sherwood Medical entered into an Administrative Order on Consent with the U.S. EPA Region IV to perform the RI/FS.

In August 1987, at FDER's request, Sherwood sampled the on-site Floridan water wells and a downgradient residential well to assess the extent of contamination and evaluate the need to implement interim remedial measures (IRM) to control and treat the contamination of the Floridan Aquifer prior to completion of the RI/FS. Based on the observed on-site Floridan Aquifer contamination, FDER recommended an IRM action be undertaken. In July of 1988 Sherwood retained Roy F. Weston, Inc. as primary contractor for IRM and RI/FS activities. Sherwood developed an investigation plan to evaluate the Floridan Aquifer and the surficial aquifer through a thorough sampling program. Field testing was completed in April of 1989.

As part of the IRM, Sherwood Medical tested all of the private wells along Kepler Road semi-annually. The wells are located immediately adjacent to the site and extend from the intersection of U.S. 92 and Kepler Road through the intersection of Marsh and Kepler Roads. Sherwood also monitored another private well, to the west of the site, just across Lake Miller. The investigation identified one private well with volatile organic compound (VOC) concentrations above safe drinking water standards. This well is located on Kepler Road, and the test results indicated PCE and

TCE concentrations of 11 ppb and 4 ppb, respectively. The applicable Florida Drinking Water Standard for both PCE and TCE is 3 ppb.

In October 1989, Sherwood submitted a design workplan to FDER outlining further interim measures to be conducted at the site including the installation of a pump and treat system to extract, clean and discharge water from the on-site affected surficial aquifer. FDER approved the design workplan in September 1990 following the receipt of the Final IRM study report. In November 1990, FDER requested that EPA assume the lead role for all actions at the Site.

In December 1989, EPA and FDER approved the Sherwood RI/FS Workplan. The initial field work for the RI began in January 1990. The field work included; the installation and sampling of additional Floridan aquifer monitoring wells; drilling and sampling of soil borings; sampling and analysis of surface water, sediment, surface soil, and a thorough resampling of all existing wells. The first draft of the RI was submitted to the Agency in March 1991.

In January 1991, EPA issued a Proposed Plan for Interim Action at the Sherwood Medical Site and initiated a Public Comment Period. On January 31, 1991 a Public Meeting was held at Stetson University to discuss the Proposed Interim Action and to allow concerned citizens to ask EPA officials questions about the Sherwood Site.

On March 27, 1991 the Regional Administrator for U.S. EPA Region IV signed the Interim Action Record of Decision for the Surficial Aquifer. Comments generated during the Public Comment Period and at the Public Meeting were included, along with responses, as Appendix A of the Record of Decision.

Between January 7 and April 17, 1991, additional IRM activities were conducted at the site. These activities included the rehabilitation of two Floridan aquifer water supply wells SMFW and SMWS, conversion of an out of service Floridan aquifer well, SMFA 1, to a stainless steel monitoring well, and installation of nine extraction wells as part of the surficial groundwater recovery system. In April 1991 Sherwood submitted the Remedial Design Work Plan/Preliminary Design for the Surficial Aquifer Groundwater Remedial Action (RD Work Plan). In June 1991, Sherwood submitted a Final Design Package for the IRM Remedial Design/Remedial Action. In a subsequent meeting between FDER, EPA and Sherwood, on June 20, 1991, it was agreed that Sherwood would undertake a study of Lake Miller's water quality to determine if Lake Miller was in compliance with applicable FDER Class III Ambient Water Quality Standards for metals and was therefore suitable for treatment system discharge.

Additional surface water and sediment samples were collected at the Site from July 1991 through November 1991. The additional samples were taken to further characterize the metals concentrations in Lake Miller in order to verify the lake's compliance with applicable FDER Class III Ambient Water Quality Standards. In November of 1991 Weston submitted the Lake Miller Water Quality Report detailing the surface water and sediment sample results and verifying Lake Miller's compliance with FDER Class III Water Quality Standards except for cadmium. At that same time Weston submitted a National Pollutant Discharge Elimination System (NPDES) application for the proposed discharge to Lake Miller. This application was submitted in accordance with CERCLA which requires that the "substantive requirements" of the NPDES permit are met. The data gathered for the Lake Miller study was incorporated in the RI.

In February 1992, Sherwood Medical resubmitted the Final Design Package along with the Remedial Action Work Plan and the Operation and Maintenance Plan for the Interim Action treatment system. EPA approved these documents on March 24, 1992.

On May 5, 1992 a Pre-Construction Conference for the Interim Action treatment system was held on-site at Sherwood Medical and construction of the system began that same day. During the first half of July 1992, the extraction well system was completed and the air stripper was installed. Results from the initial round of sampling from the treatment system were reviewed by EPA and FDER on July 29, 1992 and system start-up followed on July 31, 1992.

4.0 SUMMARY OF COMMUNITY RELATIONS ACTIVITIES

In accordance with CERCLA 113 (k)(2)(B)(i-iv) and 117 requirements, a Community Relations Plan (CRP) for the Sherwood Medical Site was developed. This Community Relations Plan outlines citizen involvement and the community's concern.

In order to fulfill community relations requirements for the Interim Action, the Interim Remedial Measures Report and the Proposed Plan for the Sherwood Site were released to the public on January 8, 1991. These two documents were made available in both the Administrative Record and an information repository maintained at the EPA Docket Room in Region IV and at the DeLand Public Library. The notice of availability was published on January 30, 1991. A public comment period was held from January 21, 1991 through February 21, 1991. In addition to the public comment period and the information repository, a public meeting was held on January 31, 1991. At this meeting, representatives from FDER and EPA answered questions and addressed community concerns. A response to comments received during the Interim

Action comment period was included as Appendix A to the Interim Action Record of Decision for the surficial aquifer.

The Final Remedial Investigation/Feasibility Study Report was placed in both the Administrative Record and the information repository in the DeLand Public Library on July 23, 1992. On the same date, the Proposed Plan for Final Action at the Sherwood Site was sent to the information repository and to all members of the public who have expressed interest in receiving information related to Sherwood Medical. The notice of availability and the announcement of the Public Comment period and Public Meeting were published in the Daytona News Journal on July 16, 1992, and again on July 28, 1992. A Public Meeting was held on July 30, 1992. At this meeting, representatives from EPA and FDER addressed community concerns and answered questions. Responses to the comments received during this period is included in the responsiveness summary, which is included as appendix A of this Record of Decision.

This decision document presents the selected remedial action for the surficial aquifer at the Sherwood Medical Site in DeLand Florida, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the National Contingency Plan. The decision for this site is based on the Administrative Record for the Site.

5.0 SCOPE AND ROLE OF THIS ACTION WITHIN SITE STRATEGY

As with many Superfund Sites, the problems at the Sherwood Medical Site are complex. It was determined early in the Superfund process that the presence of on-site contamination in the surficial aquifer posed an imminent and substantial endangerment to human health and the environment if not addressed through immediate action. As a result, EPA initiated an Interim Action for the Site. That action represented Operable Unit (OU) I in the site management strategy. EPA selected a remedy for OU I in the Interim Action ROD signed on March 27, 1991. That remedy addressed TCE and PCE contamination in the surficial aquifer to reduce the potential for contaminant migration off-site or downward to the Floridan aquifer, which is the primary source of drinking water in the DeLand, Florida area. A series of extraction wells and an air stripper were installed according to the OU 1 Interim Action ROD. This remedy was implemented in July of 1992.

The second OU, the subject of this ROD, addresses groundwater and Site soils. This includes contamination in the surficial and Floridan Aquifers, and elevated levels of chromium in Site soils.

Following the conclusion of the Remedial Investigation it was determined that further study was necessary to determine effects

of elevated levels of metals in Lake Miller sediments and a small area of wetlands nearby. EPA and FDER have determined that an additional environmental study is necessary to fully characterize biological effects of chromium in Lake Miller sediments. EPA will address Lake Miller sediments by conducting an additional environmental study to determine if chromium levels in Lake Miller are causing adverse effects for benthic and aquatic organisms. This additional action will be addressed as OU 3 for the Sherwood Medical Site.

6.0 SUMMARY OF SITE CHARACTERISTICS

The Sherwood Site is situated in a low topographic area 40 to 60 feet above Mean Sea Level (MSL). The lithologic units in the region of the Sherwood site can be divided into three primary categories in terms of their stratigraphic characteristics and geologic ages. They occur in the following order: the unconsolidated surficial sandy deposits of Holocene to Pleistocene age; the unconsolidated poorly sorted deposits of Pliocene to Miocene age; the carbonated bedrock deposits of the Eocene age Avon Park Formation.

The foliage typical of the Site is best described as floodplain with flatland soil and is a combination of deciduous and coniferous trees with intermittent grazing lands and wetlands. Due to the large number of freshwater lakes (e.g., Lake Miller, Cypress Lake, North and South Lake Talmadge) and low topography, much of the area is best described as wooded marsh.

The land surrounding the Sherwood Site is primarily residential, with some commercial properties. Residential areas are divided into 6-acre lots. According to real estate maps, 95% of the individual parcels of land (419 out of 440) within a 0.5 mile target area are north or east of the Site. Most of the residential areas are sparsely populated and their growth is restricted by zoning codes. There are 808 homes located within a one mile radius of the Sherwood Site and approximately 2,500 people.

Woodland and wooded marsh occupy approximately 200 acres of land to the south of the site. Most of this land is owned in large tracts. The area to the east of the site is almost entirely residential. Next to the site on Kepler Road is an 80 acre residential area with 15 homes. Approximately 1,000 feet to the east of the Sherwood Site lies a residential area occupying one to two square miles known as Daytona Park Estates. North of U.S. 92, the northern border for the Sherwood Site, lies a 150 acre, moderately populated development, DeLand Highlands. This area has shown the greatest recent growth, and the size of the housing lots are the smallest in the area. Beyond the DeLand Highlands the area is characterized as rural. Southwest of the Site is

mostly wooded swamp. Northwest of the site are large tracts of land owned by the DeLand Municipal Airport, the Municipal Waterworks and the Florida Military School.

The Land near the Sherwood site is known to support recreational activities including fishing, hunting, boating, and swimming. Lakes generally used for fishing in the area include Cypress, Daytona, and Talmadge. Because of the relatively large tracts of undeveloped land, hunting occurs in the area.

The predominant natural feature of the Sherwood Site is Lake Miller, a 12-acre swamp lake. Lake Miller, which is partially on the Sherwood Site, is located along the western boundary of the Site and receives recharge from a lake north of the site via a narrow canal, base flow from the surficial aquifer, and Site run-off. Lake Miller is the primary area of concern for potential ecological damage from the Site. Lake Miller is designated as a Florida Class III water body. Class III water bodies are designated for wildlife and recreational purposes.

6.1 Waste Management Units

The primary waste management units at the Sherwood Site include: a storm water holding pond; two unlined percolation ponds which historically received chromium containing process effluent; a retention basin which receives storm water runoff; an industrial wastewater treatment plant including one pathway which receives nitrate bearing wastes and another pathway which receives non-nitrate bearing wastewater; a sewage treatment plant which receives sanitary wastewater; denitrification pond which receives wastewater from one side of the IWTP and; a barrier pond which receives treated sanitary wastewater and effluent from the the other side of the IWTP.

6.2 Potential Sources

Several wastes generated by Sherwood Medical were disposed or stored on-site. Table 1 contains a list of the types of wastes that were generated at the site as a result of manufacturing operations and also contains the locations where these wastes were discharged or stored. Figure 4 illustrates waste disposal and storage locations.

The Remedial Investigation evaluated past disposal practices and areas of known contamination and through a comprehensive sampling program identified areas with elevated contaminant levels related to the Site. Remedial Investigation activities included:

- Drilling and sampling of shallow and deep soil borings

Table 1

Waste Storage and Past Disposal Locations at the Sherwood Site

Manufacturing Operation	Type of Waste	Location
1. Treatment of cooling water blowdown; hub processing and grinding.	Liquid and sludge containing sodium dichromate.	Percolation ponds east of Building A and discharge to tile drain field located to the south of Building F.
2. Grinding, cleaning, and hub processing of stainless steel and aluminum parts (Buildings B and F).	Aqueous wastes containing spent solvents.	Discharge to septic tank and graded sump (located south of Building B).
3. Grinding operations - cleaning of recirculating cooling tanks.	Discharge of aqueous wastes containing detergents and tetrachloroethene.	Discharge to two septic tanks (located south of Building F) and ultimately to a septic tank drain field located to the south of Building F.
4. Plastic molding (Building A).	Floor washings containing tetrachloroethene.	Retention basin (located near the existing IWTP) via graded sumps and the stormwater collection system.
5. None	Sludges (containing chromium and nickel) from the percolation ponds.	Temporary storage in unlined impoundments located south of the percolation ponds.

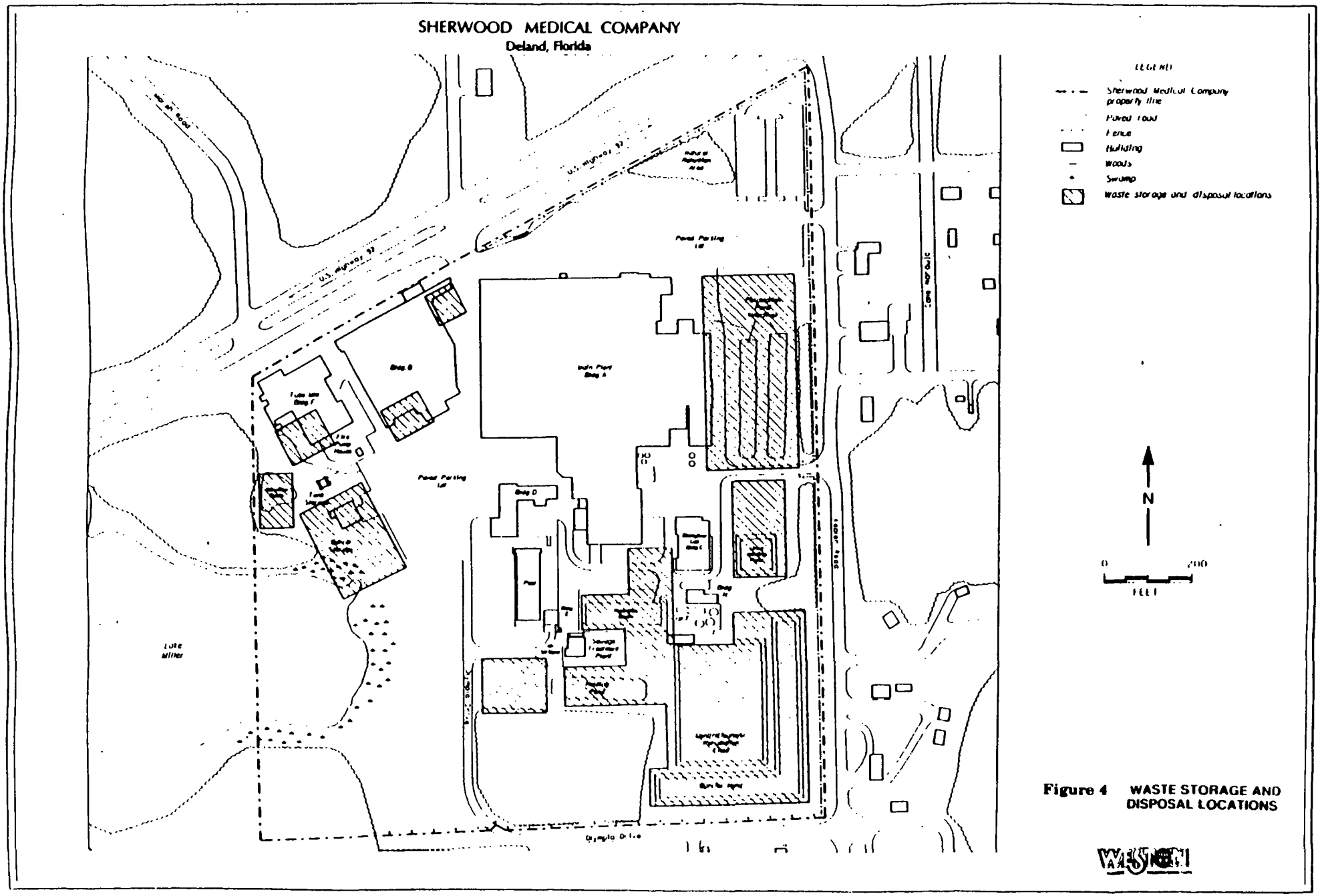


Figure 4 WASTE STORAGE AND DISPOSAL LOCATIONS

- Installation of additional surficial aquifer monitoring wells
- Installation of five off-site Floridan monitoring wells
- Rehabilitation of selected on-site Upper Floridan and Lower Floridan aquifer wells
- Sampling and analysis of all monitoring wells
- Sampling and analysis of sediment
- Sampling and analysis of surface water
- Sampling and analysis of surface soil
- Sampling and analysis of residential wells
- Geophysical logging of newly installed Floridan aquifer monitoring wells
- Ecological Study

Table 2 summarizes the compounds that were detected in the various media during the course of the RI.

6.2.1 Soils

The soil boring program conducted at the site consisted of completing 46 soil borings in and around several on-site waste disposal areas (Figure 4). Samples collected from the soil borings were analyzed for selected metals and VOCs.

Chromium was the predominant metal detected in the on-site soils. Total chromium was detected in all of the on-site soil borings except SB-17. The highest concentrations of total chromium were found in the shallow soils (0-10 ft) and were restricted to the area surrounding the percolation ponds and the area adjacent to Building F. The maximum chromium concentration detected on-site was 366 mg/kg in SB-39 near building F. This area is presently covered by a continuous asphaltic parking lot.

Lead (total) was detected in all of the soil samples collected at the site. The maximum concentration detected was 18.1 mg/kg at SB-34 from the 0-5 ft interval. Concentrations of total lead were found to be evenly distributed (vertically and horizontally) in all areas of the site that were sampled. Lead (total) concentrations (up to 1.8 mg/kg) were detected in two composite background soil borings (SB-45 and SB-48).

Trace levels of arsenic were detected in 18 of the 46 soil borings. The maximum concentration detected was 4.4 mg/kg in a composite sample.

Low levels of VOCs were detected in several of the soil samples collected. Acetone and methylene chloride were detected in several soil samples and also in some of the associated laboratory method blank samples. Concentrations of all other VOC that were detected were less than 1 mg/kg, except for a grab

Table 2

Summary of Chemicals Detected by Medium

Chemical	Soil	Surface Water	Sediment	Surficial Aquifer	Upper Floridan Aquifer	Lower/ Upper Floridan Aquifers
Organics						
Acetone	X	X	X	X	X	
Benzene				X		
Benzoic Acid			X			
Bis(2-ethylhexyl)phthalate		X	X		X	
2-Butanone	X		X	X		
Carbon Disulfide	X			X	X	
alpha-Chlordane					X	
Chloroform				X		
Chloromethane			X			
4,4'-DDE					X	
4,4'-DDT			X			
1,1-Dichloroethane			X	X		
1,1-Dichloroethene		X	X	X		
1,2-Dichloroethene (total)		X	X	X	X	X
Ethylbenzene	X		X	X		
Heptachlor					X	
Methylene Chloride	X	X	X	X		
4-Methylphenol			X			
Tetrachloroethene	X	X	X	X	X	X
Toluene	X	X	X	X		
1,1,1-Trichloroethane	X			X	X	
Trichloroethene	X	X	X	X	X	X
Vinyl Chloride		X	X	X		
Xylenes (total)	X	X	X	X		

Table 2 (con't)

Summary of Chemicals Detected by Medium

Chemical	Soil	Surface Water	Sediment	Surficial Aquifer	Upper Floridan Aquifer	Lower/ Upper Floridan Aquifers
Inorganics						
Aluminum		X	X			
Arsenic	X	X	X	X		
Barium		X				
Cadmium		X	X	X	X	X
Calcium			X			
Chromium (III)	X	X	X	X	X	
Copper		X	X			
Iron		X	X		X	
Lead		X	X		X	
Magnesium			X	X		
Manganese				X		
Mercury		X				
Nickel		X	X	X	X	
Potassium			X	X	X	X
Silver				X		
Sodium			X	X		X
Vanadium		X	X			
Zinc		X	X		X	X

soil sample collected from that indicated PCE at 1.9 mg/kg. The primary site-related VOC compounds, PCE and TCE were detected at very low levels in on-site areas where waste containing these compounds were disposed in the past. This suggests that no major VOC source areas remain in soils and that the bulk of VOC contamination has been transferred to the surficial aquifer or into the air.

6.2.2 Sediments

A total of 18 sediment samples were collected during the 1990 RI activities. Samples were collected in on-site drainage ditches and basins, along the eastern bank of Lake Miller, and within, upstream, and downstream of Lake Miller. These samples were analyzed for all of the TCL compounds. Background samples were also collected from the canal between Lake Miller and North Lake Talmadge. Additional sediment samples were taken in Lake Miller and in North Lake Talmadge, in 1991, to further define the extent of metals concentrations in the sediments of these water bodies. Six sediment samples were collected from on-site drainage ditches and basins. These sediment samples indicated levels of VOCs up to 0.11 ug/kg. Levels of benzene, toluene, and xylene detected did not exceed .013 mg/kg.

Several metals were detected above their quantification limits. Total chromium was detected in all of the samples, with a maximum concentration of 922 mg/kg. Total lead was detected in all of the samples, with a maximum concentration of 655 mg/kg. Arsenic was detected in several samples with a maximum concentration of 5.3 mg/kg.

The highest levels of the site-related compounds TCE and PCE, were found in the sediments located along the eastern bank of Lake Miller. This area received aqueous wastes containing spent solvents from floor drains in buildings B and F, which lead into former drain fields along the bank of Lake Miller. In addition, these substances may have migrated from the surficial aquifer since this aquifer discharges into Lake Miller. A total of three sediment samples were collected along the bank of Lake Miller adjacent to the Site. VOC analysis indicated the presence of TCE, PCE, methylene chloride, acetone, 1,1-dichloroethene (total), 2-butanone, vinyl chloride, toluene, and xylene. Acetone was detected in several samples and was also detected in an associated laboratory method blank. The VOC 1,2-dichloroethene (total) was detected in three samples. The concentrations of other VOCs were relatively low as compared to TCE and PCE.

Concentrations of total chromium in the sediments were relatively evenly distributed throughout Lake Miller with the exception of the eastern shore, adjoining the Site, which showed

significantly higher levels. Trace levels of chromium were also detected in background sediments collected in North Lake Talmadge. Total lead concentrations detected in Lake Miller were also found to be evenly distributed within Lake Miller. However, total lead was also detected at relatively lower levels in sediments in North Lake Talmadge and in the sediments in the canal connecting North Lake Talmadge and Lake Miller. These water bodies are upstream of Lake Miller and the Sherwood Site. Arsenic was detected only at trace levels in the sediments collected in Lake Miller.

Of the metals of concern, only total chromium concentrations detected in Lake Miller are known to be directly associated to Site operations. Total chromium in Lake Miller is assumed to be trivalent.

6.2.3 Surface Water

VOCs were detected on-site at levels less than 1 part per million (ppm). PCE was not detected in any of the samples and TCE was detected in one sample (SW_7), near the location where a discharge line entered Lake Miller. TCE and PCE were not detected in quantifiable concentrations in the surface water in Lake Miller. Therefore, if transfer of these substances has occurred from the surficial aquifer into Lake Miller, the substances have been significantly diluted or have volatilized. No base neutral compounds or pesticides were detected at levels greater than the detection limit.

Lead, chromium, and arsenic, were detected in one sample, located along the eastern shore of Lake Miller during the 1990 RI sampling activities. Other metals, with the exception of manganese and nickel, were also detected at SW-7 during 1990. However, during resampling of this location during 1991 sampling rounds in Lake Miller and in the vicinity, none of the metals of concern were detected above the quantitation limit. None of the metals, except for chromium, are known to be related to Site manufacturing operations. Data obtained during the six rounds of sampling conducted in 1991 have shown that the waters in Lake Miller are in compliance with the applicable FDER Class III Ambient Water Quality Standards with the exception of cadmium.

6.2.4 Groundwater

The hydrogeologic sequence at the Site includes the surficial aquifer, a confining unit composed of clay, sandy clay, and shell layers, and the confined Floridan Aquifer. The Floridan Aquifer is comprised of the Upper Floridan Aquifer, the primary drinking water aquifer in the DeLand area and the Lower Floridan Aquifer. Figure 5 represents a generalized hydrogeologic cross section at

the vicinity of the Sherwood Site and Table 3 presents brief descriptions of the lithological units.

The surficial aquifer extends from the uppermost saturated sediments (typically less than 10 feet below ground surface) to the top of the first aquitard. The first aquitard is 25 to 50 feet thick near Kepler Road bordering the eastern edge of the site and 10 to 15 feet thick along the western property boundary near Lake Miller.

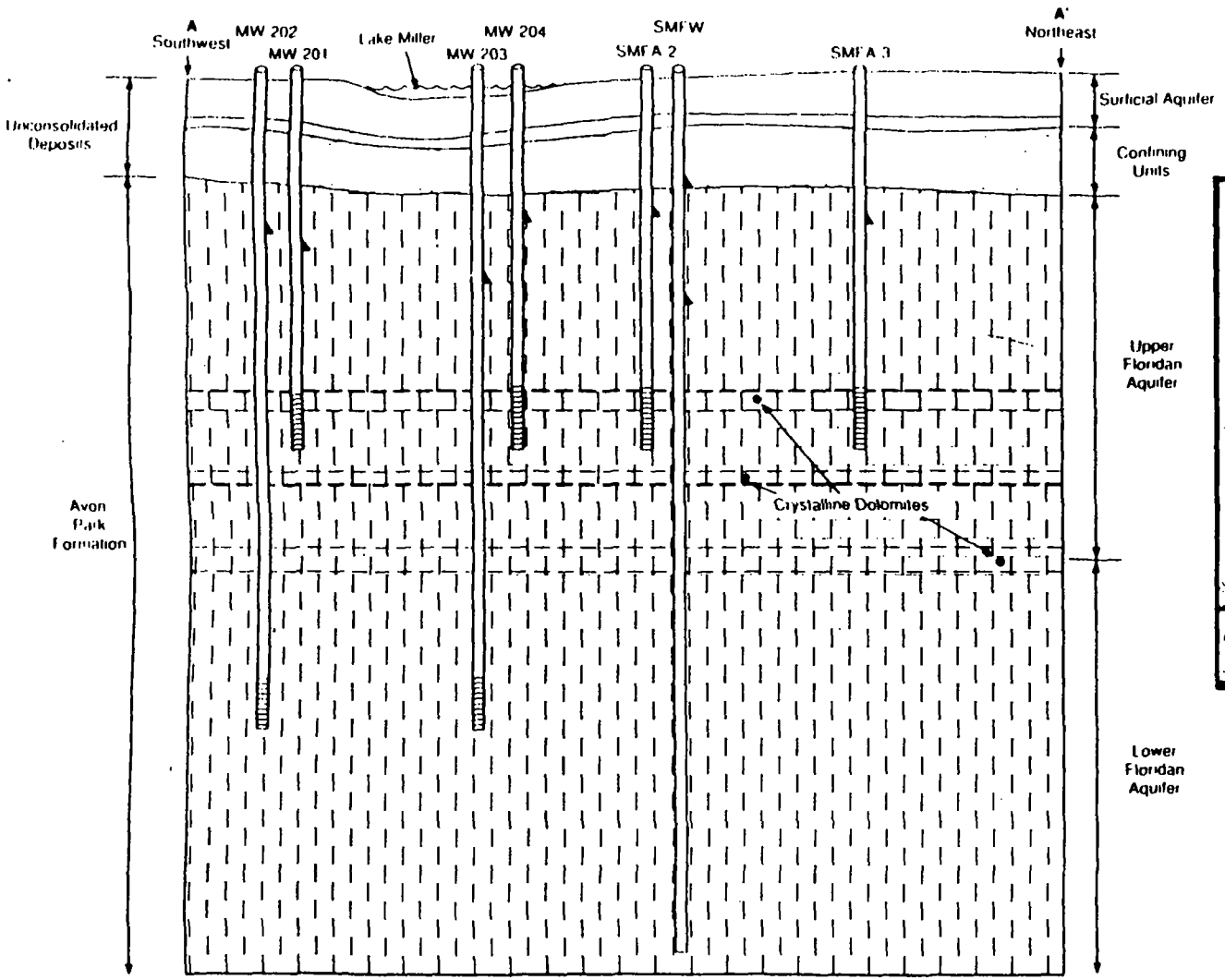
The confining unit underlying the surficial aquifer is comprised of a four to eight foot thick clay to sandy clay layer that overlies a 35 to 40 foot thick poorly sorted deposit of shells, sand, silt and clay. Collectively, these sediments serve to restrict the vertical movement of water from the surficial aquifer to the confined Floridan aquifer system below. Values for the hydraulic conductivity of the confining unit ranged from $3.3X10^{-5}$ to 0.02 ft/day.

The Upper Floridan Aquifer is highly productive and is the source of drinking water for most residents and municipalities in the DeLand area. The Upper Floridan Aquifer is recharged from the surficial aquifer.

6.2.4.1 Surficial Aquifer

Fourteen monitoring wells were installed in the surficial aquifer. Twelve of these were installed as part of the IRM Study and an additional two wells were installed during the RI activities. The analytical results of the IRM study revealed that the major contaminants were tetrachloroethene (PCE), trichloroethene (TCE), and acetone. Concentrations of other volatile organic compounds (VOCs) were also detected, but these concentrations were low compared to the concentrations of PCE and TCE. Analysis of the surficial aquifer concentrations of PCE ranged from 130 to 11,000 ppb and concentrations of TCE ranged from 16 to 420 ppb. The results indicated that generally the highest concentrations of VOCs were present on the downgradient side of the Site along Lake Miller. Figures 6 and 7 illustrate PCE and TCE isoconcentration contours in the surficial aquifer.

From groundwater depth measurements taken for the surficial aquifer, the RI determined that groundwater moves under the site from the Northeast corner across the Site southwest toward Lake Miller. Groundwater elevations fall approximately 12 feet from the Northeast corner of the Site to the edge of Lake Miller. Figure 8 illustrates the groundwater elevations in the surficial aquifer.



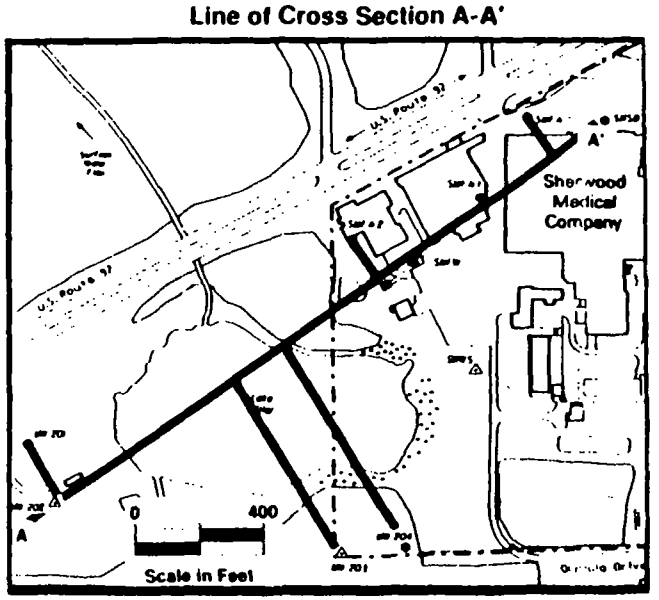


Figure 5 GENERALIZED HYDROGEOLOGIC CROSS SECTION AT THE SHERWOOD MEDICAL SITE

Table 3

Lithologic Units in the Vicinity of Sherwood Medical Company, De Land, Florida

Age	Unit	Thickness	Description	Water-Bearing Properties
Holocene to Pleistocene	Surficial Aquifer	30-55 ft	Unconsolidated fine to medium-grained sands and silty sands.	High primary porosity. Hydraulic conductivities (K) range from 0.001 to 3.5 ft/day.
Pliocene to Miocene	Confining Unit	35-55 ft	Unconsolidated clays to sandy clays overlying poorly sorted deposits of shells, sands, silts, and clays.	Low water-bearing capability. Serves to separate and confine the underlying Floridan aquifer system from the overlying surficial aquifer system. Hydraulic conductivities (K) range from 3.3×10^{-5} to 0.02 ft/day.
Mid-Eocene	Avon Park Formation* Upper and Lower Floridan Aquifer System	800-1,000 ft	White to tan to gray limestone and dolomite. Textures are widely variable from chalky to vuggy to densely crystalline. Commonly fossiliferous.	High secondary porosity through fractures, vugs, and solution openings (some primary porosity locally in Upper Floridan aquifer). Hydraulic conductivities (K) range from 15 ft/day.
Early Eocene	Oldsmar Formation	Beyond the depth of this investigation		

*The interbedded limestones and dolomites of Mid-Eocene age in peninsular Florida and southern Georgia are now referred to as the Avon Park Formation. The term "Lake City Limestone" has been abandoned, as these stratigraphic units cannot be distinguished from one another on the basis of either lithology or fauna, except locally (6).

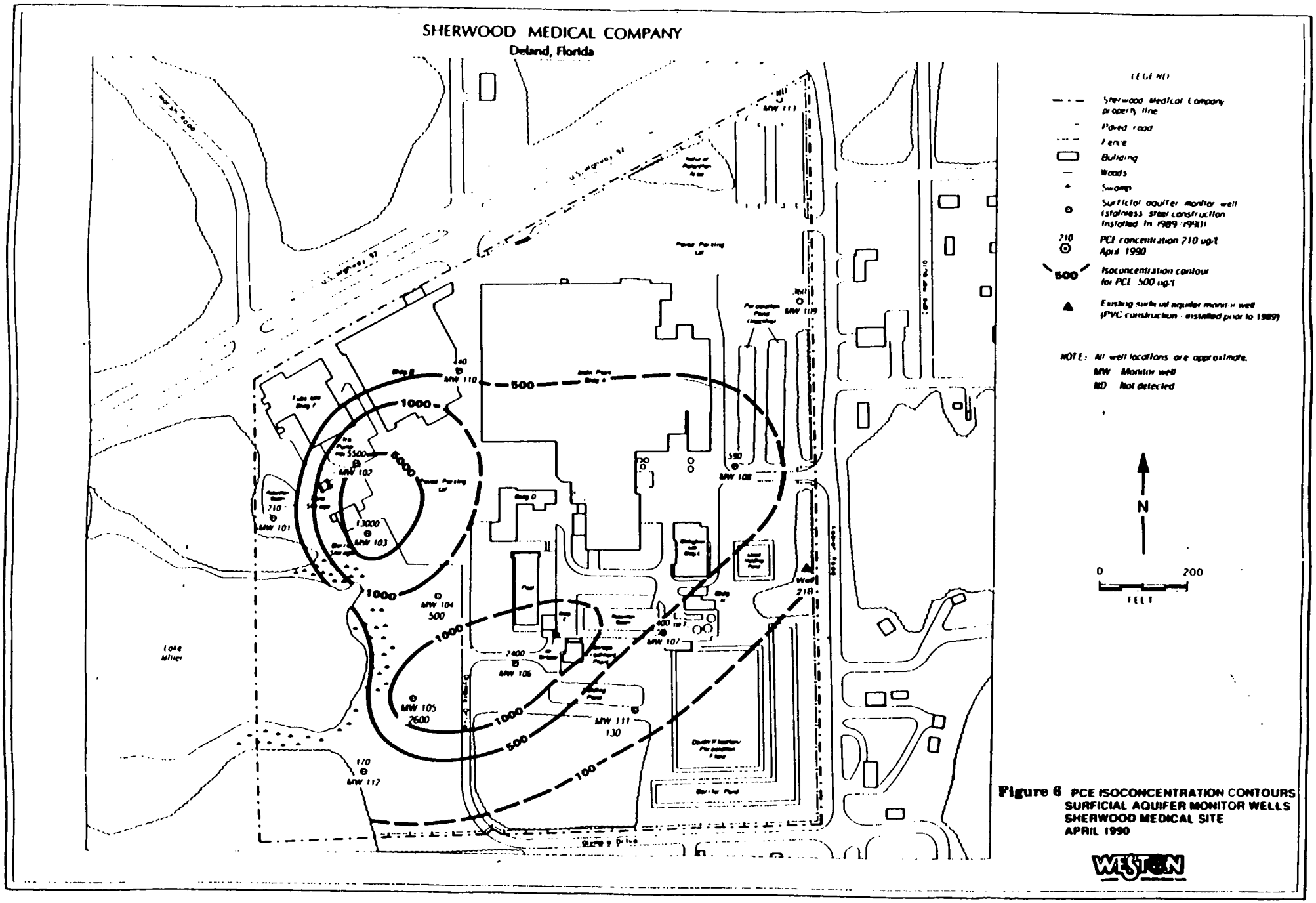


Figure 6 PCE ISOCONCENTRATION CONTOURS
SURFICIAL AQUIFER MONITOR WELLS
SHERWOOD MEDICAL SITE
APRIL 1990

WESTON

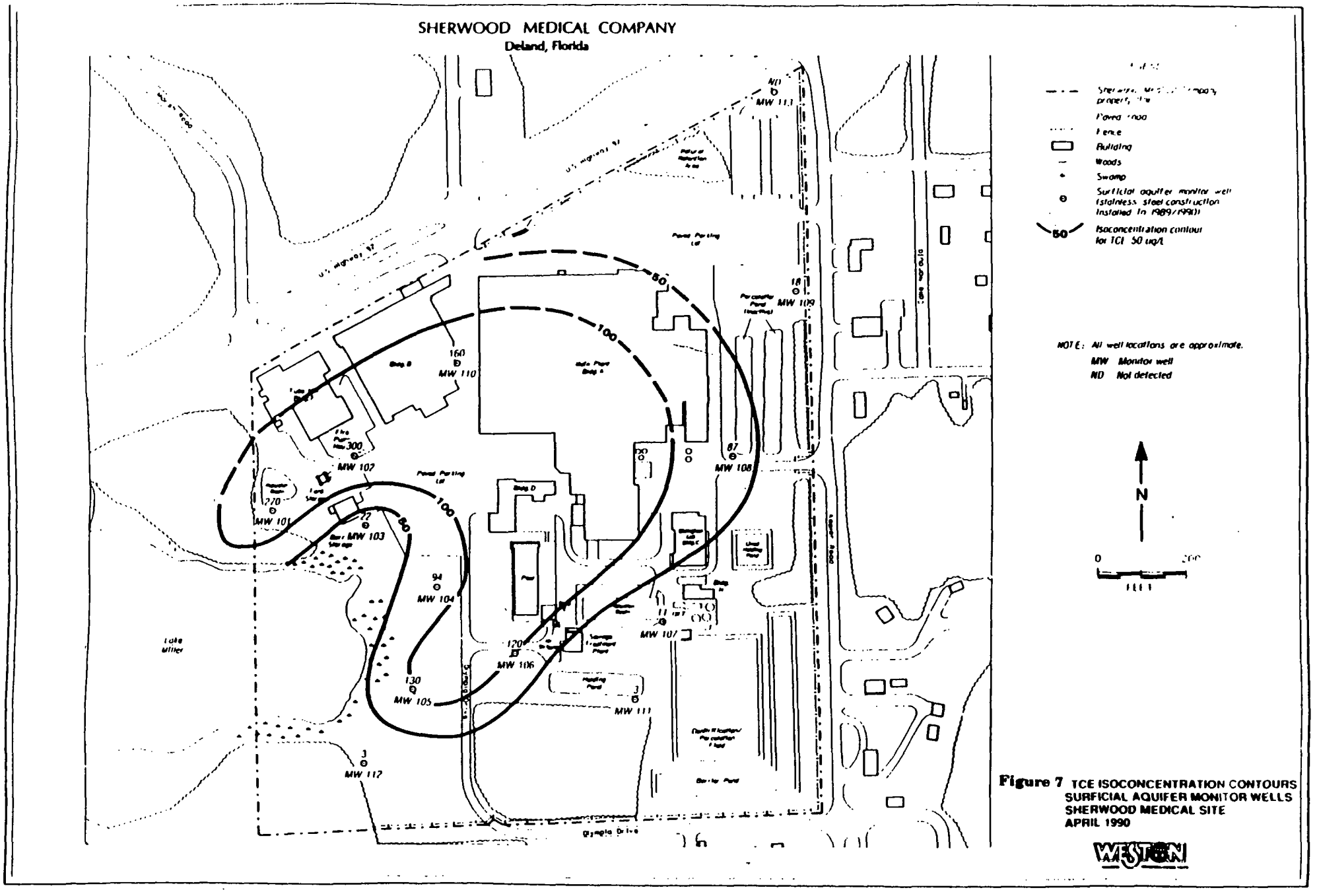


Figure 7 TCE ISOCONCENTRATION CONTOURS
SURFICIAL AQUIFER MONITOR WELLS
SHERWOOD MEDICAL SITE
APRIL 1990

WESTON

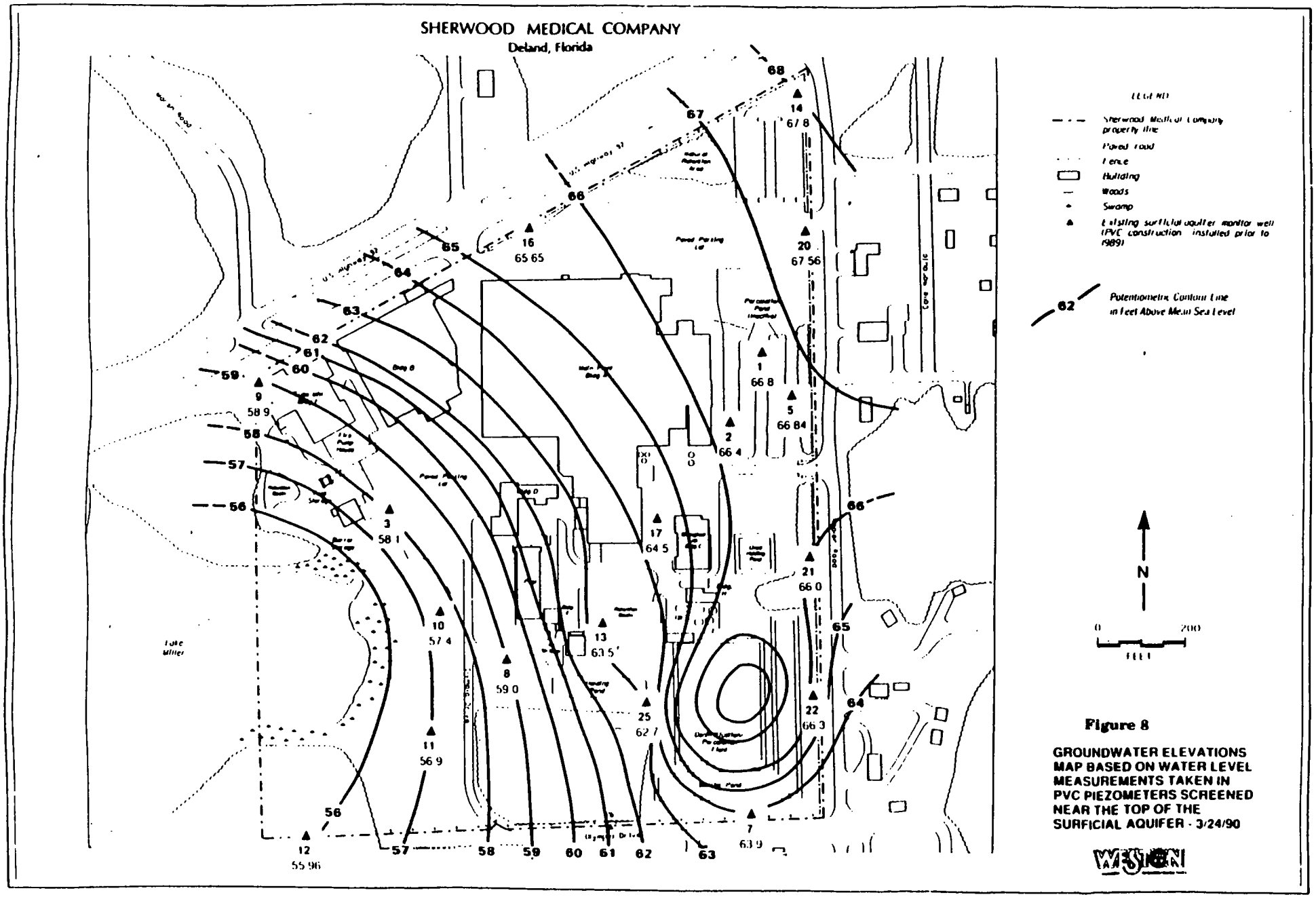


Figure 8

GROUNDWATER ELEVATIONS MAP BASED ON WATER LEVEL MEASUREMENTS TAKEN IN PVC PIEZOMETERS SCREENED NEAR THE TOP OF THE SURFICIAL AQUIFER - 3/24/90

6.2.4.2 Floridan Aquifer

Five off-site monitoring wells were drilled and installed into the Floridan aquifer in the vicinity of the Sherwood Site. Two of these were completed in the Upper Floridan Aquifer and three were completed in the Lower Floridan Aquifer. The purpose of these wells was to assess the extent of site contaminants present in the groundwater in the Floridan aquifer beneath the site.

Previously existing wells also provided data for the RI. These wells included six off-site residential wells. The off-site wells have been sampled semi-annually to ensure that off-site migration is not occuring. VOCs were identified in one off-site private well. That well was plugged and abandoned. A new replacement well installed during the IRM activities has been sampled and has not shown elevated levels of VOCs.

Three on-site, out of service, water supply wells (SMFA 1-3) were also sampled to determine contaminant migration pathways in the Upper Floridan Aquifer. Site related VOCs were identified in one of these wells (SMFA 1). This well was later converted to a stainless stell monitoring well as part of the interim action. Since the conversion, the levels of TCE and PCE have declined indicating that breaches in the well casing were responsible for migration of contaminants in the surficial aquifer. The other two wells sampled did not show TCE and PCE contamination above the quantification limit. However, samples drawn from these wells did contain elevated levels of acetone in one round of sampling.

Sherwood's water supply well (SMWS) and fire well (SMFW), which are open in both the Upper and Lower Floridan Aquifer, were also sampled for the RI. Site related VOCs were detected in isolated groundwater samples collected from Lower Floridan aquifer during a packer test and a pump test. Testing indicated that improper well construction or deteriorated casings were the cause of the VOC contamination in the Lower Floridan Aquifer. These wells were also rehabilitated as part of IRM activities. Subsequent sampling indicates that well casing rehabilitation was effective in preventing further migration of VOCs from the surficial into the Floridan Aquifer.No site related VOCs have been detected in the off-site monitor wells completed in the Lower Floridan aquifer.

Floridan Aquifer groundwater elevations in the vicinity of the Site show a substantial area of convergent flow that has been created as a result of on-site pumping from wells SMWS and SMSB and from downward borehole flows SMWS and SMFW. Groundwater flow direction in the Upper Floridan aquifer in the area of and around the Sherwood Medical Site is toward the on-site Water Supply well from all directions. Figure 9, illustrates groundwater elevations in the Upper Floridan Aquifer.

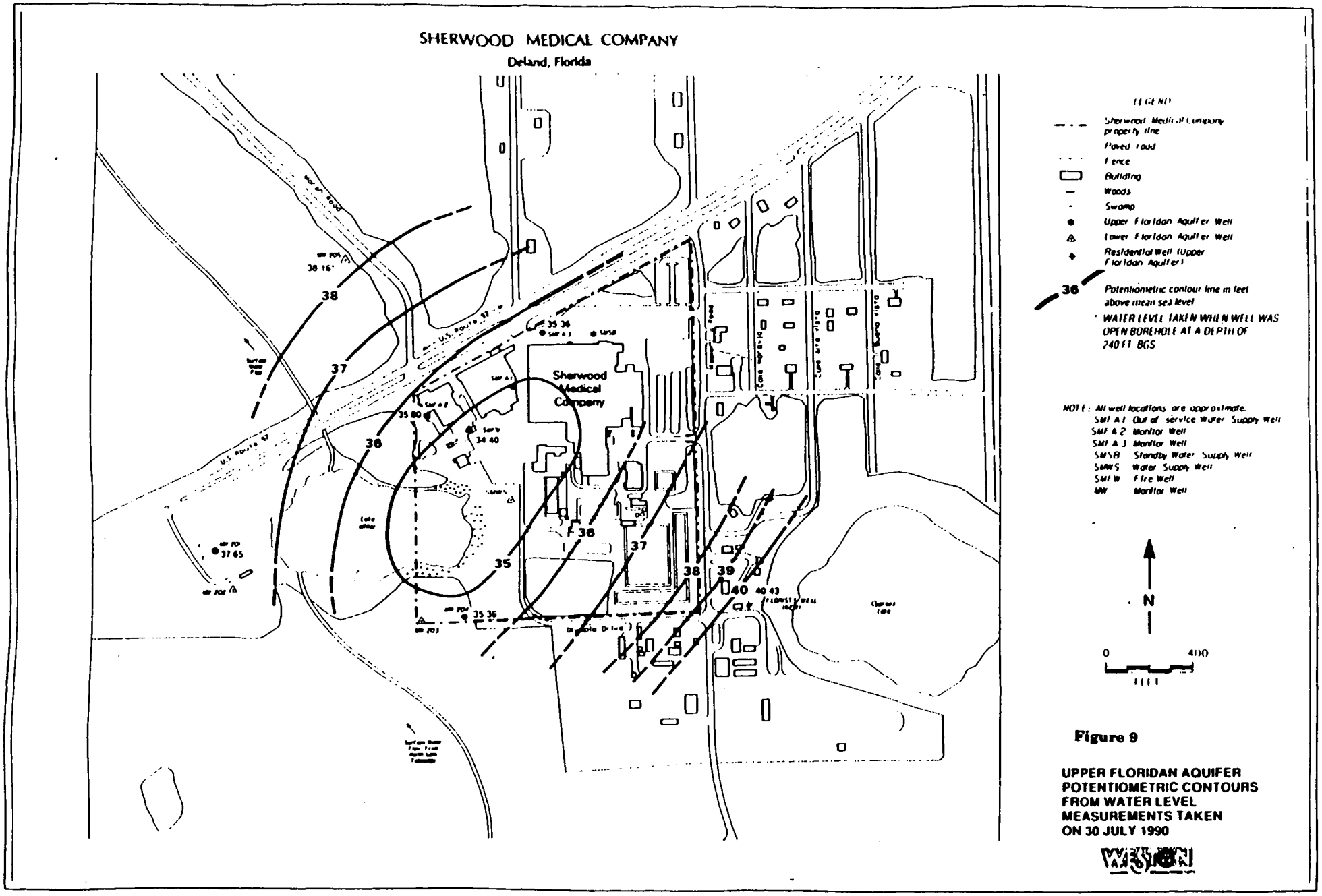


Figure 9

UPPER FLORIDAN AQUIFER POTENTIOMETRIC CONTOURS FROM WATER LEVEL MEASUREMENTS TAKEN ON 30 JULY 1990

6.2.5 Air

The primary concern at the Sherwood Medical Site is the presence of site related substances in various environmental media, predominantly in the groundwater. There are no significant levels of VOC in the soils at the Site there which would act as a source of VOC emissions to the air.

7.0 SUMMARY OF SITE RISKS

CERCLA as amended by SARA establishes a national program for responding to releases of hazardous substances into the environment. The NCP, which is the regulation that implements CERCLA, establishes the overall approach for determining appropriate remedial actions at Superfund sites. The overall mandate of the Superfund program is to protect human health and the environment from current and future threats posed by uncontrolled hazardous substance releases.

A Baseline Risk Assessment represents an evaluation of the "No Action" alternative, in that it identifies the risk present if no remedial action is taken. The assessment considers environmental media and exposure pathways that could result in unacceptable levels of exposure now or in the foreseeable future. Data collected and analyzed during the RI provided the basis for the four components: contaminant identification, exposure assessment, toxicity assessment, and risk characterization.

7.1 Contaminant Identification

Sampling data from the various environmental media at the Site (soils, sediments, surface water, and groundwater) were examined and compiled to produce a list of all contaminants. This list was reduced according to the Risk Assessment Guidance for Superfund: Volume 1; Human Health Evaluation Manual (RAGS: EPA/540/1-89/002) methodologies.

Data evaluated included the results of soil samples analyzed in February and August 1990, and surface water and sediment samples analyzed in April 1990, August 1990, and November 1991. Groundwater samples from the surficial wells in March 1989 through the end of 1991, and from the Upper Floridan and mixed Lower/Upper Floridan wells in April 1990 through the end of 1991, were also included.

Data gathered during the RI for all environmental media was analyzed to determine the nature and extent of contamination for the Site. All organic contaminants identified in any media were retained for further consideration. Because inorganic constituents occur naturally in the environment, only those that

exceeded background concentrations were retained for further consideration. Background comparisons were conducted in accordance with guidance from EPA Region IV. An inorganic chemical was retained for further consideration if the mean (or maximum) concentration in Site samples was more than two times higher than the corresponding background mean (or maximum) concentration.

The form of chromium (hexavalent verses trivalent) was investigated through the collection of four surficial soil samples in areas with elevated chromium levels. The results of the analysis suggested that hexavalent chromium (chromium VI) was not present at concentrations at or above the detection limit of 2.5 mg/Kg. Total chromium was reported in these samples at concentrations ranging from 2.2 mg/Kg to 318 mg/Kg. Based on these results it was assumed in the Risk Assessment that the chromium present in soil, as well as in other site associated media is present as trivalent chromium. Under most environmental conditions, chromium VI is usually converted to chromium III. Also, chromium III does not readily convert to chromium VI. Based on results of the Baseline Risk Assessment Chromium III, does not contribute to risk above the EPAs level of concern for carcinogenic or non-carcinogenic effects.

Tables 4 through 9 present the data summary for each of the chemical constituents identified in a particular environmental media. The Upper 95% Confidence Limit of the Mean represents the assumed Exposure Point concentration or Reasonable Maximum Exposure level for that specific contaminant in the given environmental media.

7.2 Exposure Assessment

The objectives of the exposure assessment are to develop exposure scenarios and to calculate exposure doses to the selected potential receptors. The scenarios are based on both current and potential or hypothetical future land and water uses. Doses are calculated on the assumption that no additional remediation would be performed at the facility.

The Sherwood Medical Site is zoned industrial. The land surrounding the Sherwood Site is best described as semirural. Although it is not a part of the incorporated City of DeLand, the site is located close enough to this and other communities so that residential housing tracts extend into the northern and eastern areas abutting the Site. The presence of a wooded,

Table 4

Surface Soil

Data Summary

Chemical	Frequency of Detection	Range of Sample Quantitation Limits (mg/kg)	Range of Concentrations (mg/kg)	Mean Concentration (mg/kg)	Upper 95% Confidence Limit of the Mean (mg/kg)
Organics					
Acetone	28/35	0.01-0.011	0.007J-2.2	0.24	0.39
2-Butanone	5/35	0.01-0.012	0.009J-0.062	0.0077	0.010
Carbon Disulfide	2/35	0.005-0.006	0.002J-0.006	0.0021	0.0023
Ethylbenzene	9/35	0.005-0.006	0.002J-0.007	0.0026	0.0030
Methylene Chloride	24/35	0.005-0.006	0.002J-0.052	0.0078	0.011
Tetrachloroethene	15/35	0.005-0.006	0.001J-0.38	0.027	0.051
Toluene	15/35	0.005-0.006	0.002J-0.019	0.0028	0.0039
1,1,1-Trichloroethane	8/35	0.005-0.006	0.003J-0.013	0.0038	0.0045
Trichloroethene	4/35	0.005-0.006	0.003J-0.010	0.0025	0.0030
Xylenes (total)	17/35	0.005-0.006	0.002J-0.022	0.0051	0.0069
Inorganics					
Arsenic	11/43	0.17-0.44	0.17-1.7	0.22	0.30
Chromium	39/42	2.0-2.1	1.6-366	18.1	32.5

J = Estimated value.

Table 5

Surface Water - Lake Miller

Data Summary

Chemical	Frequency of Detection	Range of Sample Quantitation Limits (mg/L)	Range of Concentrations (mg/L)	Mean Concentration (mg/L)	Upper 95% Confidence Limit of the Mean (mg/L)
Organics					
Acetone	4/5	0.0050-0.042	0.007J-0.008J	0.014[a]	0.027[a]
Bis (2-ethylhexyl) phthalate	2/5	0.0010	0.004J-0.011J	0.0036	0.0073
1,1-Dichloroethene	1/5	0.0025	0.005	0.003	0.004
1,2-Dichloroethene (total)	3/5	0.0025	0.003J-0.19	0.041	0.11
Methylene Chloride	1/5	0.0025	0.003J	0.0026	0.0028
Tetrachloroethene	3/5	0.0025	0.003J-0.004J	0.0032	0.0039
Toluene	1/5	0.0025	0.003J	0.0026	0.0028
Trichloroethene	3/5	0.0025	0.003J-0.12	0.026	0.071
Vinyl Chloride	1/5	0.0050	0.025	0.009	0.017
Xylenes (total)	1/5	0.0010-0.0025	0.001J	0.0013[a]	0.0019[a]
Inorganics					
Aluminum	14/14	0.10	0.14-1.3	0.26	0.39
Arsenic	1/14	0.0010-0.0050	0.0047	0.0048[a]	0.0049[a]
Barium	1/14	0.025-0.10	0.073	0.073	0.075[a]
Cadmium	13/14	0.0003-0.0004	0.0004-0.0023	0.0006	0.0009
Chromium	2/14	0.0050-0.010	0.0063-0.19	0.019	0.041
Copper	1/14	0.0050-0.0125	0.12	0.017	0.029
Iron	14/14	0.050	0.16-2.9	0.38	0.72
Lead	7/14	0.0010-0.0050	0.0033-0.029	0.0051	0.0082
Mercury	1/14	0.0001	0.0003	0.0001	0.0001
Nickel	1/14	0.0050-0.020	0.016	0.013	0.013
Vanadium	1/14	0.0050-0.025	0.025	0.024	0.025
Zinc	4/14	0.0050-0.015	0.014-0.28	0.032	0.065

[a]Exceeds the maximum concentration.
J = Estimated value.

Table 6

Sediment — Lake Miller

Data Summary

Chemical	Frequency of Detection	Range of Sample Quantitation Limits (mg/kg)	Range of Concentrations (mg/kg)	Mean Concentration (mg/kg)	Upper 95% Confidence Limit of the Mean (mg/kg)
Organics					
Acetone	6/6	NAV	0.13-9.5	2.5	5.2
Benzoic Acid	2/6	1.6	1.6-1.9J	1.6	1.7
Bis(2-ethylhexyl) phthalate	2/6	0.059-1.3	1.6J-11J	2.2	5.5
2-Butanone	3/6	0.020-0.19	0.047-0.17	0.072	0.12
Chloromethane	1/6	0.02-0.12	0.14J	0.043	0.081
4,4'-DDT	1/6	0.038-0.041	0.038J	0.035	0.041[b]
1,1-Dichloroethane	1/6	0.013-0.06	0.019J	0.019	0.032[b]
1,1-Dichloroethene	2/6	0.01-0.093	0.01J-0.02	0.020	0.032[b]
1,2-Dichloroethene (total)	4/6	0.06-0.093	0.078-0.46	0.20	0.34
Ethylbenzene	2/6	0.015-0.020	0.013J-0.041J	0.014	0.024
Methylene Chloride	5/6	0.015	0.021-0.22	0.092	0.16
4-Methylphenol	1/6	0.29-18.0	0.29J	1.7[b]	4.4[b]
Tetrachloroethene	3/6	0.01-0.093	8.3-30.0	8.6	17.4
Toluene	5/6	0.093	0.007J-0.11	0.049	0.082
Trichloroethene	4/6	0.06-0.093	0.002J-8.8	2.7	5.3
Vinyl Chloride	2/6	0.02-0.19	0.036-0.051	0.045	0.068[b]
Xylenes (total)	5/6	0.093	0.007J-0.0074	0.037	0.061[b]
Inorganics					
Aluminum	20/20	NAV	1,330-14,100	9,290	10,800
Arsenic	16/20	0.58-6.8	0.75-5.4	2.9	3.5
Cadmium	15/20	0.44-4.5	0.53-2.7	0.56	1.6
Calcium	19/20	2,390	500-39,870	13,100	16,300

Table 6 (con't)

Sediment — Lake Miller

Data Summary (continued)

Chemical	Frequency of Detection	Range of Sample Quantitation Limits (mg/kg)	Range of Concentrations (mg/kg)	Mean Concentration (mg/kg)	Upper 95% Confidence Limit of the Mean (mg/kg)
Chromium	20/20	NAV	4.9-922	237	332
Copper	16/20	1.7-22.5	10.2-132	44.0	57.1
Iron	20/20	NAV	222-9,870	6,070	7,210
Lead	20/20	NAV	2.7-228	82.3	102
Magnesium	19/20	2,390	85.8-1,400	1,000	1,170
Nickel	14/20	1.7-34.3	5.3-25.8	13.1	15.6
Potassium	17/20	60-2,390	144-917	516	620
Sodium	19/20	2,390	21.1-869	505	606
Vanadium	15/20	0.87-23.9	2.7-20.0	12.5	14.8
Zinc	20/20	NAV	2.2-300	143	177

J = Estimated value.
NAV = Sample quantitation limits or method detection limits were not available.

Table 7

Groundwater — Surficial Aquifer

Data Summary

Chemical	Frequency of Detection	Range of Sample Quantitation Limits (mg/L)	Range of Concentrations (mg/L)	Mean Concentration (mg/L)	Upper 95% Confidence Limit of the Mean (mg/L)
Organics					
Acetone	13/13	0.01[a]	0.0065-7.0	1.0	2.1
Benzene	2/13	0.005-0.012	0.0025-0.016	0.0039	0.0056
2-Butanone	2/13	0.01-0.023	0.0042-0.0098	0.0058	0.0069
Carbon Disulfide	1/13	0.005-0.012	0.0044J	0.0029	0.0034
Chloroform	1/13	0.005-0.012	0.0073	0.0033	0.0040
1,1-Dichloroethane	2/13	0.004-0.0063	0.0022J-0.0053J	0.0024	0.0029
1,1-Dichloroethene	4/13	0.005	0.0020J-0.0055J	0.0026	0.0031
1,2-Dichloroethene (Total)	10/13	0.005	0.0064-0.064	0.019	0.029
Ethylbenzene	1/13	0.005-0.012	0.0080	0.0033	0.0041
Methylene Chloride	6/13	0.0037-0.082	0.0023J-0.0073J	0.0031	0.0040
Tetrachloroethene	13/13	0.005[a]	0.0025-10.1	1.7	3.2
Toluene	4/13	0.0047-0.012	0.0023J-0.052	0.0068	0.013
1,1,1-Trichloroethane	4/13	0.0047-0.012	0.0023J-0.0028	0.0028	0.0032[b]
Trichloroethene	13/13	0.005[a]	0.0025-0.31	0.092	0.14
Vinyl Chloride	3/13	0.01-0.017	0.0057J-0.014J	0.0064	0.0077
Xylenes (Total)	1/13	0.005-0.012	0.045	0.0062	0.012
Inorganics					
Arsenic	9/13	0.0027-0.09	0.0033-0.072	0.017	0.028
Cadmium	4/13	0.004-0.0069	0.0032-0.0050	0.0028	0.0033
Chromium	11/13	0.017	0.01-0.28	0.053	0.091
Magnesium	13/13	0.2[a]	1.1-5.6	2.5	3.3
Manganese	13/13	0.01[a]	0.011-0.097	0.031	0.043

Table 7 (con't)

Groundwater – Surficial Aquifer

Data Summary (Continued)

Chemical	Frequency of Detection	Range of Sample Quantitation Limits (mg/L)	Range of Concentrations (mg/L)	Mean Concentration (mg/L)	Upper 95% Confidence Limit of the Mean (mg/L)
Nickel	8/13	0.02-0.054	0.015-0.16	0.040	0.061
Potassium	13/13	0.2[a]	1.3-65.9	7.5	15.9
Silver	2/13	0.023-0.03	0.012-0.015	0.012	0.013
Sodium	13/13	0.05-0.2[a]	12.6-178	69.0	93.8

[a]Method detection limit.
[b]Exceeds the maximum concentration.
J = Estimated value

Table 8

Groundwater - Upper Floridan Aquifer

Data Summary

Chemical	Frequency of Detection	Range of Sample Quantitation Limits (mg/L)	Range of Concentrations (mg/L)	Mean Concentration (mg/L)	Upper 95% Confidence Limit of the Mean (mg/L)
Organics					
Acetone	3/4	0.01	0.014-31.0	12.0	27.3
Bis (2-ethylhexyl) phthalate	2/3	0.006	0.006J-0.007J	0.0053[a]	0.0082[a]
Carbon Disulfide	2/4	0.005	0.031-0.035	0.018	0.036[a]
alpha-Chlordane	2/4	0.00045-0.0011	0.00024-0.00061	0.00040	0.00061
4,4'-DDE	1/4	0.00009-0.00022	0.00008	0.00007	0.00010[a]
1,2-Dichloroethene (Total)	2/4	0.005	0.0048J-0.0053	0.0038	0.0053
Heptachlor	2/4	0.000045-0.00011	0.000027J-0.000053	0.000039	0.000056[a]
Tetrachloroethene	1/4	0.005	0.20	0.052	0.15
1,1,1-Trichloroethane	1/4	0.005	0.0058	0.0033	0.0050
Trichloroethene	1/4	0.005	0.069	0.019	0.053
Inorganics					
Cadmium	2/4	0.004-0.0045	0.0031-0.0041	0.0029	0.0039
Chromium	2/4	0.02	0.050-0.055	0.031	0.056[a]
Iron	4/4	0.03[b]	0.16-0.87	0.45	0.76
Lead	3/4	0.002-0.05[b]	0.0025-0.15	0.053	0.12
Nickel	1/4	0.02	0.033	0.016	0.028
Potassium	4/4	0.20[b]	0.91-36.9	10.1	28.3
Zinc	3/4	0.01	0.069-0.15	0.091	0.16[a]

[a]Exceeds the maximum concentration.
[b]Method detection limit.

Table 9

Groundwater - Mixed Lower/Upper Floridan Aquifers

Data Summary

Chemical	Frequency of Detection	Range of Sample Quantitation Limits (mg/L)	Range of Concentrations (mg/L)	Mean Concentration (mg/L)	Upper 95% Confidence Limit of the Mean (mg/L)
Organics					
1,2-Dichloroethene (total)	1/2	0.005	0.014	0.008	0.033[a]
Tetrachloroethene	1/2	0.005	0.041	0.022	0.11[a]
Trichloroethene	1/2	0.005	0.054	0.028	0.14[a]
Inorganics					
Cadmium	1/2	0.005	0.11	0.056	0.30[a]
Potassium	1/2	2.0	49.4	25.2	133[a]
Sodium	2/2	0.05-0.2[b]	8.6-27.8	18.2	61.1[a]
Zinc	1/2	0.01	0.13	0.068	0.35[a]

[a]Exceeds the maximum concentration.
[b]Method detection limit.

swampy area to the south of the Site limits residential development, and a single resident owns a large tract of land to the west of the site. The topography of the area is essentially flat as the site is within the coastal plain of the Atlantic Ocean.

The current potentially exposed populations include the workers (700-900 employees) at the operating facility and residents living in housing tracts located to the east of the site. There are no residents living to the south of the site, although there is a maintenance facility operated by the Florida Department of Transportation on the southeast corner. U.S. Highway 92 borders the northern portion of the site, and a residential area is located on the north side of the highway. Groundwater from the Upper Floridan and Lower Floridan Aquifers is utilized for drinking and domestic purposes in the area. Several residents surrounding the Sherwood Site have private wells which are screened in the Upper Floridan Aquifer. In addition, Sherwood Medical draws 175,000 gallons per day from their on-site water supply well screened in the Upper Floridan Aquifer. This water is treated prior to use in the plant with an on-site air stripper. Sherwood Medical expects to remain on-site and continue current operations for the foreseeable future. However, a future land use scenario for an on-site resident was evaluated.

7.2.1 Current and Future Exposure Scenarios

Table 10 summarizes the evaluated exposure scenarios for the Site. The receptor, exposure frequency, medium, and exposure routes are listed for all of the current use and future use scenarios.

The current use scenarios were based on limited access to the site due to the presence of an 8 foot security fence and a 24 hour guard. The future use scenarios were based on the assumption that the site would be developed for residential use. In both the current and future resident scenarios, it is assumed that the resident is exposed to contaminants for 30 years, 6 years as a child and 24 years as an adult. An individual who works at the Sherwood facility 250 days/year for 25 years is evaluated in the worker scenario.

Both the trespasser and swimmer are assumed to be an adolescent, aged 10 to 18 years. It is assumed that a trespasser, or a swimmer in a relatively inaccessible surface water body such as Lake Miller, most likely would be in this age range. The trespasser is assumed to be on the site 1 day/month, 12 months/year or 12 events per year. The swimmer is assumed to use Lake Miller for 78 swimming events per year. Swimming in Lake Miller is considered as a future use scenario because swimming is not known to currently occur in Lake Miller. Exposure to

Table 10

Exposure Scenarios Evaluated for the Sherwood Medical Site

Scenario/Receptor	Exposure Frequency* and Duration	Medium	Exposure Route
Current Use			
Offsite Resident	350 days/year; 30 years	Air	Inhalation of fugitive dust.
		Surface Water	Ingestion of recreationally caught fish.
Onsite Worker	250 days/year; 25 years	Air	Inhalation of fugitive dust.
		Soil	Incidental soil ingestion; dermal contact with soil.
Future Use			
Onsite Resident	350 days/year; 30 years	Air	Inhalation of fugitive dust.
		Soil	Incidental soil ingestion; dermal contact with soil; ingestion of homegrown fruits/vegetables.
		Groundwater	Drinking water ingestion; noningestion household uses; ingestion of homegrown fruits/vegetables irrigated with groundwater; incidental water ingestion from swimming pool; dermal contact with water in swimming pool.
		Surface Water	Ingestion of recreationally caught fish.
Trespasser	12 days/year; 9 years	Air	Inhalation of fugitive dust.
		Soil	Incidental soil ingestion; dermal contact with soil.
Swimmer (Lake Miller)	78 days/year; 9 years	Surface Water	Incidental water ingestion; dermal contact with water.
		Sediment	Incidental sediment ingestion; dermal contact with sediment

*Exposure frequency may differ for some exposure routes.

chemicals through the incidental ingestion of water, dermal contact with water, incidental ingestion of sediment, and dermal contact with sediment while swimming are exposure pathways evaluated for an individual aged 10 to 18 years assumed to swim.

Future use scenarios have assumed residential use for the land which is now occupied by Sherwood Medical. However, Sherwood Medical has no plans to abandon manufacturing activities in the foreseeable future.

7.3 Toxicity Assessment

Slope factors (SFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic contaminant(s) of concern. SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans).

Reference doses (RFD's) have been developed by EPA for indicating the potential for adverse health effects from exposure to contaminant(s) of concern exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of contaminant(s) of concern ingested from contaminated drinking water can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans).

Cancer Slope Factors and Chronic Reference Doses are included in Tables 11 and 12 respectively. It should be noted that dermal Cancer Slope Factors as well as dermal Chronic RfDs have not been developed. Therefore, a dermal slope factor was derived for each applicable chemical, in accordance with EPA guidance. Likewise, chronic dermal RfDs were derived for the chemicals of concern, in accordance with EPA established guidelines.

Table 11

Cancer Slope Factors (CSFs)
(mg/kg-day)$^{-1}$

Chemical	EPA Categorization[a]	Inhalation Route	Reference or Basis	Oral Route	Reference or Basis	Dermal Route[b]
Organics						
Benzene	A	2.9E-02[c]	IRIS, 1992	2.9E-02	IRIS, 1992	3.2E-02 (V)
Bis(2-ethylhexyl)phthalate	B2	NC	---	1.4E-02	IRIS, 1992	2.8E-02 (SV)
alpha-Chlordane	B2	NC	---	1.3E+00	IRIS, 1992	2.6E+00 (SV)
Chloroform	B2	8.1E-02[c]	IRIS, 1992	6.1E-03	IRIS, 1992	6.8E-03 (V)
Chloromethane	C	NC	---	1.3E-02	EPA, 1991a	1.4E-02 (V)
4,4'-DDE	B2	NC	---	3.4E-01	IRIS, 1992	6.8E-01 (SV)
4,4'-DDT	B2	NC	---	3.4E-01	IRIS, 1992	6.8E-01 (SV)
1,1-Dichloroethane	C	NTV	---	NTV	---	NTV
1,1-Dichloroethene	C	1.8E-01[c]	IRIS, 1992	6.0E-01	IRIS, 1992	6.7E-01 (V)
Heptachlor	B2	4.6E+00[c]	IRIS, 1992	4.5E+00	IRIS, 1992	9.0E+00 (SV)
Methylene Chloride	C	1.6E-03[c]	IRIS, 1992	7.5E-03	IRIS, 1992	8.3E-03 (V)
4-Methylphenol	C	NC	---	NTV	---	NTV
Tetrachloroethene	B2	1.8E-03[c]	EPA, 1991a	5.1E-02	EPA, 1991a	5.7E-02 (V)
Trichloroethene	B2	1.7E-02	EPA, 1991a	1.1E-02	EPA, 1991a	1.2E-02 (V)
Vinyl Chloride	A	2.9E-01[c]	EPA, 1991a	1.9E+00	EPA, 1991a	2.1E+00 (V)
Inorganics						
Arsenic	A	1.5E+01[c]	IRIS, 1992	1.8E+00	IRIS, 1992	3.6E+01 (I)

Table 11 (con't)

Cancer Slope Factors (CSFs)
$(mg/kg\text{-}day)^{-1}$
(Continued)

Chemical	EPA Categorization[a]	Inhalation Route	Reference or Basis	Oral Route	Reference or Basis	Dermal Route[b]
Cadmium	B1[d]	NC	---	NA	---	NA
Lead	B2	NC	---	NTV	---	NTV
Nickel	A[d]	NC	---	NA	---	NA

[a]Reference: EPA, 1991a.
Group A - Human carcinogen
B1 - Probable human carcinogen
B2 - Probable human carcinogen
C - Possible human carcinogen

[b]Dermal CSFs were derived for volatile organics (V), semivolatile organics (SV), and inorganics (I) from the oral CSFs as described in Subsection 6.2.3.2.
[c]Converted from a unit risk by assuming the inhalation of 20 m^3 of air/day and a body weight of 70 kg.
[d]Categorized as a carcinogen through the inhalation route only.

NA = Not applicable. Chemical is not categorized as a carcinogen through this exposure route.
NC = Chemical is not of concern through this exposure route.
NTV = No toxicity value was available.

Table 12

Chronic Reference Doses (RfDs)
(mg/kg-day)

Chemical	Inhalation Route	Reference or Basis	Oral Route	Reference or Basis	Dermal Route[a]
Organics					
Acetone	5.1E+00	ACGIH-TWA	1.0E-01	IRIS, 1992	9.0E-02 (V)
Benzene	9.1E-02	ACGIH-TWA	1.0E-03	Derived	9.0E-04 (V)
Benzoic Acid	NC	--	4.0E+00	IRIS, 1992	2.0E+00 (SV)
Bis(2-ethylhexyl)phthalate	NC	--	2.0E-02	IRIS, 1992	1.0E-02 (SV)
2-Butanone	9.0E-02	EPA, 1991a	5.0E-02	EPA, 1991a	4.5E-02 (V)
Carbon Disulfide	2.9E-03[b]	EPA, 1991a	1.0E-01	IRIS, 1992	9.0E-02 (V)
alpha-Chlordane	NC	--	6.0E-05	IRIS, 1992	3.0E-05 (SV)
Chloroform	1.4E-01	ACGIH-TWA	1.0E-02	IRIS, 1992	9.0E-03 (V)
Chloromethane	NC	--	2.3E-01	Derived	2.1E-01 (V)
4,4'-DDE	NC	--	5.0E-04[c]	IRIS, 1992	2.5E-04 (SV)
4,4'-DDT	NC	--	5.0E-04	IRIS, 1992	2.5E-04 (SV)
1,1-Dichloroethane	2.3E+00	ACGIH-TWA	1.0E-01	IRIS, 1992	9.0E-02 (V)
1,1-Dichloroethene	5.7E-02	ACGIH-TWA	9.0E-03	IRIS, 1992	8.1E-03 (V)
1,2-Dichloroethene (total)	2.3E+00	ACGIH-TWA	1.0E-02[d]	EPA, 1991a	9.0E-03 (V)
Ethylbenzene	2.9E-01[b]	IRIS, 1992	1.0E-01	IRIS, 1992	9.0E-02 (V)
Heptachlor	1.4E-03	ACGIH-TWA	5.0E-04	IRIS, 1992	2.5E-04 (SV)
Methylene Chloride	8.6E-01[b]	EPA, 1991a	6.0E-02	IRIS, 1992	5.4E-02 (V)
4-Methylphenol	NC	--	5.0E-02	EPA, 1991a	2.5E-02 (SV)

Table 12 (con't)

Chronic Reference Doses (RfDs)
(mg/kg-day)
(Continued)

Chemical	Inhalation Route	Reference or Basis	Oral Route	Reference or Basis	Dermal Route[a]
Tetrachloroethene	9.7E-01	ACGIH-TWA	1.0E-02	IRIS, 1992	9.0E-03 (V)
Toluene	5.7E-01	EPA, 1991a	2.0E-01	IRIS, 1992	1.8E-01 (V)
1,1,1-Trichloroethane	3.0E-01	EPA, 1991a	9.0E-02	EPA, 1991a	8.1E-02 (V)
Trichloroethene	7.7E-01	ACGIH-TWA	7.4E-03	EPA, 1991a	6.7E-03 (V)
Vinyl Chloride	3.7E-02	ACGIH-TWA	1.3E-03	Derived	1.2E-03 (V)
Xylenes (total)	8.6E-02[b]	EPA, 1991a	2.0E+00	IRIS, 1992	1.8E+00 (V)
Inorganics					
Aluminum	NC	--	1.9E-02	Derived	9.5E-04 (I)
Arsenic	5.7E-04	ACGIH-TWA	3.0E-04	IRIS, 1992	1.5E-05 (I)
Barium	NC	--	7.0E-02	IRIS, 1992	NC
Cadmium	NC	--	5.0E-04 (water)[c] 1.0E-03 (food)	IRIS, 1992	5.0E-05[f] (I)
Calcium	NC	--	1.1E+01	Derived	5.5E-01 (I)
Chromium (III)	5.7E-07[b]	EPA, 1991a	1.0E+00	EPA, 1991a	5.0E-02 (I)
Copper	NC	--	3.7E-02[g]	EPA, 1991a	1.9E-03 (I)
Iron	NC	--	2.6E-01	Derived	1.3E-02 (I)
Lead	NC	--	9.4E-04	Derived	7.0E-06 (I)

Table 12 (con't)

Chronic Reference Doses (RfDs)
(mg/kg-day)
(Continued)

Chemical	Inhalation Route	Reference or Basis	Oral Route	Reference or Basis	Dermal Route[a]
Magnesium	NC	--	5.7E+00	Derived	2.9E-01 (I)
Manganese	NC	--	1.0E-01	IRIS, 1992	NC
Mercury	NC	--	3.0E-04	EPA, 1991a	NC
Nickel	NC	--	2.0E-02	IRIS, 1992	1.0E-03 (I)
Potassium	NC	--	8.0E+00	Derived	4.0E-01 (I)
Silver	NC	--	5.0E-03	IRIS, 1992	NC
Sodium	NC	--	4.7E+01	Derived	2.4E+00 (I)
Vanadium	NC	--	7.0E-03	EPA, 1991a	3.5E-04 (I)
Zinc	NC	--	2.0E-01	EPA, 1991a	1.0E-02 (I)

[a]Dermal RfDs were derived for volatile organics (V), semivolatile organics (SV), and inorganics (I) from the oral RfDs as described in Subsection 6.2.3.3.
[b]Converted from a reference concentration (RfC) by assuming the inhalation of 20 m^3 of air/day and a body weight of 70 kg.
[c]Value for 4,4'-DDT was used.
[d]Value is for the cis isomer.
[e]The value for water was used to evaluate the surface water and groundwater ingestion pathways; the value for food was used to evaluate the sediment and fish ingestion pathways.
[f]Based on the RfD for food.
[g]Calculated from the current drinking water standard, assuming the ingestion of 2 liters of water/day and a body weight of 70 kg.

ACGIH-TWA = Derived from the time-weighted average developed by the American Conference of Governmental Industrial Hygienists.
NC = Chemical is not of concern through this exposure route.

7.4 Risk Characterization

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a life-time as a result of exposure to the carcinogen. Excess life-time cancer risk is calculated from the following equation:

Risk = CDI x SF

where:

risk = a unit less probability (e.g., $2x10^{-5}$) of an individual developing cancer;

CDI = chronic daily intake averaged over 70 years (mg/kg-day)

SF = slope-factor, expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a reasonable maximum estimate, an individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g.,liver) within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated.

The HI is calculated as follows:

Noncancer HI = CDI/RfD

where:

CDI = Chronic Daily Intake

RfD = reference dose; and

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term). Table 13 summarizes the total hazard indices and lifetime cancer risks for all receptors. The values presented have been rounded to 1 significant figure.

The total hazard index for both the child ($6.88x10^{+0}$) and the adult 3.78 exceeded the criterion of concern which is 1.0. The elevated total hazard indices resulted from the contribution of

Table 13

Summary of Total Hazard Indices and Lifetime Cancer Risks - All Receptors[a]

Receptor	Total Hazard Index[b]	Total Lifetime Cancer Risk[c]
Current Use		
Offsite Resident	7E+00 (child) 4E+00 (adult)	2E-04
Onsite Worker	4E-01	2E-07
Future Use		
Onsite Resident[d]	2E+01 (child - surficial aquifer) 2E+01 (child - Upper Floridan aquifer) 2E+01 (child - Lower/Upper Floridan aquifers) 2E+01 (adult - surficial aquifer) 2E+01 (adult - Upper Floridan aquifer) 1E+01 (adult - Lower/Upper Floridan aquifers)	5E-03 (surficial aquifer) 5E-04 (Upper Floridan aquifer) 3E-04 (Lower/Upper Floridan aquifers)
Trespasser	5E-03	1E-08
Swimmer (Lake Miller)	7E-01	1E-05

[a]Values are rounded to one significant figure.
[b]A hazard index exceeding one (1E+00) is usually considered the benchmark of potential concern.
[c]Maximum cancer risk at hazardous waste sites is usually regulated in the range of 1E-06 to 1E-04 (10^{-6} to 10^{-4}). Risks of less than 1E-06 are generally not considered to be of concern.
[d]Different values for the same receptor reflect use of different aquifers, as indicated.

the fish ingestion exposure route. Mercury had a hazard quotient of greater than one through fish ingestion in both the child and adult residential scenarios.

The total lifetime cancer risk to the off-site resident was calculated to be approximately 2 in 10,000 ($2.1x10^{-4}$). This value exceeds EPA's target risk range of 10^{-6} to 10^{-4} or 1 in 1 million to 1 in 10,000, the range with which EPA usually regulates maximum risk at hazardous waste sites. The fish ingestion exposure route contributed more than 99% of the risk. Chemicals that were estimated to pose a greater than 10^{-6} risk (but less than 10^{-4}) through fish ingestion included bis(2-ethylhexyl)phthalate, 1,1-dichloroethene, tetrachloroethene, trichloroethene, vinyl chloride, and arsenic. Only arsenic posed a risk of greater than 10^{-4}, contributing 71% of the total risk.

There is no apparent risk of noncarcinogenic health effects posed to the worker. The total hazard index was calculated to be approximately 0.4, which is below the criterion of concern of one. The lifetime cancer risk to the worker was calculated to be approximately 2 in 10 million ($2.17x10^{-7}$). Cancer risks below 10^{-6} are considered to be below the EPA's level of concern.

The total hazard quotient for both the child and the adult exceeded the criterion of one. The total quotient for the child ranged from approximately 15 to 25. The total indices for the adult ranged from approximately 11 to 21.

The estimated lifetime cancer risk calculated for the future on-site resident ranged from approximately 1 in 10,000 to 4 in 1000, depending on the aquifer that is assumed for domestic use. Assuming use of the surficial aquifer, each of the exposure routes associated with groundwater use exceeded a 10^{-4} risk, except for the Ingestion of Groundwater while swimming route. The groundwater ingestion route exceeded a 10^{-3} risk. Tetrachloroethene, arsenic and vinyl chloride posed the greatest risk. The surficial aquifer is not currently used for drinking water purposes in the DeLand area because of poor background water quality. It is highly unlikely that this aquifer would be utilized for domestic purposes.

Assuming use of the Upper Floridan aquifer, each of the exposure routes exceeded a 10^{-6} risk. Groundwater ingestion poses the greatest risk at approximately 10^{-4}. Assuming use of the mixed Lower/Upper Floridan aquifers each exposure route posed greater than a 10^{-6}, but less than 10^{-4} risk, except for ingestion while swimming which was below 10^{-6}. Groundwater ingestion posed the highest risk ($3.96x10^{-5}$).

The chemicals that were calculated to have hazard quotients that exceeded the criterion of one or posed a cancer risk of greater than 10^{-6} in the future on-site resident scenario are summarized

in Table 14 by medium and exposure route. Chemicals with hazard indices greater than 10 or that posed risks that exceeded 10^{-4} are also indicated.

Elevations in chromium levels were not shown to warrant remediation in exposed areas according to the Baseline Risk Assessment. Chromium contamination existing under current surface coverings (paved areas or buildings) has no current route of exposure and is not of immediate concern. However, if structures or pavement are removed or excavation occurs on-site, exposed soils must meet TCLP criteria or contain chromium at less than 520 mg/kg to remain on-site without treatment. This level was developed by EPA and FDER based on the assumption that 10% of total chromium is hexavalent. This level has been determined to be protective of human health and the environment.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

7.5 Ecological Effects

The area in which the Sherwood site is located is part of the Outer Coastal Plain Forest ecoregion. This ecoregion is dominated primarily by beech, sweetgum, magnolia, pine, and oak forests. The predominant natural feature at the site is Lake Miller, a 12-acre swamp lake that receives recharge from North Lake Talmadge via a narrow canal, base flow from the surficial aquifer, and Site runoff.

The Ecological Risk Assessment for the Sherwood Site served to identify and estimate the actual and potential ecological impacts associated with the release of chemicals from the Sherwood Medical facility into the environment. This assessment focused primarily on Lake Miller the primary environmental receptor for the Sherwood Site.

Following the conclusion of the Remedial Investigation, EPA and FDER determined that further study would be necessary to fully characterize sediment quality in Lake Miller, as well as sediment of a small area of wetlands located nearby. In order to further characterize the nature and extent of the effects of elevated chromium levels in Lake Miller sediments, EPA will conduct an additional ecological study. Following the completion of the additional study the Ecological Risk Assessment for Lake Miller will be presented. This additional action will be addressed as Operable Unit 3 for the Sherwood Medical Site. The Sherwood Site, with the exception of Lake Miller and its immediate surroundings, is largely unsuitable for wildlife habitat.

Table 14

**Chemicals Posing the Greatest Risk Potential —
Future Onsite Resident Scenario**

Medium/ Exposure Route	Hazard Quotient		Lifetime Cancer Risk	
	>1	>10	$>10^{-6}$	$>10^{-4}$
Soil				
Dust Inhalation	None	None	None	None
Soil Ingestion	None	None	None	None
Dermal Contact	None	None	None	None
Vegetable Ingestion	None	None	Tetrachloroethene Arsenic	None
Surficial Aquifer				
Groundwater Ingestion	Tetrachloroethene (C, A) Trichloroethene (C) Arsenic (C,A)	None None None	Benzene 1,1-Dichloroethene Trichloroethene	Tetrachloroethene Vinyl Chloride Arsenic
Noningestion Use	None	None	Benzene Chloroform 1,1-Dichloroethene Tetrachloroethene Trichloroethene Vinyl Chloride	None
Ingestion While Swimming	None	None	Tetrachloroethene Vinyl Chloride Arsenic	None

Table 14 (con't)

**Chemicals Posing the Greatest Risk Potential —
Future Onsite Resident Scenario
(continued)**

Medium/ Exposure Route	Hazard Quotient		Lifetime Cancer Risk	
	>1	>10	$>10^{-6}$	$>10^{-4}$
Dermal Contact While Swimming	Tetrachloroethene (A)	None	1,1-Dichloroethene Trichloroethene Vinyl Chloride	Tetrachloroethene
Vegetable/Fruit Ingestion	None	None	Arsenic	None
Upper Floridan Aquifer				
Groundwater Ingestion	Acetone (C,A) Lead (C,A)	None	Bis(2-ethylhexyl)phthalate alpha-Chlordane Heptachlor Trichloroethene	Tetrachloroethene
Noningestion Use	None	None	Heptachlor Tetrachloroethene Trichloroethene	None
Ingestion While Swimming	None	None	Tetrachloroethene	None

Table 14 (con't)

**Chemicals Posing the Greatest Risk Potential —
Future Onsite Resident Scenario
(continued)**

Medium/ Exposure Route	Hazard Quotient		Lifetime Cancer Risk	
	> 1	> 10	$> 10^{-6}$	$> 10^{-4}$
Dermal Contact While Swimming	None	None	Bis(2-ethylhexyl)phthalate alpha-Chlordane Heptachlor Tetrachloroethene Trichloroethene	None
Vegetable/Fruit Ingestion	alpha-Chlordane (C, A)	None	Bis(2-ethylhexyl)phthalate alpha-Chlordane 4,4'-DDE	None
Mixed Lower/Upper Floridan Aquifers				
Groundwater Ingestion	Cadmium (A)	Cadmium (C)	Tetrachloroethene Trichloroethene	None
Noningestion Use	None	None	Tetrachloroethene Trichloroethene	None
Ingestion While Swimming	None	None	None	None
Dermal Contact While Swimming	None	None	Tetrachloroethene Trichloroethene	None

Table 14 (con't)

Chemicals Posing the Greatest Risk Potential —
Future Onsite Resident Scenario
(continued)

Medium/ Exposure Route	Hazard Quotient		Lifetime Cancer Risk	
	>1	>10	$>10^{-6}$	$>10^{-4}$
Vegetable/Fruit Ingestion	None	None	None	None
Surface Water				
Fish Ingestion	Mercury (C,A)	None	Bis(2-ethylhexyl)phthalate 1,1-Dichloroethene Tetrachloroethene Trichloroethene Vinyl Chloride	Arsenic

(A) = Adult scenario.
(C) = Child scenario.

No surface water bodies exist on site except as part of the IWTP. The rest of the site consists of pavement or short mown grass.

The remedial action following this ROD in conjunction with Operable Unit III will effectively protect Lake Miller.

8.0 DESCRIPTION OF ALTERNATIVES

A Feasibility Study (FS) was conducted to develop and evaluate remedial alternatives to address the groundwater and soils at the Sherwood Medical Site. The primary objective of the FS was to determine and evaluate alternatives for appropriate remedial action to prevent or mitigate the migration or the release or threatened release of hazardous substances from the Site. The following section of this ROD provides a summary of the four alternatives that were developed as part of the FS.

The FS was conducted in several stages and used data gathered during the Remedial Investigation as well as data gathered during the Interim Remedial Measures study, for the identification of ARARs and development of management strategies and remedial alternatives to address contamination at the Site. The groundwater beneath the Site is the primary medium of concern. The surficial aquifer is the primary source of VOCs at the Site. Significant amounts of VOCs are not present in the site soils; therefore, there are no contaminated solid wastes or residues on-site that are contributing to site contamination that require remediation and handling. However, in accordance with the requirements of 40 CFR 264 (the applicable regulations under the Federal Resource Conservation and Recovery Act (RCRA)), the residues resulting from treatment must be considered. In addition, there is no significant migration of site-related substances, via surface water and sediments, beyond the eastern shore of Lake Miller, which is on the Sherwood property, Therefore, the focus of this FS was on the VOC contamination contained in the surficial aquifer and all possible points of migration. The primary VOCs detected in the surficial aquifer are PCE and TCE. Their products of degradation, such as 1,2-dichloroethylene and vinyl chloride, were also found in surficial groundwater and are addressed by this ROD. Site related metals such as trivalent chromium were detected at low levels in the surficial aquifer. Non Site related metals such as arsenic and cadmium were also detected in various media at the Site as well as in background samples.

Remedial Action alternatives were initially identified and were subject to screening to identify the best possible alternatives for further consideration. The focus of the screening process was to eliminate technologies, based on information obtained from the studies conducted at the Site, that would not be

implementable due to Site specific conditions or technical impractibility.

Following this screening process, four alternatives were retained for further consideration in the FS.

A detailed evaluation of the remedial alternatives based on the following nine criteria was conducted. These criteria include:

1) Overall Protection of Human Health and the Environment,

2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs),

3) Long-Term Effectiveness and Permanence,

4) Reduction of Toxicity, Mobility, and Volume,

5) Short-Term Effectiveness,

6) Implementability,

7) Cost,

8) State/Support Agency Acceptance, and

9) Community Acceptance.

In addition a comparative analysis of the alternatives was included for the remaining alternatives, which compared the alternatives with each other.

8.1 Alternative 1 - No Action

In accordance with the National Contingency Plan (NCP), EPA has evaluated a "No Action" alternative as part of the FS. The No Action alternative serves as a basis against which other alternatives can be compared. Under the No Action Alternative, no remedial response would be performed on any of the media of concern at the Site. There is no implementation cost associated with this alternative. Monitoring would be conducted in all groundwater aquifers on a semi-annual basis. Under this alternative the treatment system installed as part of the Interim Action would be turned off.

8.2 Alternative 2 - Limited Action

Alternative 2 would utilize institutional controls and long-term monitoring. Reduction in the VOC levels in the surficial aquifer

would be due to: 1) Slow volatilization over a long period of time; 2) migration to Lake Miller; 3) migration to the Upper Floridan aquifer, and 4) natural attenuation. Institutional controls to be implemented would include; posting of signboards around Lake Miller indicating "NO FISHING OR SWIMMING IN LAKE MILLER", notification of the adjacent property owner on Lake Miller that hazardous substances are present in Lake Miller, maintenance of current security fence around the Site property, maintenance of current Sherwood policy restricting access to Site by the public and prohibiting use of Lake Miller by Sherwood employees.

This alternative would provide for continued monitoring of surficial and Floridan Aquifers and Lake Miller. In addition, any soils excavated on-site would be sampled and any soils containing chromium greater than 520 mg/kg would be remediated or disposed of off-site. Use of the Site would be restricted to industrial operations.

In this alternative the treatment system installed as part of the Interim Action would be turned off.

8.3 Alternative 3A - Groundwater Interception and Treatment

The objective of the groundwater extraction system is to effectively reduce VOC concentrations present in the surficial groundwater by effectively recovering and treating VOC contaminated groundwater. This alternative would completely utilize the nine well extraction system installed as part of the Interim Action for the Site. Using a groundwater model (MODFLOW), it was determined that locating six surficial aquifer extraction wells along the eastern side of Lake Miller and three extraction wells in the southeast corner of the site would create an effective capture zone. A margin of safety would be provided by the three wells located along the southeastern corner of the Site.

The air stripper installed as part of the Interim Action is the treatment technology selected for this alternative. PCE and TCE would easily be removed from the groundwater by the air stripper to levels in compliance with FDER surface water quality and groundwater standards. Other VOCs would also be easily removed by the air stripper and will also meet all Federal and State ARARS.

Since the concentrations of the background metals in the surficial aquifer are generally low, no metal treatment would be required.

All of the institutional controls listed in Alternative 2 would also be implemented for alternative 3A. Monitoring requirements set forth as part of this alternative would include:

1. Floridan Aquifer monitor wells MW-201 through MW-205 will be monitored semi-annually for VOC;

2. Floridan Aquifer wells SMWS and SMFW will be monitored quarterly for the first year and semi-annually thereafter to determine the reduction of VOC concentrations due to the continued pumping from the on-site water supply well SMWS. Water pumped from water supply well is currently routed through an air stripper.

3. Floridan Aquifer wells SMFA-1, SMFA-2, and SMFA-3 will be monitored quarterly for the first year and semi-annually thereafter to determine the reduction of VOC due to continued pumping of on-site production wells SMWS and SMSB.

4. Eight residential wells located east of the site on Kepler Road and one residential well located west of the site will be sampled and analyzed for VOCs semi-annually.

5. Water levels will be recorded and samples taken from the surficial aquifer monitor wells (MW-101 through MW-114) quarterly for the first year and semi-annually thereafter to determine the drawdown and VOC reduction in the surficial aquifer. In addition these samples will be analyzed for metals.

Monitoring of the surficial aquifer will continue until the EPA and FDER determine that contamination in the surficial aquifer has been remediated and the treatment system can be shutdown. In order for shutdown to occur, two successive semi-annual rounds of sampling must indicate that the remediation goals have been reached. The Floridan Aquifer will be monitored until two successive semi-annual sampling rounds indicate that the contaminant levels have declined to acceptable levels. Monitoring of the treatment effluent will continue as long as the treatment system is in operation. Monitoring of residential wells will continue until two successive rounds of sampling, following start up of the treatment system, show no contamination above drinking water standards. A round of confirmation sampling will be conducted following system shutdown to ensure that contaminant levels remain stable.

8.4 Alternative 3B - Concentrated Area Interception and Treatment

In this alternative, groundwater will be extracted from two localized areas near Lake Miller, identified with the highest levels of VOC contamination in the surficial aquifer. The objective of this extraction well system is to encompass areas with VOC contamination above 1,000 parts per billion in the capture zone. Groundwater would be recovered from three extraction wells located in the primary concentrated contaminant area and one well in the secondary concentrated contaminant area. Although the capture zone includes most of the western side of the site, it does not encompass the entire site, especially the eastern half of the property where PCE and TCE contamination has been detected in the surficial groundwater.

The treatment system would utilize the same air stripper indicated in alternative 3A. The stripper would be operated at a lower flow rate to account for fewer extraction wells.

The treated groundwater would be discharged to Lake Miller as in Alternative 3A. All of the monitoring requirements and institutional controls would be implemented in the same manner as Alternative 3A.

9.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the ROD provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA and in Section 300.430 of the NCP. The major objective of the FS was to develop, screen, and evaluate alternatives for groundwater remediation at the Sherwood site. The remedial alternatives selected from the screening process were evaluated using the following nine evaluation criteria:

- Overall protection of human health and the environment.
- Compliance with applicable and/or relevant Federal or State public health or environmental standards.
- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, or volume of hazardous substances or contaminants.
- Short-term effectiveness, or the impacts a remedy might have on the community, workers, or the environment during the course of implementing it.
- Implementability, that is, the administrative or technical capacity to carry out the alternative.

- o Cost-effectiveness considering costs for construction, operation, and maintenance of the alternative over the life of the project, including additional costs should it fail.

- o Acceptance by the State.

- o Acceptance by the Community.

The NCP categorizes the nine criteria into three groups:

(1) Threshold Criteria - overall protection of human health and the environment and compliance with ARARs (or invoking a waiver) are threshold criteria that must be satisfied in order for an alternative to be eligible for selection;

(2) Primary Balancing Criteria - long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability, and cost are primary balancing factors used to weigh major trade-offs among alternative hazardous waste management strategies; and

(3) Modifying Criteria - state and community acceptance are modifying criteria that are formally taken into account after public comment is received on the proposed plan and incorporated in the ROD.

The selected alternative must be protective of human health and the environment and comply with all ARARs or be granted a waiver for compliance with a specific ARAR. Any alternative that does not satisfy both of these requirements is not eligible for selection and are not evaluated further in the comparative analysis. The Primary Balancing Criteria are the technical criteria upon which the detailed analysis is primarily based. The final two criteria, known as Modifying Criteria, assess the public's and the state agency's acceptance of the alternative. Based on these final two criteria, EPA may modify aspects of a specific alternative.

The following is a summary of the comparative analysis of alternatives.

9.1 Overall Protection of Human Health and the Environment

Alternative 1 does not provide protection to human health and the environment. The VOC migration pathways to Lake Miller and potentially to the Upper Floridan aquifer would remain unchanged. The current risks to human health due to swimming and fishing in Lake Miller would continue. This alternative does not comply

with federal or state ARARs. Therefore it will not be considered further.

Alterative number 2 provides moderate protection to human health. Restricted access to the Site and Lake Miller, along with the land use restrictions would limit the potential for exposure. However, continued migration of contaminants in the surficial aquifer could threaten residential wells with ruptured casings. VOC migration pathways to Lake Miller and potential for migration to the Upper Floridan Aquifer would remain. Institutional controls, if properly implemented and maintained would provide moderate protection to human health but would not further reduce the potential for harm to the environment.

Potential risks to human health and the environment are sufficiently addressed in Alternative 3A. The reduction of VOCs in the surficial aquifer will effectively mitigate the risk of VOC migration to Lake Miller or the Upper Floridan Aquifer. The use of institutional controls and an extensive groundwater monitoring ensure protection of human health.

Potential risks to human health and the environment are not sufficiently addressed in Alternative 3B. Since the groundwater extraction capture zone does not include the total VOC contaminated area of the Site, residual VOC contamination can still potentially migrate to Lake Miller or to the Floridan aquifer. Threats to human health and the environment are not sufficiently addressed in this alternative.

9.2 Compliance with ARARs

Alternatives 1 and 2 do not comply with all State and Federal ARARs. Surficial aquifer groundwater standards would not be met since groundwater would remain untreated in the surficial aquifer.

Alternative 3A complies with all Federal and State ARARs. Currently, the VOC levels in the surficial aquifer do not meet surface water or drinking water standards. The groundwater will be treated to meet the Clean Water Act or Florida Surface Water Quality Criteria as outlined in FAC 17-302, whichever is more stringent, prior to discharge to Lake Miller. The surficial aquifer will be treated until the remediation criteria have been met.

Air emissions will easily meet the established guidelines of the Clean Air Act or Florida Administrative Code 17-2 whichever is more stringent.

Alternative 3B does not comply with all Federal and State ARARs. Due to the fact that only the source areas of the groundwater

would be treated, PCE and TCE may not be completely removed and may remain on Site at levels above applicable water quality standards. VOCs remaining would pose the risk of migration to Lake Miller or the Upper Floridan aquifer and would not meet ARARs in a reasonable time.

9.3 Short Term Effectiveness

Alternatives 1, 2, and 3B did not meet the threshold criteria and, therefore, are not evaluated further.

A short-term risk of exposure is encountered by workers in Alternative 3A during the excavation activities for air stripper installation. Dust-control measures have been implemented to minimize this risk. Workers will be required to use appropriate safety equipment and take precautionary measures during remedial activities.

9.4 Long Term Effectiveness

Alternative 3A addresses potential risks to human health and the environment. Since the surficial groundwater VOCs are totally removed upon completion of the remedial actions, there will be no migration of VOC to Lake Miller or to the Floridan aquifer.

9.5 Reduction of Toxicity, Mobility and Volume of Contaminants

In alternative 3A, the toxicity and volume of contaminants will be eliminated upon completion of the remedial actions, as the surficial aquifer groundwater will be treated until there is no threat posed to human health or the environment. The mobility of the VOC in the surficial groundwater has been virtually eliminated with the commencement of the remediation activities.

9.6 Implementability

Alternative 3A can easily be implemented. The construction materials and technical expertise for implementing this alternative are readily available.

For Alternative 3A, an air stripper design has been completed for surficial aquifer groundwater remediation as part of the Interim Action treatment system. No specialized construction techniques will be necessary for installation of the air stripper. The groundwater extraction wells have already been installed, and pump tests have been conducted to verify its performance. A groundwater monitoring program can be easily implemented due to the existence of a current program to which additional wells can

be added. Groundwater sampling and analysis is easily implemented using conventional methods.

9.7 Cost

Present worth costs were calculated for each alternative to provide a baseline for comparison. All of the costs represent construction and O&M costs of each alternative. The present worth cost of Alternative 3A is $1,017,000.

9.8 State Acceptance

The State of Florida Department of Environmental Regulation (FDER) has had input at virtually every step of the Superfund process for Sherwood Medical. FDER provided valuable input during the RI/FS process. FDER has reviewed this Record of Decision and concurs with EPAs alternative selection.

9.9 Community Acceptance

EPA solicited input from the community on the Proposed Plan for clean-up of the Sherwood Medical Site. Public comments were addressed at a Public Meeting held in DeLand Florida on July 31, 1992. Comments received during the meeting and in written form indicated community support for alternative 3A.

10.0 THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives, and public and state comments, EPA has selected Alternative 3A. Alternative 3A consists of a groundwater remedy and institutional controls. The selected remedy consists of the following components:

1. Extraction of the affected groundwater from the surficial aquifer via the nine extraction well network;

2. Treatment of the recovered surficial aquifer groundwater by an on-site air stripper for VOC removal;

3. Discharge of treated water to Lake Miller;

4. Groundwater monitoring;

5. Access restrictions for the Site and Lake Miller;

6. Other institutional controls including; a requirement for excavated soils to meet TCLP criteria or contain

chromium at levels less than 520 mg/kg, and deed restrictions requiring that the Sherwood Medical site remain industrially zoned.

7. Continued operation of the Floridan Aquifer groundwater recovery and treatment system associated with the Sherwood's water supply well.

The surficial aquifer groundwater treatment system has already been installed as part of the Interim Action. The system includes nine extraction wells and an air stripper. Following an initial round of effluent sampling, that indicated successful VOC removal, the system was started on July 31, 1992.

The components of the selected remedy are discussed in detail below.

10.1 Groundwater Extraction

The objective of the groundwater extraction system is to efficiently and effectively recover VOCs exeeding site cleanup criteria present in the surficial aquifer groundwater by creating a groundwater capture zone. Using the groundwater model MODFLOW, it was determined that six wells located along the eastern side of Lake Miller and three wells located in the southeast corner of the site would create an effective capture zone in the surficial aquifer. The six extraction wells located along the east side of Lake Miller will capture groundwater moving toward the Lake. The three extraction wells in the southeast corner of the site will reduce the potential for off-site migration of the substances of concern. This potential exists due to the mounding in the surficial aquifer caused by the discharge of treated wastewater from the IWTP.

Figure 10 depicts the predicted potentiomentric surface in the surficial aquifer under pumping conditions.

The predicted draw down created when pumping groundwater from the nine wells is depicted in Figure 11.

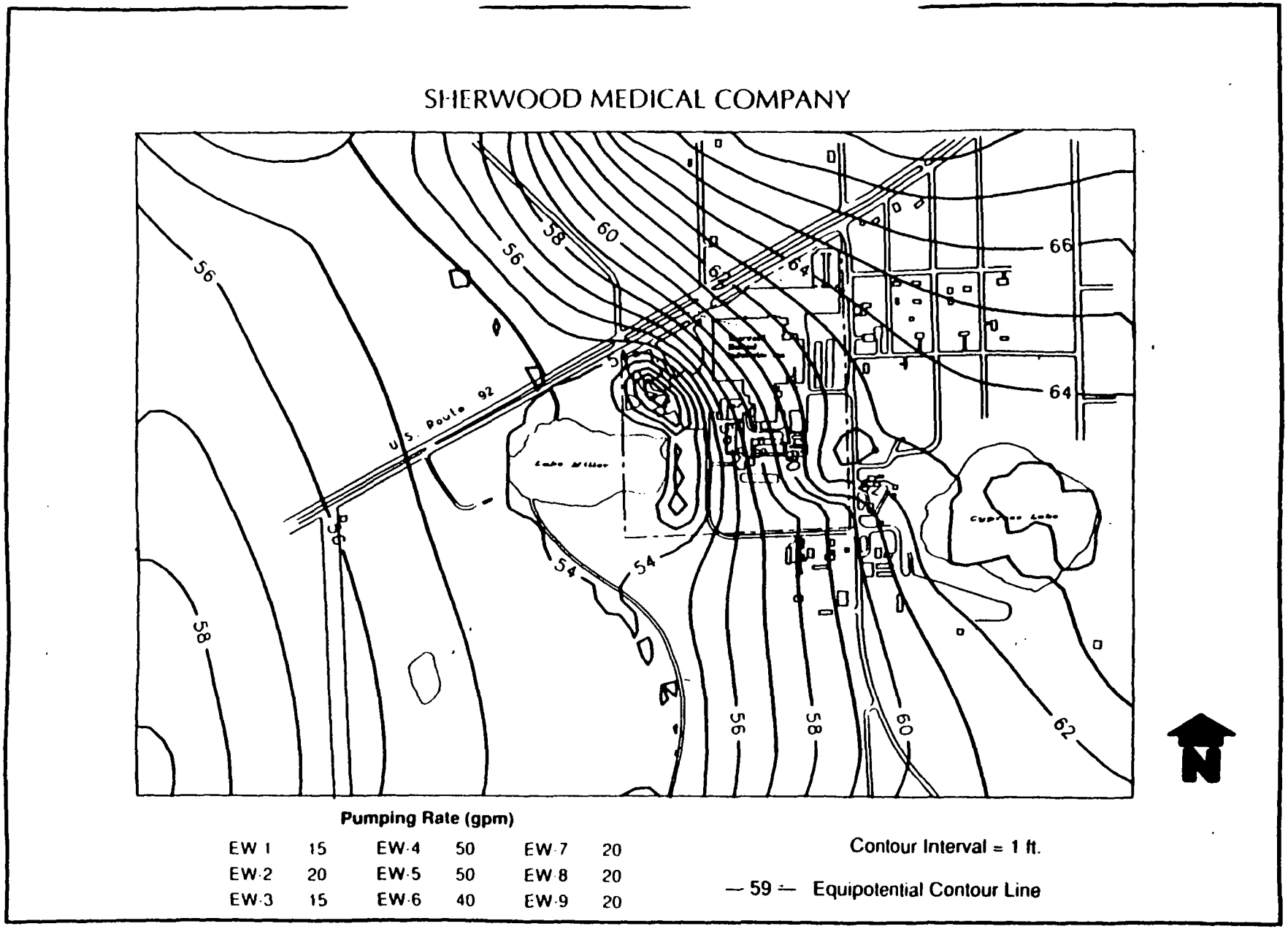


Figure 10 PREDICTED POTENTIOMETRIC SURFACE IN THE SURFICIAL AQUIFER - NINE PUMPING WELLS - ALTERNATIVE 3A

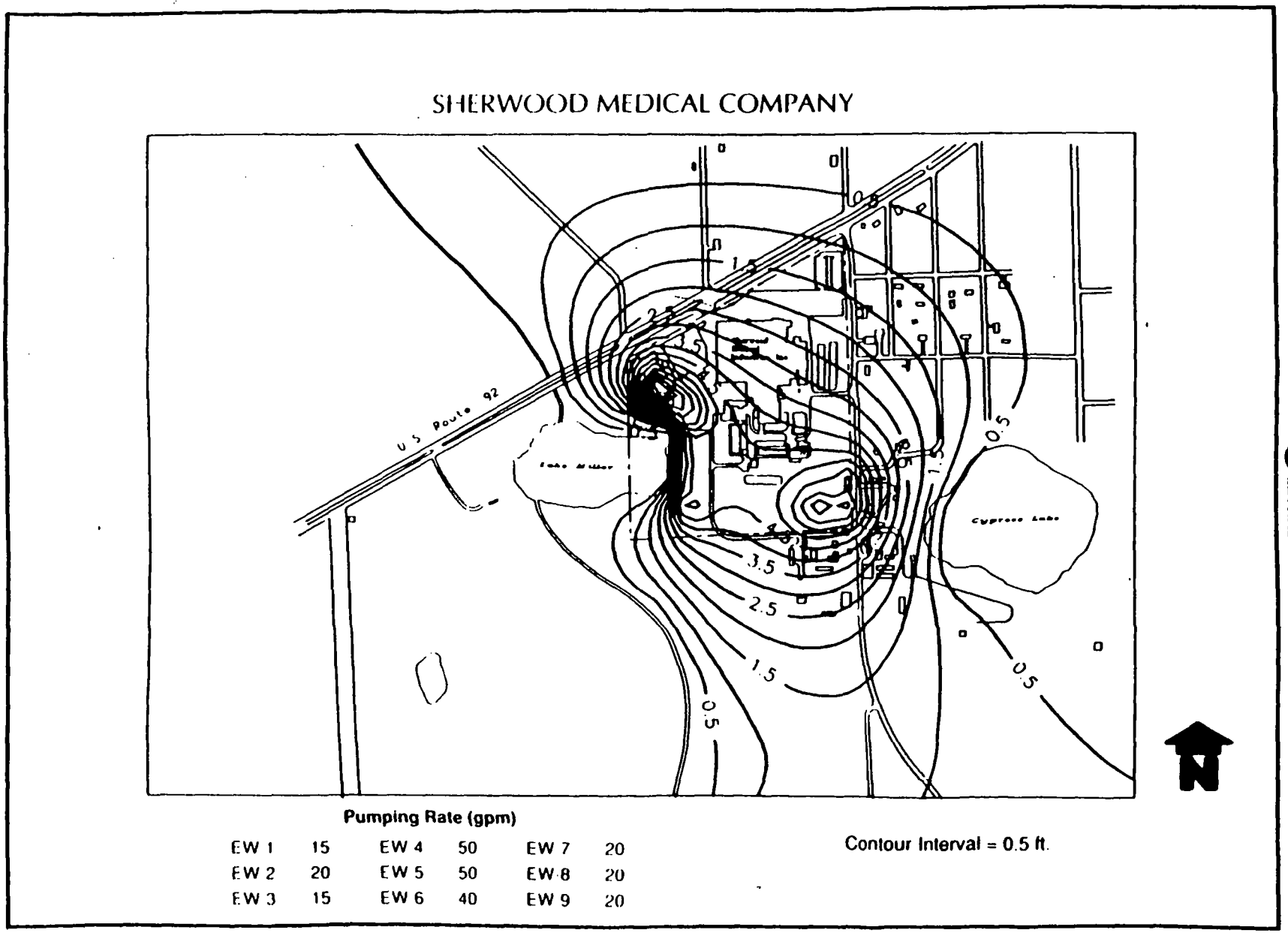


Figure 11 DRAWDOWN PREDICTED IN THE SURFICIAL AQUIFER - NINE PUMPING WELLS - ALTERNATIVE 3A

Results of groundwater modeling indicate that the majority of groundwater moves southwest towards one of the six wells located along the eastern side of Lake Miller, while a smaller portion is directed to the three wells located in the southeast corner of the site. The maximum expected yield from all of the wells combined is approximately 325 gpm.

The groundwater velocity across the site under pumping conditions has been calculated to determine the amount of time required for groundwater to be intercepted by the extraction well field. Under ideal conditions, groundwater located across the Site from Lake Miller would require approximately 3 years to reach the extraction well field and be intercepted (1,400 ft.). This model includes a high degree of uncertainty and groundwater sampling will be used to determine treatment completion.

10.2 Groundwater Treatment

Air stripping of the contaminated surficial aquifer groundwater is the treatment technology to be utilized in this alternative. Data analysis indicates that the upper 95% confidence level of the mean concentration of PCE and TCE in the groundwater is 3,200 ug/L and 140 ug/L, respectively. These chemicals are easily stripped from the water to meet the applicable surface water quality standards for the treated groundwater. Vinyl chloride and other VOCs determined to be present at lower levels are also easily stripped to meet surface water standards.

Air emissions from the stripper will meet the guidelines established by the Clean Air Act or, Florida Administrative Code 17-2 whichever is more stringent.

10.3 Treated Water Discharge

The treated water from the air stripper will be discharged to Lake Miller. A single port diffuser will be installed at the end of the discharge pipe at a distance of 60 feet from the shore. The treated effluent will meet the discharge criteria of the Clean Water Act (40 C.F.R. § § 122-125) including the substantive requirements of the NPDES program or, FAC 17-3 surface water standards, whichever is more stringent.

According to the schedule set by EPA and FDER the effluent will be sampled weekly for the first month, monthly for the first quarter, quarterly for the first year and semi-annually thereafter.

10.4 Cleanup Levels

The purpose of this response action is to control risks posed by ingestion of surficial aquifer groundwater. The carcinogenic risk posed by a hypothetical future on-site resident ingesting surficial aquifer groundwater is $3.42X10^{-3}$. The hazard index associated with the same scenario is 1.32. Both of these values are above EPAs level of concern.

This remedy will also address migration of surficial aquifer contaminants to the Floridan Aquifer by requiring Sherwood to continue operating their Floridan Aquifer water supply well and associated treatment system.

Groundwater will have to meet clean-up criteria, in monitoring well samples, for two successive semi-annual sampling rounds in order for Site remediation to be considered complete. The following table lists the remediation goals for specific compounds which correspond to the MCLs set by the Safe Drinking Water Act and, where more stringent, Florida groundwater regulations. The remediation goal for acetone represents Florida Groundwater Guidance Concentrations.

Chemical	Cleanup Goal (ARAR)	Regulation
Acetone	0.700 mg/l	FGWGC
Trichloroethene	0.003 mg/l	FAC 17-550
Tetrachlorethene	0.003 mg/l	FAC 17-550
1,2-dichloroethane	0.003 mg/l	FAC 17-550
Vinyl Chloride	0.001 mg/l	FAC 17-550
Chromium	0.10 mg/l	SDWA

FGWGC - Florida Groundwater Guidance Concentration
FAC - Florida Administrative Code
SDWA - Safe Drinking Water Act

10.5 Groundwater Monitoring

The groundwater monitoring program for this alternative will include all monitoring activities proposed under the limited action alternative and other activities as listed below:

1. Floridan Aquifer monitor wells MW-201 through MW-205 will be monitored semi-annually for VOC;

2. Floridan Aquifer wells SMWS and SMFW will be monitored quarterly for the first year and semi-annually thereafter to determine the reduction of VOC concentrations due to the continued pumping from the on-site water supply well SMWS. Water pumped from the water supply well is currently routed through an air stripper.

3. Floridan Aquifer wells SMFA-1, SMFA-2, and SMFA-3 will be monitored quarterly for the first year and semi-annually thereafter to determine the reduction of VOCs due to continued pumping of on-site production wells SMWS and SMSB.

4. Eight residential wells that draw water from the Upper Floridan aquifer located upgradient (east of Kepler Road) and one residential well located downgradient (Mills) will be sampled and analyzed for VOCs semi-annually.

5. Water levels will be recorded and samples taken from the surficial aquifer monitor wells (MW-101 through MW-114) quarterly for the first year and semi-annually thereafter to determine the drawdown and VOC reduction in the surficial aquifer. In addition these samples will be analyzed for metals.

10.6 Institutional Controls

Institutional controls will include:

1. Installation of 10 signboards around Lake Miller indicating "NO FISHING OR SWIMMING IN LAKE MILLER". Placement of these signs will be reviewed by EPA personnel.

2. Installation of signs on all sides of the groundwater treatment facility warning that it is a hazardous waste treatment facility.

3. Notifying Mr. Mills, a property owner across Lake Miller from Sherwood, that Lake Miller should not be used for fishing or swimming purposes.

4. Maintenance of security fence to discourage trespassing on the Site property and maintenance of current Sherwood regulations restricting employee access to Lake Miller.

5. Requirement that Sherwood notify FDER and EPA of plans to excavate soils, demolish buildings, or remove

pavement. Soils exposed as a result of these activities will be required to meet TCLP criteria or contain less than 520 mg/kg of chromium to remain on-site untreated.

6. Requirement that Sherwood Medical Site remain industrially zoned area or address elevated contaminant levels in all environmental media at the site such that the site does not pose a threat to human health and the environment as defined by EPA and FDER.

10.7 Cost Summary

Table 15 summarizes the capital costs associated with the implementation of the selected remedy 3A. Table 16 summarizes the operation and maintenance costs associated with Alternative 3A.

11.0 STATUTORY DETERMINATIONS

EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedy for this site must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy for the Sherwood Medical Site meets these statutory determinations.

11.1 Protection of Human Health and the Environment

The selected remedy for the Sherwood medical Site protects human health and the environment through extraction and treatment of the affected surficial aquifer. Treatment of the surficial aquifer will effectively reduce risk from exposure to the surficial aquifer as well as prevent further migration of the groundwater contaminant plume to the Floridan aquifers and Lake Miller. The combined institutional controls along with the

Table 15

Estimated Capital Costs for Alternative 3A: Groundwater Interception and Treatment

	Item	Total ($)
1.	Air stripper and associated equipment, including foundation	55,100
2.	Piping and valves for groundwater collection and discharge system	87,200
3.	Electrical work	127,900
4.	Instrumentation, including flow metering equipment	24,100
5.	Health and safety equipment (for construction workers)	10,000
6.	Access-restriction signs*	1,000
7.	Subtotal	305,300
8.	Mobilization/demobilization, construction management (22%)	67,200
9.	Technology implementation, designs, plan specifications, regulatory approval, insurance, bonds, and permits (22%)	67,200
10.	Contingency (25%)	76,300
11.	Total	$516,000

*Does not include administrative costs for deed restrictions.

Table 16

Estimate of Annual O&M Costs for Alternative 3A: Groundwater Interception and Treatment

Item	Description	Quantity	Unit Cost ($)	Total Cost/Year ($)
1.	Labor (2 hrs/day) — inspections	520 hrs/year	21/hr	10,900
2.	Maintenance — (5% of total equipment cost)		lump sum	14,700
3.	Health and safety equipment		lump sum	5,000
4.	Utilities (electricity and chemicals)			7,200
5.	Air stripper monitoring			
	• Water sample at inlet and outlet of air stripper (VOC)	24	250/sample	6,000
	• Labor: 2 hrs/month	24	21/hr	500
	• Labor: report (quarterly)	80	35/hr	2,800
6.	Groundwater monitoring			
	• Samples (66 VOC/4 blanks/ 4 duplicates)	74	250/sample	18,500
	• Labor: sampling	60 hrs/year	50/hr	3,000
	• Labor: report	50 hrs/year	60/hr	3,000
	• Other expenses		lump sum	2,000
8.	Subtotal (rounded)			74,000
9.	Administrative (15%)			11,100
10.	Contingency (25%)			18,500
11.	Total (rounded)			$104,000

monitoring requirements will serve to ensure protection of human health and the environment.

The current risks associated with the site are a carcinogenic risk of $2x10^{-4}$ for the current off-site resident and $2x10^{-7}$ for the current worker. The Hazard Indices are 4 and 0.4 for the off-site resident and the on-site worker respectively. Through implementation of the selected remedy risk levels should be effectively reduced to acceptable levels.

Potential short term risks will be controlled through the utilization of standard engineering practices.

11.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121 (d)(2)(A) of CERCLA incorporates into the law the CERCLA Compliance Policy, which specifies that Superfund remedial actions must meet any federal and state standards, requirements , criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). Also included is the provision that state ARARs must be met if they are more stringent than federal requirements.

Applicable requirements are defined as cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

All potential ARARs for treating contaminated groundwater at the Sherwood Medical Site are presented below. Where VOCs and inorganic compounds affect groundwater, the Safe Drinking Water Act (SDWA) provides potential ARARs for establishing cleanup goals, i.e., Maximum Contaminant Levels (MCLs). In addition, the State of Florida has established MCLs under Florida Administrative Code (FAC) for specific Volatile Organic Compounds, which, when more stringent than the federal MCL, have been selected as the cleanup goals for this project.

The recommended alternative was found to meet or exceed the following ARARs.

11.2.1 Chemical Specific Requirements

Clean Water Act (CWA) / Safe Drinking Water Act (SDWA)

Safe Drinking Water Act (40 C.F.R. § § 141, 142 and 143), which specifies the MCLs for the contaminants of concern that will be

applicable as the remediation levels for contaminated groundwater. However, should the State drinking water standard under Florida Administrative Code (FAC) 17-550, for a particular contaminant be more stringent, the State standard will be used as the remediation level.

Clean Water Act (40 C.F.R. § § 122-125) which specifies the substantive requirements of the National Pollutant Discharge Elimination System (NPDES). The treatment system will meet the substantive requirements of the NPDES program but will not be permitted since it is an on-site action. However, should the State effluent limitations for surface water, under 17-302, be more stringent, the State standard will be applicable.

Florida Administrative Code (FAC) 17-550

FAC 17-550 establishes contaminant concentrations acceptable in potable water. These standards will be applicable when more stringent than the federal MCL.

Resource Conservation and Recovery Act (RCRA)

RCRA (40 C.F.R. § 261.31) applies to chemical concentrations in groundwater. RCRA is relevant and appropriate.

Florida Administrative Code Chapter 17-302

FAC 17-302 establishes effluent limitations and operating requirements for surface water discharge. This requirement will be applicable in those instances where it is more stringent than an applicable Federal requirement.

Florida Administrative Code Chapter 17-736

FAC 17-736 requires that warning signs be placed on all sides of the groundwater treatment facility with the warning that there is a hazardous waste treatment system present. FAC 17-736 is applicable.

Florida Groundwater Guidance Concentrations

Health based guidance concentrations developed using EPAs Integrated Risk Information systems.

11.2.2 Action Specific Requirements

Clean Air Act (CAA) (40 C.F.R. § 61, CAA § 112)

CAA applies to air emissions from treatment technologies, such as air stripping. Also, 40 C.F.R. § 51, 61, and 112. Since

treatment will occur on-site, only the substantive requirements of the PSD permit must be met. The CAA is applicable.

Florida Administrative Code 17-550

FAC 17-550 establishes drinking water MCLs for groundwater and effluent from treatment systems. These standards will be applicable when more stringent than the Federal regulations under the SDWA.

Florida Administrative Code 17-2

FAC 17-2 applies to air emissions from treatment technologies, such as air stripping. Standards included in this regulation will be applicable when more stringent than Federal regulations under the Clean Air Act.

11.2.3 Location Specific Requirements

Endangered Species Act (ESA) (50 C.F.R. § 402)

The selected remedy is protective of species listed as endangered or threatened under the ESA. Requirements of the Interagency Section 7 consultation process, 50 CFR part 402 will be met. The U.S. Department of Interior (DOI) and the U.S. Fish and Wildlife will be consulted during the RD to ensure that endangered or threatened species are not adversely impacted by implementation of this remedy. The ESA is a relevant and appropriate requirement.

11.3 Cost Effectiveness

This remedy employs a proven technology which can be easily implemented at the Sherwood Medical Site. This technology provides the most cost effective treatment when compared to the other alternatives due to its ability to most effectively treat and limit further spread of contamination.

11.4 Utilization of Permanent Solutions and Alternative Treatment Technology or Resource Recovery Technologies to the Maximum Extent Practicable

EPA and the Florida Department of Environmental Regulation have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost effective manner for contaminant treatment at the Sherwood Medical Site. The selected alternative complies with the ARARs, EPA and the State have determined that the

selected remedy provides the best overall balance of tradeoffs in the terms of the five balancing criteria: long term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; and cost. Additionally, the selected remedy fulfills the two modifying criteria: state acceptance: and community acceptance.

The selected remedy meets the statutory preference to utilize permanent solutions and treatment technologies, to the maximum extent practicable. Remediation of the surficial aquifer with continual pumping and treating of the Floridan aquifer will effectively permanently remove the contaminant plume from the surficial aquifer and prevent further migration to the Floridan aquifer or Lake Miller the primary environmental receptor at the Sherwood Site.

11.5 Preference for Treatment as a Principal Element

The principal threats posed to human health and the environment are addressed through the use of air stripping, a proven treatment technology. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

11.6 Documentation of Significant changes

The Proposed Plan for the Sherwood Site was released for public comment on July 23, 1992. The Proposed Plan identified the Pump and Treat System with institutional controls and groundwater monitoring as the preferred alternative for this action. EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.