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Superfund Record of Decision:

South Jersey Clothing, NJ

50272-101

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First Remedial Action - Final

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 1.2-acre South Jersey Clothing Company (SJCC) site is an active clothing manufacturing facility located in Minolta, Buena Borough, Atlantic County, New Jersey. Land use in the area is commercial and residential, and local residents obtain drinking water from the Borough municipal water supply system. Onsite features include two buildings used for manufacturing operations, as well as the remains of a building damaged in a 1979 fire. Another Superfund site, the 3,000-square-foot Garden State Cleaners (GSC) site, is located 500 feet south of the South Jersey Clothing site. GSC site features include a small building covering much of the site. In 1940, SJCC began manufacturing clothing for the military using VOCs including TCE, as part of the dry cleaning process. Based on State records, wastewater containing TCE from these processes was routinely discharged directly onto the facility grounds, and other process wastes were stored onsite in leaking drums. In addition, State records indicate that the 1979 fire may have resulted in the release of an estimated 275 gallons of TCE from an onsite storage tank. State investigations in 1981 identified elevated TCE levels onsite . Later in 1981, SJCC identified and removed thirty-three 55-gallon drums of TCE-contaminated soil;

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - South Jersey Clothing, NJ
First Remedial Action - Final
Contaminated Media: soil, gw
Key Contaminants: VOCs (benzene, PCE, TCE, toluene)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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South Jersey Clothing, NJ
First Remedial Action - Final

Abstract (Continued)

installed additional ground water monitoring wells from 1981 to 1984; and installed a ground water pump and treatment system under a State Order in 1985. In 1989, SJCC began installing a limited soil vapor extraction system in the vicinity of the TCE storage tank that reportedly ruptured in the 1979 fire, but this action was abandoned at the start of the RI. Because the SJCC and GSC sites are in proximity to one another and have similar contamination, both sites will be remediated concurrently. This Record of Decision (ROD) addresses soil and ground water contamination at both the SJCC and GSC sites, as a final remedy. The primary contaminants of concern affecting the soil and ground water are VOCs including benzene, PCE, TCE, and toluene.

The selected remedial action for this site includes treating approximately 1,600 cubic yards of onsite contaminated soil using in-situ vapor extraction; treating the contaminated wastewater from the vapor extraction processes onsite using an air stripping column; treating air emissions using carbon adsorption units; pumping and onsite treatment of contaminated ground water using air stripping and carbon adsorption, followed by reinjecting the treated water upgradient from the site; regenerating spent activated carbon from both treatment processes offsite; conducting long-term ground water monitoring; and implementing temporary institutional controls. The estimated present worth cost for this remedial action at the SJJC site is $5,718,000, which includes an estimated annual O&M cost of $293,100 for 70 years. The estimated present worth cost for this remedial action at both the GSC and SJCC sites is $11,169,000, which includes an annual O&M cost of $542,000.

PERFORMANCE STANDARDS OR GOALS: Federal and State agencies have agreed to jointly establish Interim Soil Action Level (ISAL) clean-up goals of 1,000 ug/kg for PCE and TCE, given the predominance of the two compounds at the site. Ground water remediation goals are based on the more stringent of SDWA Federal and State MCLs, and include PCE 1 ug/l (State) and TCE 1 ug/l (State).

- Reinjection of the treated groundwater upgradient from the sites; and

- Appropriate environmental monitoring to ensure the effectiveness of the remedy.

Soil

- In situ vapor extraction of soil contaminated with volatile organic compounds.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies 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.

William J. Muszynski

Constantine Sidamon-Eristoff
Regional Administrator
U.S. EPA, Region II

Sept 26, 1991
Date

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Scott A. Weiner
Commissioner

September 24, 1991

Mr. Constantine Sidamon-Eristoff
Administrator
U.S. Environmental Protection Agency
Region II
Jacob K. Javits Federal Building
New York, New York 10278

Dear Mr. Eristoff:

The Department of Environmental Protection and Energy has evaluated and concurs with the selected remedy for the South Jersey Clothing Company Superfund site as stated below:

"This final remedy addresses remediation of the entire contaminated ground water plume, one of the threats posed by the sites. In addition, the contaminated soil, which represents the source of ground water contamination, is addressed as the principal threat posed by the sites. Contaminent soil concentrations would be reduced thereby minimizing continued releases of contaminants to ground water. Current and future exposure to, and migration of, groundwater contaminants would be controlled, and contaminant concentrations reduced to within the appropriate drinking water standards.

The major components of the selected remedy include:

Ground Water

- extraction of the contaminated ground water;
- treatment of the extracted ground water;
- reinjection of the treated ground water upgradient from the sites;
- long-term ground water monitoring.

Soil

- in-situ vapor extraction of volatile organic compounds from approximately 1,600 cubic yards of contaminated soil".

The Department reserves its final comments on the complete Record of Decision pending an opportunity to review the completed documents, including the document's responsiveness summary.

Very truly yours,

Scott A. Weiner
Commissioner

SAW:EP/dfh

DECISION SUMMARY

SOUTH JERSEY CLOTHING COMPANY/ GARDEN STATE CLEANERS SITES

BUENA BOROUGH, NEW JERSEY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION II

NEW JERSEY

Table of Contents

Attachments

Appendices

Table of Contents (continued)

SITE NAME, DESCRIPTION AND LOCATION

The South Jersey Clothing Company (SJCC) is located on the northwest corner of the intersection of Central and Atlantic Avenues in an area known as Minotola, Buena Borough, New Jersey. Garden State Cleaners (GSC) is located approximately 500 feet south of SJCC, also west of Central Avenue and north of Summer Road. The sites are located within Atlantic County, less than two miles from the intersection of Atlantic, Gloucester and Cumberland Counties. Figure 1 shows the locations of the sites within the Town of Minotola.

The area of the SJCC property is approximately 1.2 acres. The site topography in the immediate vicinity of SJCC is flat with no predominant slope direction. Surface elevations at SJCC range from between approximately 120 and 123 feet, National Geodetic Vertical Datum (NGVD).

A line of the Central Railroad of New Jersey runs adjacent to the northwest property boundary of SJCC. The track grade lies approximately one to three feet below the elevation of the SJCC property. Two buildings are currently located on this property. In 1979, a fire at the facility destroyed much of the original 16,000 square foot manufacturing building. The remains of this building occupy the northeast corner of the SJCC property. Figure 2 shows the location of this building and other structures at SJCC (note that the dumpsters, drum storage area and former trichloroethylene (TCE) tank are no longer present at the SJCC site). Following the fire, all operations of the company were relocated to a separate building on the western portion of the SJCC property. In addition, two single-family residences are located on Central Avenue immediately south of the abandoned manufacturing building.

The GSC property occupies an area of approximately 3,000 square feet. The topography at the GSC site is also flat. Surface elevations range from approximately 121 to 122 feet, NGVD. GSC operates from a small building of approximately 1,800 square feet which covers much of the property (Figure 3). The property is surrounded by residential dwellings and small commercial establishments.

The land area downgradient from the sites is occupied primarily by residences and small businesses. A recreational area lies adjacent to the Cleary Junior High School, located approximately 2,000 feet south of the sites. The predominantly rural area surrounding Minotola is considered to be one of New Jersey's prime agricultural regions. While some of this area is irrigated, only one irrigation well is known to exist between the sites and Wheat Road (Figure 1).

There are no surface water features in the immediate vicinity of either site. The nearest surface water stream, Deep Run, is located approximately 1.2 miles from the sites. Runoff collected

in storm drains in Minotola is discharged to this stream. While the nearest catch basin is reportedly located approximately 600 feet from SJCC, surface runoff from SJCC appears to travel into the drainage ditch along the railroad tracks adjacent to the SJCC property. Surface water at GSC appears to infiltrate directly into the soil surrounding the GSC building.

All residents in the vicinity of the sites are connected to the borough water supply system. This system serves 50 percent of the borough land area and 75 percent of the population and extends approximately 4,000 feet downgradient from the sites. The two deep wells which provide water for the system are located approximately 2,000 feet northeast (upgradient) of the sites.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The SJCC, in operation since 1940, is an active facility which was once engaged in the manufacture of military clothing. According to information obtained from the New Jersey Department of Environmental Protection (NJDEP) files, volatile organic compounds (VOCs), particularly TCE, were used in the dry cleaning processes of the company's manufacturing operations. Wastewaters containing VOCs were routinely discharged directly onto the facility grounds located between the corner of the original manufacturing building and the adjacent railroad tracks. Other process wastes were also stored in leaking drums. These disposal practices possibly occured since 1940. In addition, according to NJDEP files, in 1979, a fire at the facility may have resulted in the release of an estimated 275 gallons of TCE from an on-site storage tank (Figure 2).

In early 1981, in response to a complaint by a nearby resident, the NJDEP performed several inspections of the SJCC facility. The resident believed her well was polluted and was worried "because a nearby clothing factory dumps a black waste onto the ground." Samples were collected from liquid and solid wastes and a puddle of surface water located beneath a discharge pipe of the northwest corner of the manufacturing building. An additional sample was collected from the contents of a leaking drum located beside the building. Analysis of these samples revealed elevated concentrations of VOCs with concentrations ranging as high as 620,000 parts per billion (ppb).

According to information obtained from the NJDEP, in May 1981, a limited soil removal was conducted by SJCC. Reportedly, thirty-three 55-gallon drums of contaminated soil were removed from the facility. No other details regarding this action are available.

In October 1981, SJCC agreed to install four groundwater monitoring wells at locations specified by NJDEP. Laboratory analysis of samples obtained from the wells indicated the

presence of a variety of VOCs. The following VOCs (and the highest concentrations detected) were identified in SJCC Well 2, located downgradient from the abandoned manufacturing building: TCE (9,860 ppb); toluene (82 ppb); 1,2-dichloroethane (59 ppb); tetrachloroethylene (28 ppb); and benzene (22 ppb).

During the following year, soil samples collected by NJDEP at SJCC detected elevated concentrations of TCE, tetrachloroethylene (PCE) and chloroform. TCE, PCE, and chloroform were detected at concentrations of 940,000, 340,000 and 47,000 ppb, respectively.

Between November 1981 and December 1983, SJCC installed an additional eight groundwater monitoring wells at, and downgradient from the SJCC facility. Figure 1 shows the locations of the SJCC monitoring wells. TCE concentrations were highest in wells at, and immediately downgradient from the manufacturing building. The highest reported concentration of TCE, 79,000 ppb, was detected in SJCC Well 2 in July 1984. These wells continue to be sampled in accordance with requirements established by NJDEP.

In January 1984, SJCC entered into an Administrative Order on Consent (ACO) with the NJDEP. Pursuant to this order, SJCC began operation of a groundwater extraction and treatment system in 1985. Groundwater is extracted from two wells (3A and 12), located near SJCC, at a continuous combined rate of approximately 25 gallons per minute (gpm) (Figure 1). Extracted groundwater is then treated by a system comprised of two air stippers connected in series. A third well (11), located on Summer Road, continuously extracts groundwater at an estimated ten gpm for discharge directly to the Buena Borough Municipal Utilities Authority (BBMUA) sewer system. Treatment system effluent is discharged to the groundwater via an injection well. This system, which remains in operation today, has served to contain the contaminated groundwater plume to some extent.

In November 1984, NJDEP installed five groundwater monitoring wells downgradient from the sites (Figure 1). Four VOCs were detected during two sampling events. The maximum concentration detected was 2.2 ppb of PCE in NJDEP Well 4 (NJ4).

Garden State Cleaners is an active dry cleaner in operation since 1966. Until 1985, according to a NJDEP Administrative Order and Notice of Civil Administrative Penalty Assessment, wastes were discharged through pipes located on the north wall of the building to the ground below. PCE was the primary compound used by GSC in its processes.

In 1984, when elevated concentrations of PCE were detected in SJCC Wells 6 and 8, located adjacent to and immediately downgradient from GSC, soil samples were collected from the GSC property. PCE and TCE were identified at 43,000 and 16,500 ppb

respectively in a sample collected from beneath the steam condensate pipe located on the north wall of the GSC building. In 1988, analyses of samples collected from SJCC wells 6 and 8 indicated concentrations of PCE at 6,100 and 450 ppb, respectively.

In 1985, GSC failed to enter into an ACO with the NJDEP. The order would have required GSC to determine the nature and extent of contamination at the site and evaluate appropriate measures for remediation of the contamination. In July 1987, NJDEP issued GSC an Administrative Order and Notice of Civil Administrative Penalty Assessment.

In June 1986, the SJCC and GSC sites were recommended by NJDEP for inclusion on the Environmental Protection Agency's (EPA) National Priorities List (NPL). Two years later, EPA proposed adding the sites to the NPL. In March and October 1989, GSC and SJCC, respectively, were officially added to the NPL.

On July 5, 1988, EPA sent a Special Notice letter to both SJCC and GSC notifying the companies of EPA's intent to conduct the necessary Remedial Investigation/Feasibility Study (RI/FS). Additionally, SJCC and GSC were presented with the opportunity to undertake the work. SJCC declined the opportunity to participate in the investigation. GSC gave no indication that it was either interested in, or capable of, undertaking the RI/FS.

During January and March 1989, an initial soil gas survey was conducted by EPA's Emergency Response Team. The survey was intended to provide information concerning sources of contamination, as well as the extent of migration of contaminants in groundwater. The sampling results showed that the highest TCE concentrations were found adjacent to the SJCC property. In addition, it was found that the highest PCE concentrations were found near GSC. These results were expected based on the primary cleaning solvents used at each facility. More details on the soil gas survey can be found in the Remedial Investigation (RI) Report.

On August 29, 1989, EPA provided SJCC with a second opportunity to conduct or finance (in part) the RI/FS as outlined in the final Work and Field Operations Plans developed for the sites in August 1989. Again, SJCC declined the opportunity.

In November 1989, EPA began a RI/FS for both sites. Phase I of the RI included primarily shallow and subsurface soil sampling, shallow and intermediate well installation, and groundwater sampling, and continued through February 1990. Phase II was conducted between January and April 1991 and included shallow soil sampling, intermediate and deep monitoring well installation, and groundwater sampling activities.

Also in 1989, SJCC began the installation of a limited soil vapor extraction system in the vicinity of the TCE storage tank that reportedly ruptured in the 1979 fire. This project was abandoned, however, with the start of EPA's RI.

On July 18, 1991, both companies were informed of their potential financial liabilities in connection with work performed at the sites. The notice letter also informed the "potentially responsible parties (PRPs)" that EPA may conduct, or require the PRPs to conduct, response actions at the sites. Further, the letter stated that if the response actions are performed by EPA, rather than a PRP, EPA has the authority to recover the public funds expended to respond to the release of hazardous substances at the sites.

HIGHLIGHTS OF COMMUNITY INVOLVEMENT

In August 1989, EPA prepared a Community Relations Plan for the sites. This document designated the Buena Borough Municipal Building and EPA's Regional Public Docket Office in New York City as information repositories for the sites (Appendix DD of the Responsiveness Summary). All key, site-related documents (including the administrative record file) are maintained at these repository locations.

On November 20, 1989, a local public availability session was held, at which representatives from EPA and its contractor were available to answer any questions regarding the plans for investigating the sites. Prior to the meeting, a fact sheet outlining the components of the investigation was distributed throughout the community.

In March 1991, at the start of Phase II of the remedial investigation, an updated fact sheet was issued to summarize the results of Phase I of the investigation and outline the plans for Phase II.

The draft RI/FS Reports and Proposed Plan for the SJCC and GSC sites were released to the public and both SJCC and GSC on Thursday, July 18, 1991. These documents were made available to the public at both information repository locations. On Friday, July 19, a press release was issued announcing the availability of the documents and the initiation of a public comment period. Also, on this day, a notice of availability for the documents was published in The Press of Atlantic City and The Daily Journal newspapers. These notices outlined the remedial alternatives and provided the dates for the public comment period and public meeting. The public comment period was held from July 19 through August 19, 1991. The public meeting was held on Thursday, August 8, at the Buena Borough Municipal Building. At this meeting, representatives from EPA and its contractor presented the RI/FS

results and remedial alternatives and answered questions about the investigation and alternatives under consideration. A transcript of the public meeting is included in the Administrative Record file for the sites.

All comments which were received by EPA prior to the end of the public comment period, including those expressed verbally at the public meeting, are addressed in the Responsiveness Summary (Appendix D) of this Record of Decision (ROD).

This decision document presents the selected remedial action for the South Jersey Clothing Company and Garden State Cleaners sites, in Buena Borough, New Jersey, chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, 42 U.S.C.A. 9601, et seq., and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300 et seq. The decision is based on the administrative record established for these sites.

SCOPE AND ROLE OF RESPONSE ACTION

This ROD addresses remediation of the contaminated groundwater plume, one of the primary threats posed by the sites. In addition, the contaminated soil, which represents the source of groundwater contamination, is addressed as the principal threat to human health and the environment posed by the sites. Contaminant soil concentrations would be reduced to comply with the appropriate requirements and minimize continued releases of contaminants to the groundwater. Current and future exposure to, and migration of, groundwater contaminants would be controlled, and contaminant concentrations reduced to within the appropriate drinking water standards. This response action addresses all known soil and groundwater contamination and is the final action contemplated for the sites.

SITE CHARACTERISTICS

The scope of the RI for the SJCC and GSC sites included studies for all media that may be contaminated. Soil, groundwater and air at and in the vicinity of the sites were investigated.

Soil

Figures 4 and 5 show the approximate areal extent of soil contamination at the SJCC and GSC sites as found during the RI. The estimated volume of contaminated soil at both sites totals 1,600 cubic yards (1,400 and 200 cubic yards at SJCC and GSC, respectively). Contaminants in soil in these areas exceed the

soil cleanup level goals developed for the sites. Based on the results from other sampling efforts, including groundwater samples collected from wells adjacent to and immediately downgradient from these areas, and the high levels of contaminants detected in the 9 to 10 foot depth range, soil contamination in each of these areas is believed to extend to a depth of 25 feet. Summaries of the compounds detected at SJCC and GSC during both phases of the RI and the cleanup level goals for those compounds are provided in Tables 1 and 2.

At SJCC, the zone of soil contamination extends from the northwest corner of the abandoned manufacturing building to the adjacent railroad bed. According to information obtained from the NJDEP files, this is the same area where wastes were reported to have been disposed. TCE was the predominant contaminant identified at SJCC with a maximum detected concentration of 68,000 ppb. Other VOCs were detected at lower concentrations in the soil at SJCC (Table 1). Contaminants detected during the RI at concentrations exceeding the soil cleanup level goals included TCE, PCE and acetone.

At GSC, the zone of soil contamination is confined to a small area adjacent to the north wall of the GSC building. According the NJDEP files, this is the same area where wastes were reported to have been discharged. PCE was the predominant contaminant identified in soil at GSC with a maximum detected concentration of 1,300,000 ppb. Other VOCs, detected at lower concentrations, are shown in Table 2. Contaminants detected during the RI at concentrations exceeding the soil cleanup level goals at GSC also included PCE, TCE and acetone.

Groundwater

During the RI, a zone of contaminated groundwater containing TCE, PCE and other VOCs was identified (Figures 6 and 7). This zone extends from the shallow wells located near SJCC and GSC to EPA's intermediate wells 6I (EP-6I) and 12I (EP-12I). TCE and PCE were detected in EP-8D, a deep well located downgradient from the sites, at concentrations of 0.9 and 7 ppb, respectively. The highest concentrations of VOCs were found within the shallow aquifer between the sites and SJCC Well 8. Seven VOCs detected in groundwater samples exceeded State and Federal maximum contaminant levels (MCLs) for drinking water. MCLs are enforceable standards which apply to specific contaminants which EPA and the State of New Jersey have determined have an adverse effect on human health. These compounds included TCE, PCE and other VOCs as summarized in Table 3. This table also identifies the MCLs for the compounds.

The contaminated soil located at the northwest corner of the manufacturing building at SJCC has been identified as the most probable source of contaminated groundwater emanating from SJCC.

This determination is based on the finding that SJCC Well 2, located downgradient from the contaminated soil, has shown the highest concentrations of TCE throughout the RI. In addition, neither TCE nor PCE was detected in SJCC Well 9 located upgradient from the area of contaminated soil. The location of the likely source of PCE is the contaminated soil adjacent to the north wall of the GSC building. Groundwater sampling results show that the concentrations of PCE in SJCC Wells 6 and 8, located adjacent and immediately downgradient from GSC, are substantially higher than those detected in other SJCC wells. Similar concentrations of PCE were identified in wells upgradient from GSC.

A vertical profile of the VOC contamination detected during Phase II is shown on Figure 8. When viewed in combination with groundwater Figures 6 and 7, the TCE and PCE concentration contour maps, it appears that the TCE and PCE contamination is migrating deeper into the groundwater aquifer as it travels from the sites. The contamination was detected in Well EP-6I and further downgradient in EP-12I. Neither TCE nor PCE were detected in any other intermediate wells (including those down-gradient from EP-12I).

Air

The air emission rates measured at SJCC ranged from non-detect to 1,463 ug/m^3-min (micrograms per cubic meter per minute) for TCE. As the primary contaminant at SJCC, a contour map of TCE emission rates from SJCC was generated to show an emission profile of the site (See RI Report). Based on modeling, 24-hour emission values were produced. The TCE value for SJCC at a distance of 100 meters was 44.32 ug/m^3.

At GSC, air emission rates measured ranged from non-detect to 10,955 ug/m^3-min for PCE. The RI Report provides an air emission profile for PCE at GSC. The PCE value for GSC at 100 meters was 0.0024 ug/m^3. Comparison of this value, to a value of 1.1 ug/m^3 (i.e., a value corresponding to a $1x10^{-6}$ (corresponding to a one in a million) risk obtained from the 1989 Health Effects Assessment Summary Table), indicates that air emissions at GSC are of no concern to off-site residents.

SUMMARY OF SITE RISKS

EPA conducted a baseline Risk Assessment to evaluate the potential risks to human health and the environment associated with the SJCC and GSC sites in their current states. The Risk Assessment focused on contaminants in the ambient air, surface soil and downgradient groundwater which are likely to pose significant risks to human health and the environment.

Summaries of the contaminants of concern (COCs) in sampled matrices are listed on Table 4.

EPA's Risk Assessment identified several potential exposure pathways by which the public may be exposed to contaminant releases at the sites under potential present and future land use scenarios. Under each scenario, the pathways were evaluated for exposure to the media of concern (i.e., ambient air, surface soil and downgradient groundwater). These exposure pathways included the following: ingestion, inhalation, and dermal absorption. The receptor groups for which risks were evaluated at the sites included the following: adult workers, residents, trespassers and customers, adolescent residents and trespassers, and finally, child residents. The receptor groups and relevant exposure routes considered are shown on Table 5. Exposures were based on reasonable maximum concentrations, calculated as the 95th percentile upper confidence limit (95% UCL) of the arithmetic mean. This reasonable maximum exposure is defined as the highest exposure that is reasonably expected to occur at the sites for individual and combined pathways.

Under current EPA guidelines, the likelihood of carcinogenic (cancer causing) and non-carcinogenic effects due to exposure to site chemicals are considered separately. It was assumed that the toxic effects of the site-related chemicals would be additive. Thus, carcinogenic and non-carcinogenic risks associated with exposures to individual compounds of concern were summed to indicate the potential risks associated with mixtures of potential carcinogens and non-carcinogens, respectively.

Non-carcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intakes and safe levels of intake (Reference doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects. RfDs, which are expressed in units of mg/kg-day (milligrams per kilogram per day), are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) are compared with the RfD to derive the hazard quotient for the contaminant in the particular medium. The HI is obtained by adding the hazard quotients for all compounds across all media.

A HI greater than 1.0 indicates that the potential exists for non-carcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

For the SJCC and GSC sites, none of the estimated HI values from current exposure to surface soil exceeded 1.0 for any potential receptor. Table 6 presents the total estimated HIs for current exposure to the various environmental media. Under the future scenario, the HI was also below 1.0 for surface soil exposure for an adult non-resident worker at SJCC. At GSC, however, the HI exceeded 1.0 for on-site adolescent and child residents. The HI values for these receptors were 1.5 and 3.6, respectively. In addition, under the future scenario, the HI exceeded 1.0 for both on- and off-site residents exposed to groundwater via ingestion. When the estimated HIs were summed for each environmental media to calculate the total HIs for potential receptors, the total HIs exceeded 1.0 (ranging from 1.0 - 7.3) for all receptors except an adult worker who is not a resident of the site area. Table 7 presents the total estimated HIs for exposure to various environmental media under future scenarios.

Potential carcinogenic risks were evaluated using the cancer slope factors (SFs) developed by EPA for the contaminants of concern. SFs have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. 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 generate an upper-bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes the underestimation of the risk highly unlikely. The SFs for the contaminants of concern are presented in Table 8.

For known or suspected carcinogens, EPA considers excess upper bound individual lifetime cancer risks of between 10^{-4} to 10^{-6} to be acceptable. This level indicates that an individual has not greater than a one in ten thousand to one in a million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year period under specific exposure conditions at the sites.

The results of this portion of the assessment concluded that the estimated lifetime excess cancer risk from current exposure to surface soil at the GSC for adult workers and trespassers fell within EPA's target risk range at total values of 9.8×10^{-5} (9.8 in ten thousand) and 3.8×10^{-6}, respectively. The estimated excess cancer risks from all other media for the various receptors were below 1×10^{-6}. Table 9 presents the total estimated lifetime excess cancer risk from current exposure to the various environmental media of concern. Under the future scenario, the estimated lifetime excess cancer risks from exposure to groundwater for an adult worker/off-site resident, adult off-site resident/trespasser and adult on-site resident were at values of

$1.1x10^{-3}$ (1.1 in a thousand), $9.7x10^{-4}$, and $1.2x10^{-3}$, respectively. Also, under this scenario, the lifetime excess cancer risk from exposure to surface soil at GSC for an adult on-site resident was at a value of $1.4x10^{-4}$. These values exceed the EPA acceptable risk range for carcinogens. Finally, at SJCC, the ambient air exposure had an estimated lifetime excess cancer risk of $8.8x10^{-5}$ for an on-site adult resident. The estimated lifetime excess cancer risks from surface soil exposure at the SJCC and ambient air exposure at the GSC site were below $1x10^{-6}$. Table 10 presents the total estimated lifetime excess cancer risk resulting from future exposure to the various environmental media.

For more detail on the risk assessment, including brief summaries of the critical human health effects associated with long-term exposure to each of the chemicals of concern, see chapter 6, the Baseline Risk Assessment, of the RI Report.

A brief environmental evaluation was also conducted as part of the baseline risk assessment. The evaluation concluded that the threat to biological resources posed by the sites appears to be minimal and limited to potential impacts to plants exposed to contaminants in surface soils. These plants include primarily cultivated grasses and weeds. According to the RI Report, the potential exists for bioaccumulation to occur in these plants causing sublethal effects (stunted growth) or death in the more sensitive species. These effects, however, have not been observed in the vegetation at SJCC and GSC.

Effects of contamination on terrestrial animals were considered insignificant. This conclusion was based on the likelihood that the duration of exposure would be brief and frequency of exposure low.

Finally, it was concluded that while the sites are located within the range of several endangered or threatened animal species including the Pine Barrens Treefrog, Pine Snake, Red-shouldered Hawk, Barred Owl and Red-headed Woodpecker, conditions at the sites do not conform to the habitats preferred by these species. Thus, it is believed that these species are not likely to be present within either site area.

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include environmental chemistry sampling and analysis, exposure models and assumptions, and toxicological models and parameters.

As a result, the Risk Assessment provides upper bound estimates of the risks to populations near the sites, and is highly unlikely to underestimate actual risks related to the sites.

Actual or threatened releases of hazardous substances from these sites, if not addressed by the preferred alternative or one of the other active remedial alternatives considered, may present a current or potential threat to the environment through the groundwater and soil pathways.

DESCRIPTION OF ALTERNATIVES

A Feasibility Study (FS) was conducted to develop and evaluate remedial alternatives for soil and groundwater at the SJCC and GSC sites. Remedial alternatives were assembled from applicable remedial technology process options and were intially evaluated for effectiveness, implementability, and cost. The alternatives meeting these criteria were then evaluated and compared to nine criteria required by the NCP.

The remedial alternatives described in this ROD are organized according to the media which they address and are numbered to correspond with the numbers in the FS. The alternative numbers for soil are preceeded by the letter "S." Groundwater alternative numbers are preceeded by the letters "GW."

Estimated capital and annual operation and maintenance (O&M) costs are used to calculate an estimated total present worth cost for each alterative. In addition, for all described alternatives, the implementation timeframe refers to the time required to implement the alternative from the start of construction and operation of the treatment system to its completion. This timeframe does not include the time required to perform remedial design activities.

More detailed descriptions of the various soil and groundwater alternatives are presented within Chapter 3 of the FS Report, Development and Analysis of Alternatives.

Soil

Five remedial alternatives for contaminated soil at SJCC and GSC were considered for detailed evaluation and are described below. The capital, operation and maintenance, and present worth costs provided for these alternatives were totaled for the sites.

For total VOCs in soil, NJDEP established an Interim Soil Action Level (ISAL) of 1 ppm (or 1,000 ppb). EPA regards this action level as a "to-be-considered" requirement. As such, it can be used in determining the necessary level of cleanup for the protection of human health and the environment. In the absence of any existing chemical specific Federal or State ARARs for soil, EPA and the NJDEPE have agreed to establish cleanup goals of 1 ppm for TCE and PCE, separately, given the predominance of the two compounds at the sites.

Alternative S1: NO ACTION

Estimated Capital Cost: $20,000
Estimated Annual O&M Cost: $87,000
Estimated Total Present Worth (PW) Cost: $1,700,000
Estimated Implementation Timeframe: None

CERCLA requires that the "No Action" Alternative be evaluated at every site to establish a baseline for comparison to the other alternatives. Under this alternative, EPA would take no further action at the sites to prevent exposure to the soil contamination. A long-term groundwater monitoring program would be implemented to track the migration of soil contaminants from the soil into the groundwater utilizing existing groundwater monitoring wells to the maximum extent possible. For cost estimation purposes, it was assumed that sampling would occur on a quarterly basis. The groundwater samples would be analyzed for VOCs including TCE, PCE, cis-1,2-dichloro ethene, 1,1-dichloroethene, carbon tetrachloride, vinyl chloride, 1,1,1-trichloroethane and benzene.

Because this alternative would result in contaminants remaining on site, CERCLA requires that the sites be reviewed every five years. If justified by the review, remedial actions would be implemented at that time to remove or treat the wastes. The cost estimates above include the cost to perform this review.

Alternative S2: SOIL VAPOR EXTRACTION

Estimated Capital Cost: $461,000
Estimated Annual O&M Cost: $188,000
Estimated Total PW Cost: $649,000
Estimated Implementation Timeframe: 6 - 9 months

Approximately 1,600 cubic yards of contaminated soil would be treated by in situ vapor extraction. The extraction process utilizes a vacuum generated by a pump or blower to induce air flow through the contaminated soil, stripping and volatilizing the VOCs from the soil into the air. Contaminated air and water from the soil would flow to a water/vapor separator where the contaminated water would be removed and pumped for treatment. The contaminated air would flow through activated carbon canisters arranged in series for treatment. Spent activated carbon would be regenerated at an off-site location for reuse. A surface liner would be used to prevent air leakage from the soil surface. Additional study on soil vapor extraction would be performed during the design phase.

Alternative S3: EXCAVATION, LOW TEMPERATURE THERMAL DESORPTION, BACKFILL TREATED SOIL

Estimated Capital Cost: $1,160,000
Estimated Annual O&M Cost: $38,000
Estimated Total PW Cost: $1,198,000
Estimated Implementation Timeframe: 5 - 8 months

Approximately 1,600 cubic yards of contaminated soil would be excavated and staged prior to treatment in an on-site, mobile thermal desorption unit. Thermal desorption is a mass transfer process in which soil is passed through a thermal rotary dryer where VOCs are transferred to the gas phase. Off-gases would be managed in a treatment unit and condensate treated in an on-site groundwater treatment plant. The treated soil would be used to backfill the excavations. The unit would comply with the appropriate Federal and State air quality standards.

Alternative S4: SOIL FLUSHING

Estimated Capital Cost: $133,000
Estimated Annual O&M Cost: $34,000
Estimated Total PW Cost: $167,000
Estimated Implementation Timeframe: 10 - 14 months

Under this alternative, water is applied at or near the soil surface. Infiltration of the water through the vadose zone causes contaminants to desorb from the soil and move to the groundwater. Using extraction wells, contaminated groundwater leachate would be extracted from the groundwater and pumped to a groundwater treatment system. The treated groundwater would then be reapplied to the soil resulting in a cyclic flow pattern. Given that this alternative requires treatment of the extracted groundwater, it would be considered only in conjuction with one of the active groundwater alternatives. Costs associated with treatment of the extracted groundwater are included under the groundwater alternatives. Temporary dikes would surround the soil areas to contain the flushing solution within the treatment area. Periodic subsurface soil sampling and analysis would be required to effectively monitor the progress of the soil flushing.

Alternative S5: EXCAVATION, OFF-SITE DISPOSAL, BACKFILL WITH BORROW MATERIAL

Estimated Capital Cost: $5,890,000
Estimated Annual O&M Cost: 0
Estimated Total PW Cost: $5,890,000
Estimated Implementation Timeframe: 4 - 5 months

Approximately 1,600 cubic yards of contaminated soil would be excavated, loaded into trucks, and hauled to an approved off-site

Resource Conservation and Recovery Act (RCRA) landfill for treatment and disposal. To comply with the RCRA land disposal restrictions requirements (LDRs), treatment of the contaminated soil would be required prior to disposal. For cost estimation purposes, it was assumed that the soil would undergo thermal treatment. The excavations would be backfilled with clean fill material from an off-site source.

Groundwater

Five remedial alternatives for contaminated groundwater at the SJCC and GSC sites were considered for detailed evaluation and are described below. The cost estimates for the active groundwater alternatives are based on a treatment period of 70 years. For cost estimation purposes, it was assumed that the treatment facility would be located on the SJCC property.

The estimates presented below differ from those presented in the Proposed Plan. Because these alternatives must attempt to achieve low levels of contaminants in the groundwater, there is some uncertainty associated with the required timeframes for cleanup under the alternatives. Thus, more conservative cost estimates were developed to better reflect the time needed to achieve these levels.

The active groundwater alternatives employ two types of groundwater extraction systems. The limited extraction system, proposed under groundwater Alternatives GW2(a) and GW3(a), would attempt to remediate only the highly-contaminated groundwater areas location in the immediate vicinity of the sites. The remainder of the contaminated groundwater plume would not be actively remediated under this system, but would be allowed to naturally attenuate. Extraction of the total groundwater plume, proposed under groundwater Alternatives GW2(b) and GW3(b), would attempt to remediate all zones of groundwater contamination exceeding the appropriate Federal and State drinking water standards.

Conceptual layouts for the proposed system options are shown on Figures 9 and 10.

Except for the No Action Alternative which includes long-term groundwater monitoring only, each alternative includes the following common elements:

Groundwater Extraction and Injection: The limited extraction system would include an estimated seven extraction wells pumping an average of approximately 30 gpm. Twenty pore volumes are associated with limited extraction (estimated to be 353 million gallons). To the maximum extent possible, the existing extraction and monitoring wells will be utilized to limit costs. The wells would be connected by a header pipe leading to the on-

site treatment plant. This piping would be intalled below the ground surface and would follow street rights-of-way where possible.

The total extraction system would include an estimated twenty extraction wells pumping an average of approximately 50 gpm each. Approximately twenty-three pore volumes are associated with the total extraction system (estimated to be 1.6 billion gallons). This system would utilize the same wells proposed under the limited extraction system option along with an additional estimated 13 deep extraction wells located downgradient from the sites. A line of extraction wells would be placed along the downgradient edge of the contaminated groundwater plume and along the centerline of the plume between the sites and the downgradient edge of the plume.

Effluent from the treatment plant would be reinjected into the groundwater via a network of injection wells. For cost estimation purposes, five injection wells were proposed under the limited extraction system, and ten under the total plume extraction system option. These wells would be located upgradient from the sites to enhance aquifer flushing and the desorption of contaminants from soil. The actual number and locations of the wells would be determined during design of the system.

Long-Term Groundwater Monitoring: A groundwater monitoring program would be implemented to monitor the performance of the remedial action. Existing monitoring wells would be utilized to the maximum extent possible. While the actual locations of the wells would be determined during design, anticipated points include locations upgradient and downgradient from, and within the groundwater plume. Groundwater samples would be analyzed for VOCs including TCE, PCE, cis-1,2-dichloroethene, 1,1-dichloroethene, carbon tetrachloride, vinyl chloride, 1,1,1-trichloroethane and benzene.

Temporary Institutional Controls: The need for providing home treatment units for individual residents south of Louis Drive will be evaluated during the remedial design phase. The existence of groundwater contamination south of Louis has not been determined. All residences located on Louis Drive, however, receive public water.

Groundwater

Alternative GW1: NO ACTION

Estimated Capital Cost: $20,000
Estimated Annual O&M Cost: $87,000
Estimated Total PW Cost: $1,700,000
Estimated Implementation Timeframe: None

As previously indicated, CERCLA requires that the "No Action" Alternative be evaluated at every site to establish a baseline for comparison to the other alternatives. Under this alternative, EPA would take no further action at the site to prevent exposure to the groundwater contamination and the contamination would continue to migrate from the site and could impact downgradient potable wells in the future. Using existing monitoring wells to the extent possible, a long-term groundwater monitoring program would be implemented to track the migration of contaminants in the groundwater. For cost estimation purposes, it was assumed that sampling would occur on a quarterly basis.

Because this alternative would result in contaminants remaining on site, CERCLA requires that the site be reviewed every five years. If justified by the review, remedial actions would be implemented at that time to remove or treat the wastes. The above cost estimates include the cost to perform this review.

Alternative GW2(a): LIMITED EXTRACTION, AIR STRIPPING, CARBON ADSORPTION, REINJECTION OF TREATED WATER, LONG-TERM MONITORING

Estimated Capital Cost: $1,024,000
Estimated Annual O&M Cost: $187,000
Estimated Total PW Cost: $4,640,000
Estimated Implementation Timeframe: 70 years

Using a series of an estimated seven extraction wells, groundwater would be extracted from the more highly-contaminated portions of the water table aquifer at a flow rate of approximately 200 gpm. To treat the VOCs in the extracted groundwater, an air stripping column and granular activated carbon adsorption units would be constructed on site. In the air stripping process, VOCs are transferred from the water to the air phases and discharged to the atmosphere. Air emissions from the stripper column would comply with the appropriate Federal and State air quality standards and regulations. In the carbon adsorption process, VOCs are adsorbed onto activated carbon, thereby removing them from the groundwater. The spent carbon would be regenerated for reuse when possible. The treated groundwater would be reinjected upgradient from the sites.

Alternative GW2(b): TOTAL PLUME EXTRACTION, AIR STRIPPING, CARBON ADSORPTION, REINJECTION OF TREATED WATER, LONG-TERM MONITORING

Estimated Capital Cost: $3,665,000
Estimated Annual O&M Cost: $354,000
Estimated Total PW Cost: $10,520,000
Estimated Implementation Timeframe: 70 years

This alternative is similar to Alternative GW2(a) except that groundwater would be extracted from throughout the aquifer at an approximate flow rate of 1,000 gpm. Extracted groundwater would be treated via air stripping and carbon adsorption and reinjected upgradient of the sites. Air emissions would comply with the appropriate air quality standards and regulations.

Alternative GW3(a): LIMITED EXTRACTION, ULTRAVIOLET (UV)/OXIDATION, REINJECTION OF TREATED WATER, LONG-TERM MONITORING

Estimated Capital Cost: $1,168,000
Estimated Annual O&M Cost: $234,000
Estimated Total PW Cost: $5,700,000
Estimated Implementation Timeframe: 70 years

As described for Alternative GW2(a), a series of an estimated seven extraction wells would be used to extract groundwater from the water table aquifer at a flow rate of approximately 200 gpm. Extracted groundwater would be pumped to a UV plant comprised of a UV radiation/oxidation reactor and ozone generator modules, a hydrogen peroxide feed system and catalytic ozone decomposer unit for treatment. In the UV oxidation process, UV light reacts with hydrogen peroxide and/or ozone molecules to form hydroxyl radicals. These very powerful chemical oxidants then react with the organic compounds in the water. The treated water from the reactor would be reinjected into the groundwater aquifer. No waste residuals would remain after treatment.

Alternative GW3(b): TOTAL PLUME EXTRACTION, UV/OXIDATION, REINJECTION OF TREATED WATER, LONG-TERM MONITORING

Estimated Capital Cost: $3,035,000
Estimated Annual O&M Cost: $475,000
Estimated Total PW Cost: $12,220,000
Estimated Implementation Timeframe: 70 years

This alternative is similar to Alternative GW3(a) except that groundwater would be extracted from the aquifer at a flow rate of approximately 1,000 gpm. Extracted groundwater would be pumped to an above-ground equalization tank before being pumped to the UV oxidation plant for treatment. Given the high flow rate, contaminated groundwater would undergo oxidation in two oxidation

reactors before entering the UV oxidation reactor. Reinjection of the treated groundwater would follow.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The soil and groundwater remedial alternatives developed in the FS were analyzed in detail using the nine evaluation criteria described below. The resulting strengths and weaknesses of the alternatives were then weighed to identify the soil and groundwater alternatives which provide the best balance among the nine criteria.

The critera are categorized into three groups -- threshold, primary balancing and modifying criteria. Briefly, threshold criteria are the most important and must be satisfied by any alternative to be eligible for selection. Primary balancing criteria are used to make comparisons and identify the major tradeoffs among the various alternatives. Finally, modifying criteria are generally taken into account after the formal public comment period on the RI/FS Reports and the Proposed Plan is complete.

THRESHOLD CRITERIA

Criterion 1: Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether a remedy provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, or engineering or institutional controls.

All of the soil alternatives would provide for protection of human health and the environment, except for Alternative S1, the No Action Alternative. Soil Alternatives S2 through S5 would achieve protection by eliminating or reducing risk through treatment and other controls. Under Alternative S5, the source of contamination would be completely removed from the site for off-site treatment and disposal. Alternatives S2 and S3 would result in the reduction of risk to approximately the $1x10^{-8}$ (one in a hundred million) level. While Alternative S4 would achieve the same reduction in risk, contaminants would be allowed to spread into the groundwater. As the No Action Alternative (S1) does not include treatment, it provides no reduction in risk and will no longer be discussed with regard to soil contamination.

All of the treatment technologies employed by the active groundwater alternatives are protective of human health and the environment by eliminating or reducing risk through treatment of contaminants in groundwater. In addition, the temporary institutional controls and the available existing municipal water

supply would minimize further use of groundwater, and therefore reduce exposure to contaminants. As Groundwater Alternative GW1 does not include treatment, it provides no reduction in risk and will no longer be considered.

Criterion 2: Compliance with Applicable Relevant and Appropriate Requirements (ARARs)

Compliance with ARARs addresses whether a remedy will meet all Federal and State environmental laws and/or provide basis for a waiver from any of these laws. These ARARs are divided into the following three groups: chemical specific, action specific and location specific.

The technologies and methods proposed for use under the soil and groundwater alternatives would be designed and implemented to satisfy all corresponding ARARs.

To comply with the RCRA LDRs, treatment of the contaminated soil under Soil Alternative S5 would be required prior to disposal. Federal and State regulations dealing with the handling and transportion of hazardous wastes to an approved off-site RCRA landfill for treatment and disposal would be followed. Under the remaining alternatives, contaminated soil at the sites would be treated in accordance with the EPA/NJDEPE soil cleanup level goals. Tables 1 and 2 identify the soil cleanup level goals for the compounds detected. Atmospheric emissions under Alternatives S2 and S3 would meet the appropriate air standards and regulations. Alternative S4 would meet the permit requirements for the off-site discharge of treated groundwater.

Air emissions from all groundwater alternatives would meet the appropriate air quality standards and regulations. The treatment technologies employed under the groundwater alternatives would attempt to meet the Federal and State MCLs for drinking water (Table 3), except in the downgradient groundwater under Groundwater Alternatives GW2(a) and GW3(a), where the contaminated groundwater would be allowed to naturally attenuate.

See STATUTORY DETERMINATIONS for more details on ARARs for the soil and groundwater alternatives.

PRIMARY BALANCING CRITERIA

Criterion 3: Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

All of the soil alternatives would result in minimal residual risk. Under Soil Alternative S5, risks would be eliminated because of the excavation, treatment and off-site disposal of the contaminated soil. Soil Alternatives S2 through S4 are expected to attain the EPA/NJDEPE soil cleanup level goals. Under Soil Alternative S4, however, contaminants would be flushed into the groundwater which would then be extracted and treated as part of the groundwater remedial action. Residuals (i.e., spent carbon) under Soil Alternative S3 would undergo regeneration for reuse when possible.

All of the groundwater alternatives are expected to attain Federal and State MCLs for drinking water (Table 3), thereby resulting in minimal risk from contaminant residuals in groundwater. However, as Groundwater Alternatives 2(a) and 3(a) would address only the highly-contaminated portion of the groundwater plume, allowing the downgradient portion to naturally attenuate, the resulting risks under these alternatives would be greater. Temporary institutional controls and the existing municipal water supply additionally mitigate residual risks by minimizing the use of groundwater.

Under Groundwater Alternatives GW2(a) and GW2(b), residual wastes (i.e., the carbon beds) would be regenerated for reuse. Alternatives GW3(a) and GW3(b) would require replacement of UV lamps when necessary, and constant regulation of proper dosages of hydrogen peroxide and ozone.

Criterion 4: Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the preference for a remedy that uses treatment to reduce health hazards, contaminant migration, or the quantity of contaminants at the site.

Soil Alternatives S2 through S5 would result in treatment of the same volume of contaminated soil to the same levels. Soil Alternatives S2 and S3 employ processes that are irreversible (i.e., the effects of treatment). While Alternative S4 would provide for reduction in toxicity and volume, mobility of the contaminants would be increased with the flushing action.

All of the groundwater alternatives employ an irreversible treatment, with proper system operation and maintenance, as an element to address one the threats posed by the sites. However, Groundwater Alternatives GW2(a) and GW3(a) would accomodate smaller volumes of contaminated groundwater than the remaining groundwater alternatives (i.e., GW2(b) and GW3(b)).

Criterion 5: Short-Term Effectiveness

Short-term effectiveness refers to the period of time needed to complete the remedy and any adverse impacts on human health and the environment that may be posed during the construction and implementation of the remedy.

Provided that system equipment is properly maintained and the appropriate protective measures are followed during construction and operation of the system, Alternative S2 is not expected to pose any appreciable short-term risks to the community and workers during construction and implementation. Soil Alternative S3 and S5 would require excavation of the contaminated soil which could potentially result in the generation of dust and vapors. Proper health and safety precautions would be undertaken to reduce potential risks to the community and workers. Alternative S5 would also involve the use of trucks to transport the excavated soil off site. Alternative S4, as discussed, would provide for potential short-term risks to the environment by temporarily increasing the mobility of contaminants from the soil to groundwater. The implementation timeframes are as follows: Alternative S2 - 6 to 9 months; Alternative S3 - 5 to 8 months; Alternative S4 - 10 to 14 months; and Alternative S5 - 4 to 5 months.

As the more limited groundwater extraction system alternatives, however, GW2(a) and GW3(a) would require less clearance of underbrush, excavation of trenches along roadsides, and the installation of fewer wells. Less noise and dust would result from the frequent movement of heavy vehicles carrying construction materials. Also, fewer roads would require closing. All of the groundwater alternatives would require an estimated 70 years for completion.

Criterion 6: Implementability

Implementability refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution. It also includes coordination of Federal, State, and local governments to cleanup the site.

Some of the soil alternatives are more easily implemented than others. Soil Alternatives S2 and S4 involve easily constructed and operated technologies and require only routine site preparation. Alternatives S2 through S4 all require specialists to operate the systems and can easily be modified in response to a change in action. Monitoring of S4, however, may present some difficulties. Soil Alternatives S3 and S5 would require significant preparation, mainly with regard to the required excavation of soil. Alternative S3 would also require numerous Federal and State approvals to construct and operate the mobile thermal unit.

Groundwater Alternatives GW2(a) and GW3(a) are the most easily technically implemented given that these alternatives require less construction, as described, than the remaining groundwater alternatives. Also as described briefly under the previous criterion, Groundwater Alternatives GW2(b) and GW3(b) would require extensive clearance of underbrush, excavation of roadsides for system piping and the installation of approximately 20 extraction wells. Roads would require temporary closing. Acquiring access to the affected properties may be difficult and time consuming. Groundwater Alternatives GW2(a) and GW2(b) employ treatment components that are proven effective for the contaminants of concern, well understood, and readily available commercially. As an innovative technology, the technology employed under Alternatives GW3(a) and GW3(b) would require treatability studies to determine the level of effectiveness the technology would achieve.

Criterion 7: Cost

This criterion examines the estimated costs for each remedial alternative. These include estimated capital and annual operation and maintenance costs, also expressed as estimated total present worth cost.

Cost estimates for the five soil alternatives are as follows:

Alt.	Capital Cost	O&M	Total PW Cost
S1	$ 20,000	$ 87,000	$1,700,000
S2	$ 461,000	$188,000	$ 649,000
S3	$1,160,000	$ 38,000	$1,198,000
S4	$ 133,000	$ 34,000	$ 167,000
S5	$5,890,000	$ 0	$5,890,000

Cost estimates for groundwater treatment are based on a 70-year period which is the estimated time required to achieve the Federal and State MCLs. The five groundwater alternatives and their costs are as follows:

Alt.	Capital Cost	O&M	Total PW Cost
GW1	$ 20,000	$ 87,000	$ 1,700,000
GW2(a)	$1,024,000	$187,000	$ 4,640,000
GW2(b)	$3,665,000	$354,000	$10,520,000
GW3(a)	$1,168,000	$234,000	$ 5,700,000
GW3(b)	$3,035,000	$475,000	$12,220,000

MODIFYING CRITERIA

Criterion 8: State Acceptance

State acceptance reflects aspects of the preferred alternative and other alternatives that the support agency favors, objects to, and any specific comments regarding State ARARs or the proposed use of waivers.

EPA has involved the New Jersey Department of Environmental Protection and Energy (NJDEPE) in the RI/FS and remedy selection process. The NJDEPE was provided the opportunity to comment on the draft RI/FS documents and the Proposed Plan, and was present at the public meeting held on August 8 to inform the public of the results of the RI/FS and the Proposed Plan. The State of New Jersey concurs with the selected remedy (Appendix C -- State Letter of Concurrence).

Criterion 9: Community Acceptance

This criterion summarizes the public's general response to the alternatives described in the Proposed Plan and in the RI/FS, based on public comments received.

EPA solicited input from the community on the remedial alternatives proposed for soil and groundwater contamination at the SJCC and GSC sites. Written comments were received on August 19, 1991, from Franklin J. Riesenburger of Riesenburger & Kizner, P.C., Attorneys at Law, on behalf of the SJCC. No written comments were received from GSC. Although public comments indicate no specific opposition to the preferred combination of alternatives, residents and their representatives did raise some concerns regarding responsible party liabilities, the results of EPA's investigation of the sites, remediation costs and potential health effects associated with contamination at the sites. These issues, and others, are addressed in the attached Responsiveness Summary (Appendix D) which addresses all comments received during the public comment period and the August 8 public meeting.

SELECTED REMEDY

EPA has selected the combination of Soil Alternative S2 and Groundwater Alternative GW2(b) as the remedy for the SJCC and GSC sites. This remedy is comprised of the following components:

Alternative S2: Soil Vapor Extraction

- In situ treatment of contaminated soil via vapor extraction process.

Alternative GW2(b): Total Plume Extraction, Air Stripping and Carbon Adsorption, Reinjection of Treated Water and Long-Term Groundwater Monitoring

- Extraction of groundwater with concentrations of VOCs above MCLs;

- Treatment of contaminated groundwater with an on-site air stripping column and carbon adsorption units;

- Reinjection of the treated water into the aquifer; and

- Long-term monitoring of groundwater.

The selection of this remedy is based upon the comparative analysis of the soil and groundwater alternatives above, and provides the best balance of tradeoffs with respect to the nine evaluation criteria. ARARs for the selected remedy are provided in the discussion Attainment of Applicable or Relevant and Appropriate Requirements of Environmental Laws in the following section. As described in the comparative analysis, the selected alternative for cleanup of contaminated soil employs an effective, readily-implementable technology for treatment of volatile organic compounds. The only residual, spent carbon, would be regenerated for reuse.

Air emissions would meet the appropriate Federal and State air quality standards and regulations. Also, as an in situ technology, the alternative meets the statutory preference for treatment of a principal threat. In addition, as pointed out in the comparative analysis, the selected groundwater remedy would address the entire contaminated groundwater plume via air stripping and carbon adsorption. This alternative was chosen over the remaining alternative which would have provided for natural attenuation of the downgradient portion of the groundwater plume. EPA recognizes, however, that the cooperation of the affected community, particularly in regard to the placement of extraction wells, is essential to the successful implementation of the selected alternative. Without this cooperation, the extent of the groundwater cleanup may need to be modified.

The combination of air stripping and carbon adsorption technologies have been proven highly effective on the type of contaminants present at the sites.

EPA and NJDEPE have determined that, given the predominance of TCE and PCE at the sites, the levels of 1 ppm for each of these compounds would be used as the goal for cleanup of contaminated soil at the SJCC and GSC sites. These levels also formed the basis for defining the extent of soil contamination at the sites.

The goal of the groundwater remedy is to restore the contaminated groundwater plume to levels below Federal and State MCLs (Table 3). A further objective of the groundwater remedy is to restore the groundwater to its beneficial use, which is, at these sites, a drinking water aquifer. Based on information obtained during the RI, and on careful analysis of all remedial alternatives, EPA and the State of New Jersey believe that the selected groundwater remedy will achieve this goal. It may become apparent, however, during implementation or operation of the groundwater extraction system and its modifications, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal over some portion of the contaminated groundwater plume. In such a case, the system performance standards and/or the remedy may be reevaluated.

The remedy would include groundwater extraction for an estimated period of 70 years, during which time the system's performance would be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include any or all of the following:

- Discontinuing pumping at individual wells where cleanup goals have been attained;

- Alternating pumping at wells to eliminate stagnation points;

- Pulse pumping to allow aquifer equilibration and to allow adsorbed contaminants to partition into groundwater; and/or

- Installing additional extraction wells to facilitate or accelerate cleanup of the contaminant plume.

To ensure that cleanup levels are maintained, the aquifer will be monitored at those wells where pumping has ceased following discontinuation of groundwater extraction. These wells would be sampled on a regular basis (e.g., quarterly) for several years, followed by annual sampling thereafter for 5 - 10 years.

The total estimated cost for the selected soil remedy is $649,000. Details of the costs for this remedy, on a site-specific basis, is shown in the Appendicies to the FS Report (Volume II).

The total estimated cost for the selected groundwater remedy is $10,520,000. Details of the costs for this remedy is shown in the Appendicies to the FS Report (Volume II).

STATUTORY DETERMINATIONS

EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the

environment. CERCLA also requires that the selected remedial action for the site comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws, unless a waiver is granted. The selected remedy must also be cost-effective and utilize permanent treatment technologies or resource recovery technologies to the maximum extent practicable. The statute also contains a preference for remedies that include treatment as a principal element. The following sections discuss how the selected remedy for contaminated soil and groundwater at the SJCC and GSC sites meets these statutory requirements.

Protection of Human Health and the Environment

The selected soil remedy protects human health and the environment by reducing the levels of contaminants in soil through treatment, and eliminating the source of groundwater contamination. Treatment of the soil will continue until levels consistent with the EPA/NJDEPE soil cleanup level goals are achieved (an estimated 6 to 9 months). No unacceptable short-term risks or cross-media impacts would be caused by implementing this alternative.

In addition, the groundwater remedy will attempt to remediate contaminated groundwater at and downgradient from the sites to the appropriate drinking water standards. These standards are intended to protect human health and the environment by assuring the quality of potable water supplies. EPA expects this remedy to take an estimated 70 years or longer to implement. Together with the temporary institutional controls and the available existing municipal water supply, the threat of exposure currently posed to residents from contaminated groundwater would be significantly reduced if not eliminated.

Attainment of Applicable or Relevant and Appropriate Requirements of Environmental Laws

All ARARs would be met by the selected remedy.

Chemical Specific ARARs.

The selected groundwater remedy would attempt to achieve compliance with chemical specific ARARs related to the contaminated groundwater at and downgradient from the sites. The relevant and appropriate requirements include the Federal and State of New Jersey MCLs established by the Safe Drinking Water Act. Table 3 provides these levels for those compounds detected in groundwater. The more restrictive of these levels will be used as the cleanup levels for groundwater. Concentrations of these compounds throughout the entire contaminated groundwater plume would be reduced to these levels.

Emissions from the air stripper system will be monitored and if required, controls would be implemented to ensure compliance with the National Emission Standards for Hazardous Air Pollutants and N.J.A.C. 7:27-8 of the State of New Jersey Air Pollution Control standards and regulations.

Action Specific ARARs.

The selected remedy would address and comply with action specific ARARs for injection of treated water back into the groundwater according to 40 CFR Parts 144 and 146, Underground Injection and Underground Injection Control (UIC) - Standards and Criteria, of the Federal Safe Drinking Water Act and N.J.A.C. 7:14A-1 et seq. and 7:26-9 et seq., UIC and Groundwater Monitoring Systems, of the State of New Jersey Pollutant Discharge Elimination System and Requirements for Groundwater Monitoring.

Residuals from the treatment processes (i.e., spent carbon) would be regenerated for reuse when possible. If the carbon would require treatment and disposal, treatment and disposal of the carbon would comply with CFR Part 268 of the Federal Resource Conservation and Recovery Act, LDRs.

The selected remedy would comply with all requirements regulating worker health and safety under the Federal Occupational Safety and Health Act.

Location Specific ARARs.

There are none. The sites do not lie within the vicinity of floodplains, wetlands, or coastal barriers or the coastal zone as designated by the State of New Jersey. In addition, there are no endangered/threatened species, or federally-designated wild or scenic rivers in the vicinity of the sites. Therefore, Executive Orders 11988 and 11990, the Coastal Barrier Resource Act, the Wild and Scenic Rivers Act, and the Coastal Zone Management Act are not ARARs for this project. Finally, based on an evaluation of the project area for the potential for discovery of and impact to cultural resources, it was determined that a cultural resources survey was not required.

To Be Considered

The selected soil remedy would attempt to achieve compliance with the EPA/NJDEPE soil cleanup level goals. Summaries of the compounds detected at SJCC and GSC during both phases of the RI and the cleanup goals for those compounds are provided in Tables 1 and 2. Concentrations of these compounds throughout the soil would be reduced to these levels.

Cost Effectiveness

EPA believes the selected remedy is cost-effective in mitigating risks posed by the contaminated soil and groundwater within a reasonable period of time. Section 300.430(f)(ii)(D) of the NCP requires EPA to evaluate cost-effectiveness by comparing all the alternatives which meet the threshold criteria presented earlier. The selected remedy meets these criteria and provides for overall effectivness in proportion to its cost. The estimated total cost for the selected soil and groundwater remedy is $11,169,000.

Utilization of Permanent Solutions and Alternate Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

EPA believes the selected soil and groundwater remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the SJCC and GSC sites. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy for soil and groundwater provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; and cost, and also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

Preference for Treatment as a Principal Element

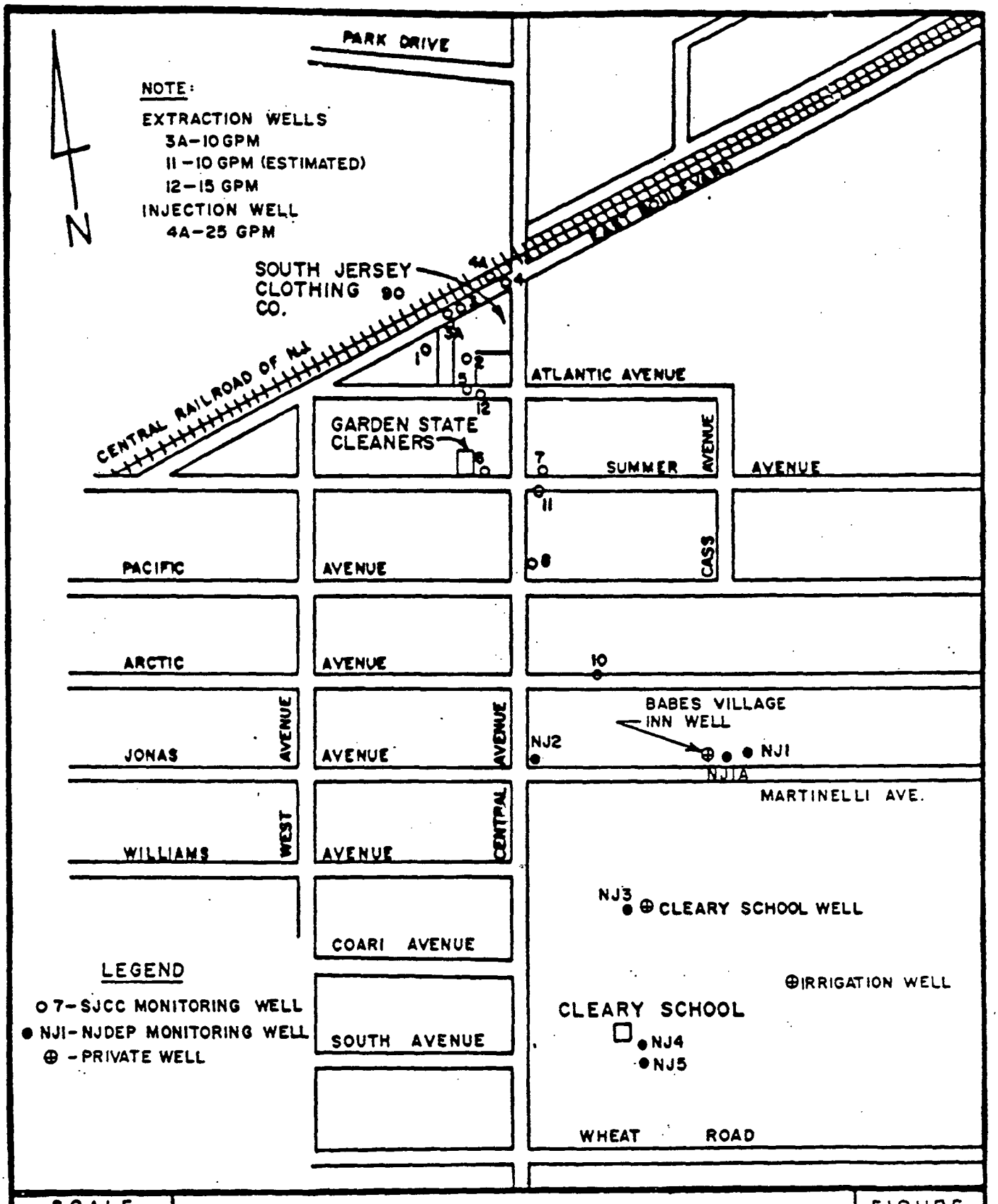
The selected remedy satisfies the statutory preference for treatment as a principal element. The principal threat to human health is from exposure to contaminated soil at the sites. This soil also represents the source of groundwater contamination. The selected remedy reduces levels of contaminants in soil through treatment via vapor phase extraction. In addition, the selected groundwater remedy would reduce the levels of contaminants in groundwater, another threat posed by the sites, through treatment via air stripping combined with carbon adsorption.

DOCUMENTATION OF SIGNIFICANT CHANGES

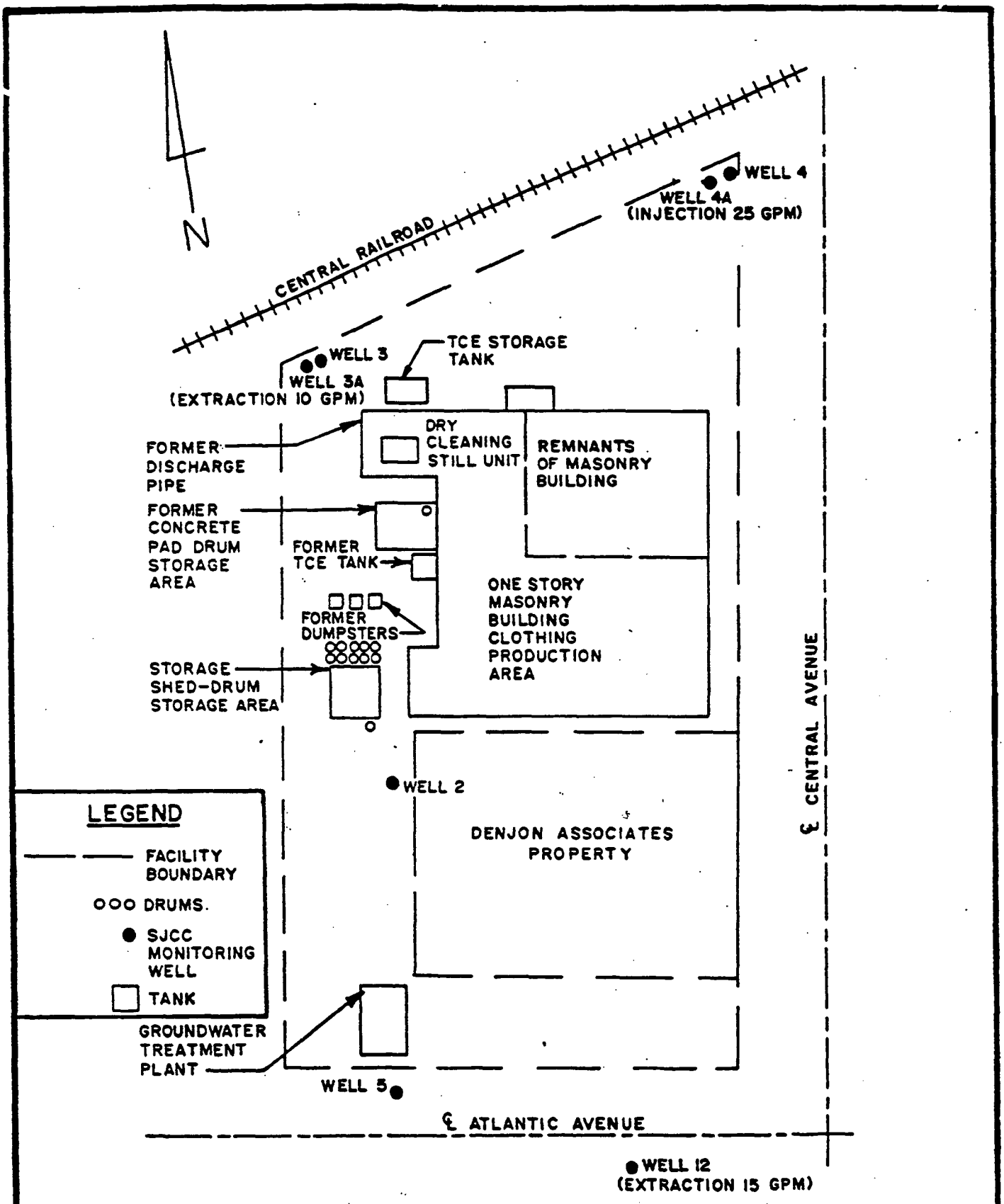
The Proposed Plan for the sites was released to the public in July 1991. This Plan identified the combination of Soil and Groundwater Alternatives S2 (Soil Vapor Extraction) and GW2(b) (Total Plume Extraction) as the preferred alternatives to remediate the soil and groundwater contamination at the SJCC and GSC sites. EPA reviewed all comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the selected remedy, as it was originally identified in the Proposed Plan, were necessary.

APPENDIX A

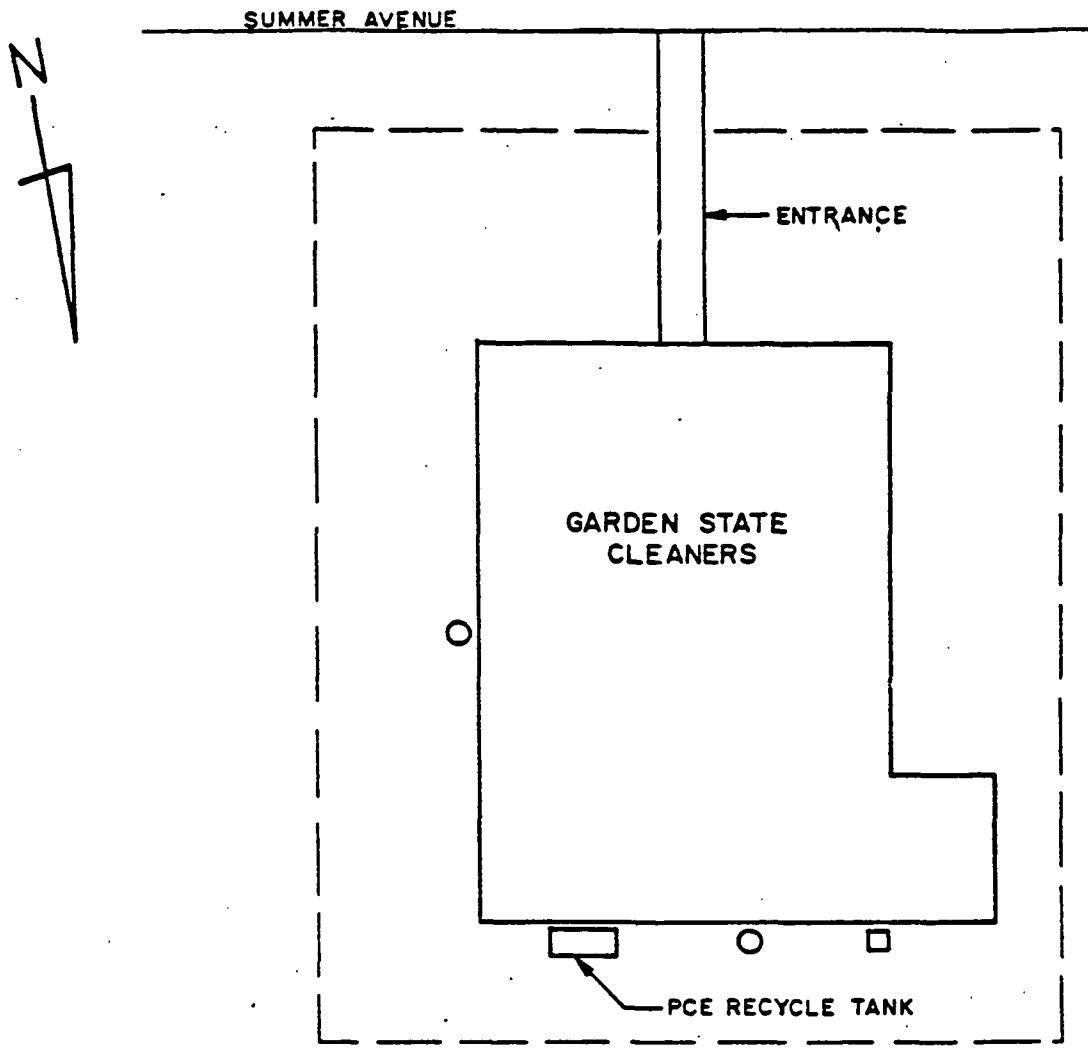
FIGURES



SCALE	ARCS II	FIGURE
1" = 500'	SOUTH JERSEY CLOTHING CO./GARDEN STATE CLEANERS SITES	1
DATE	LOCATION OF SITES AND SELECTED WELLS	
JUNE 1991		



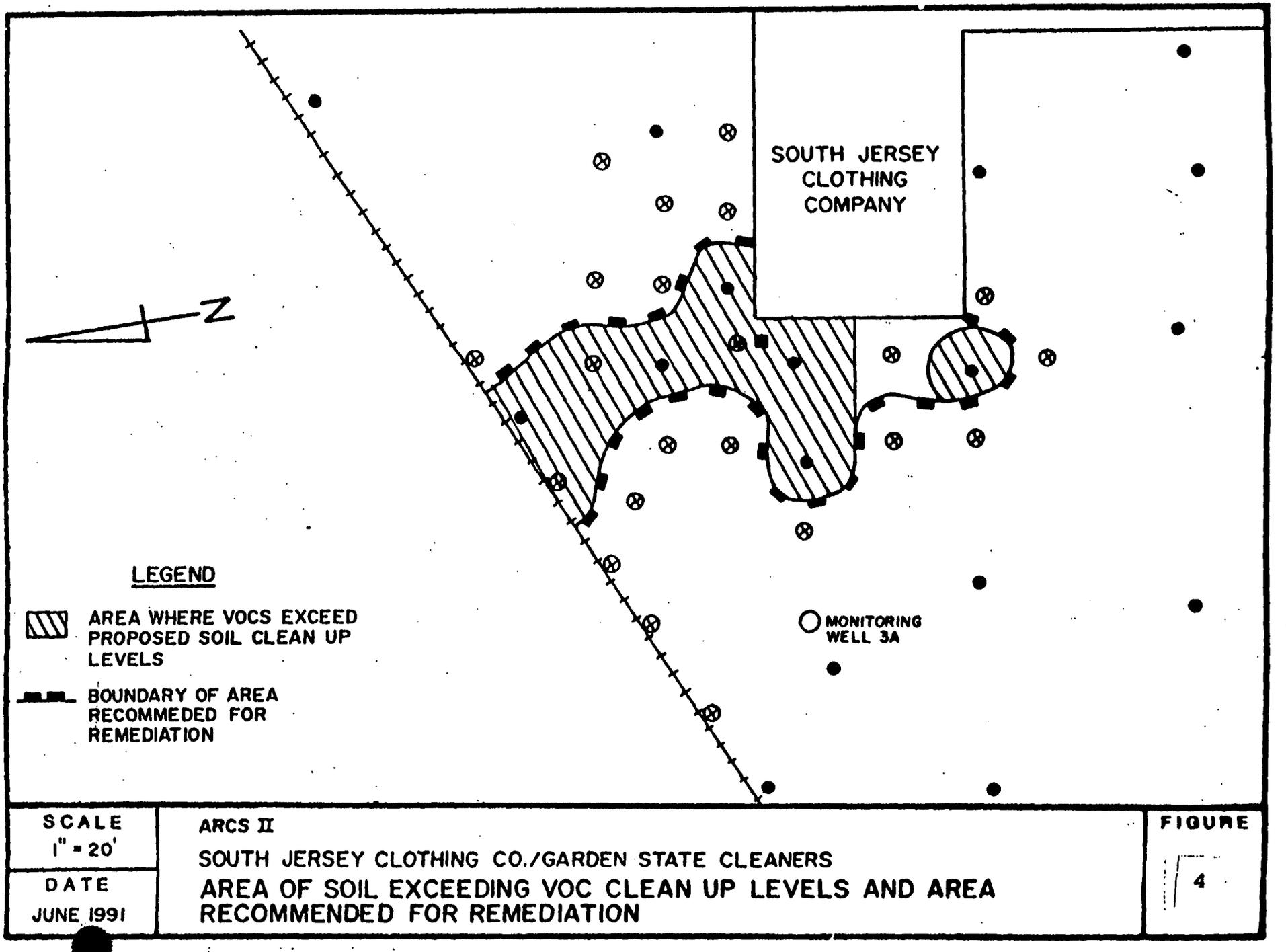
SCALE	ARCS II	FIGURE
1" = 60'	SOUTH JERSEY CLOTHING CO./GARDEN STATE CLEANERS SITES	2
DATE JUNE 1991	FACILITY MAP – SJCC	



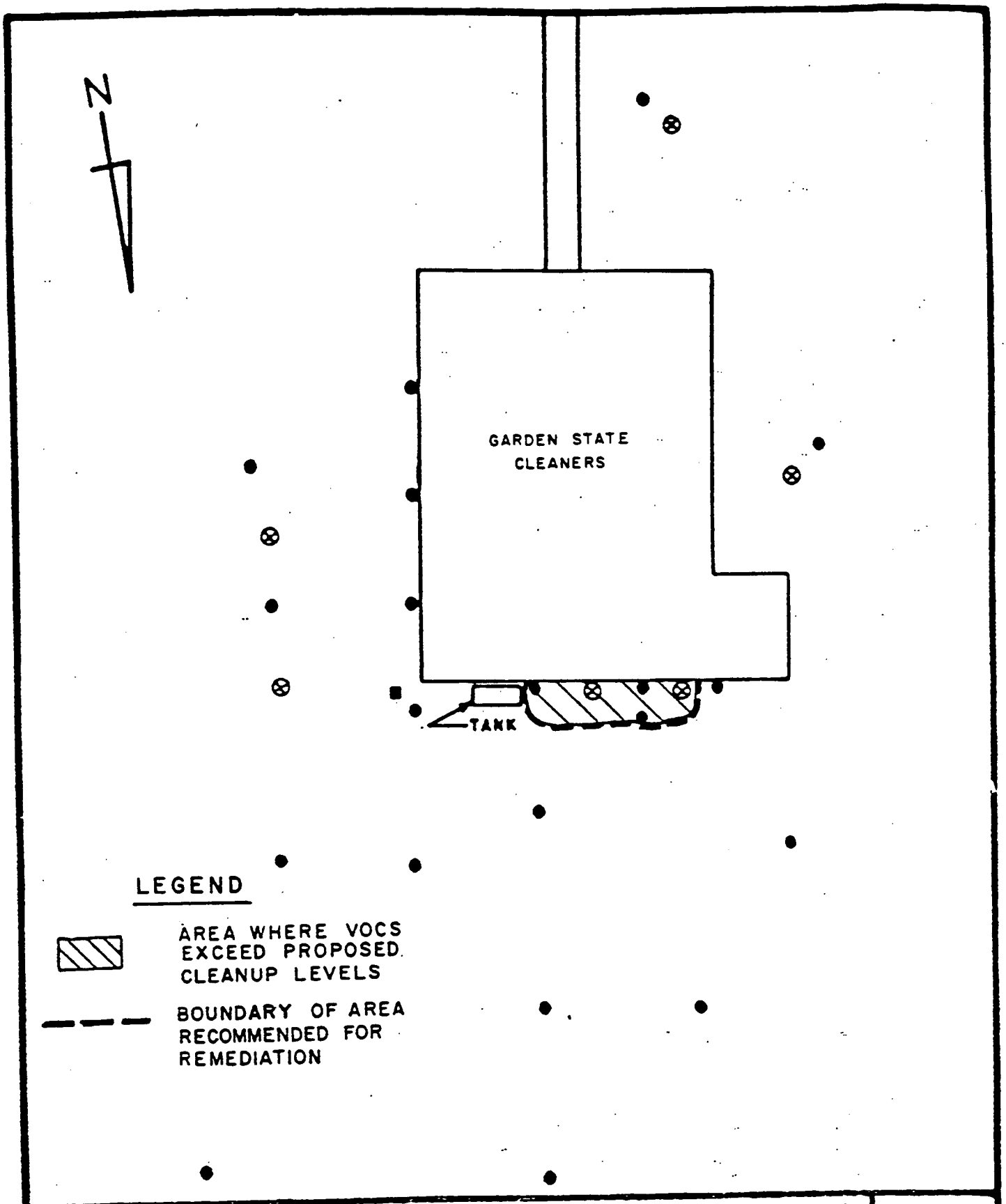
LEGEND

— — — FACILITY BOUNDARY
○ — STEAM CONDENSATE PIPE
□ — BOILER BLOW DOWN PIPE

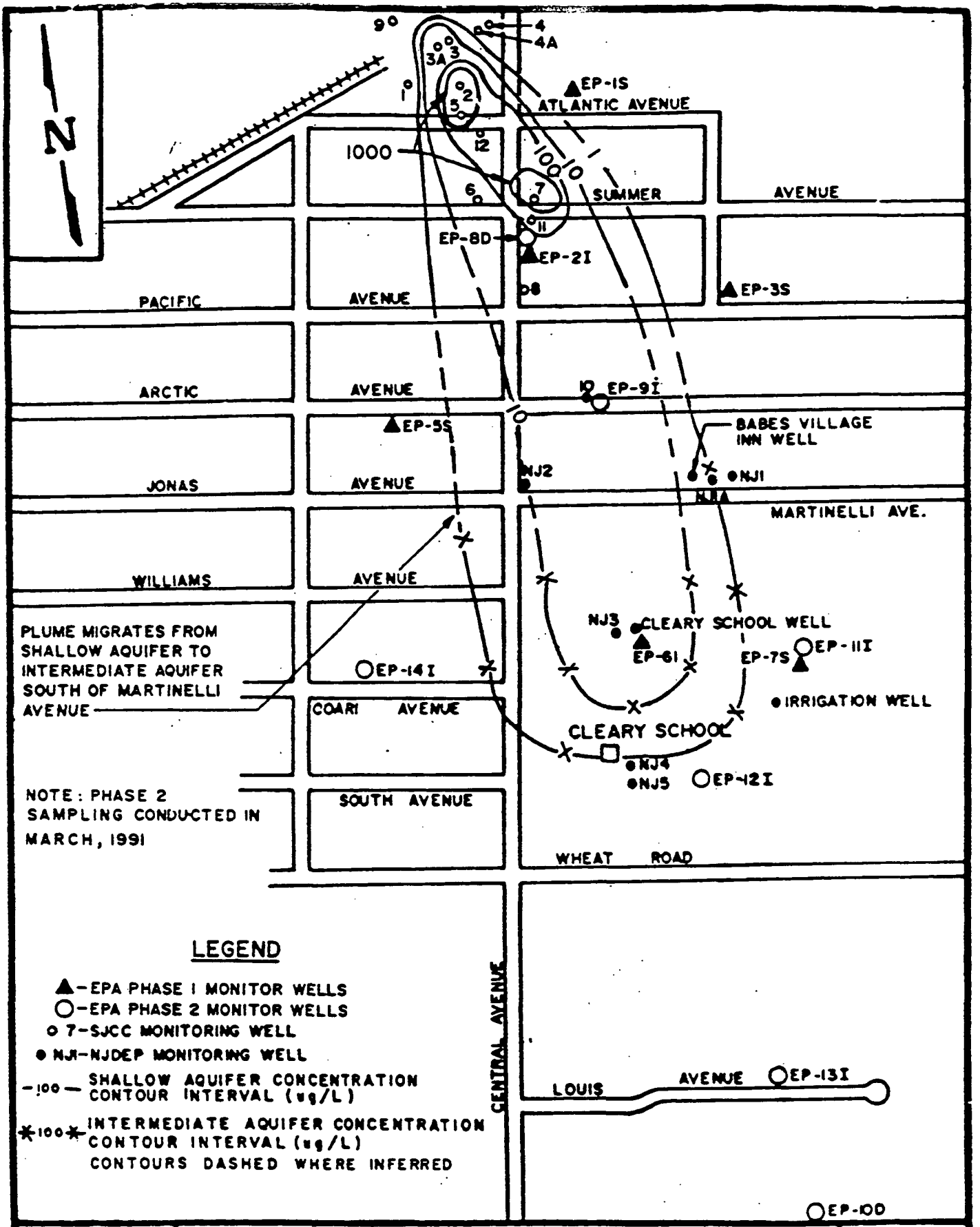
SCALE 1" = 15'	ARCS II SOUTH JERSEY CLOTHING CO./GARDEN STATE CLEANERS SITES GARDEN STATE CLEANERS SITE	FIGURE 3
DATE JUNE 1991		



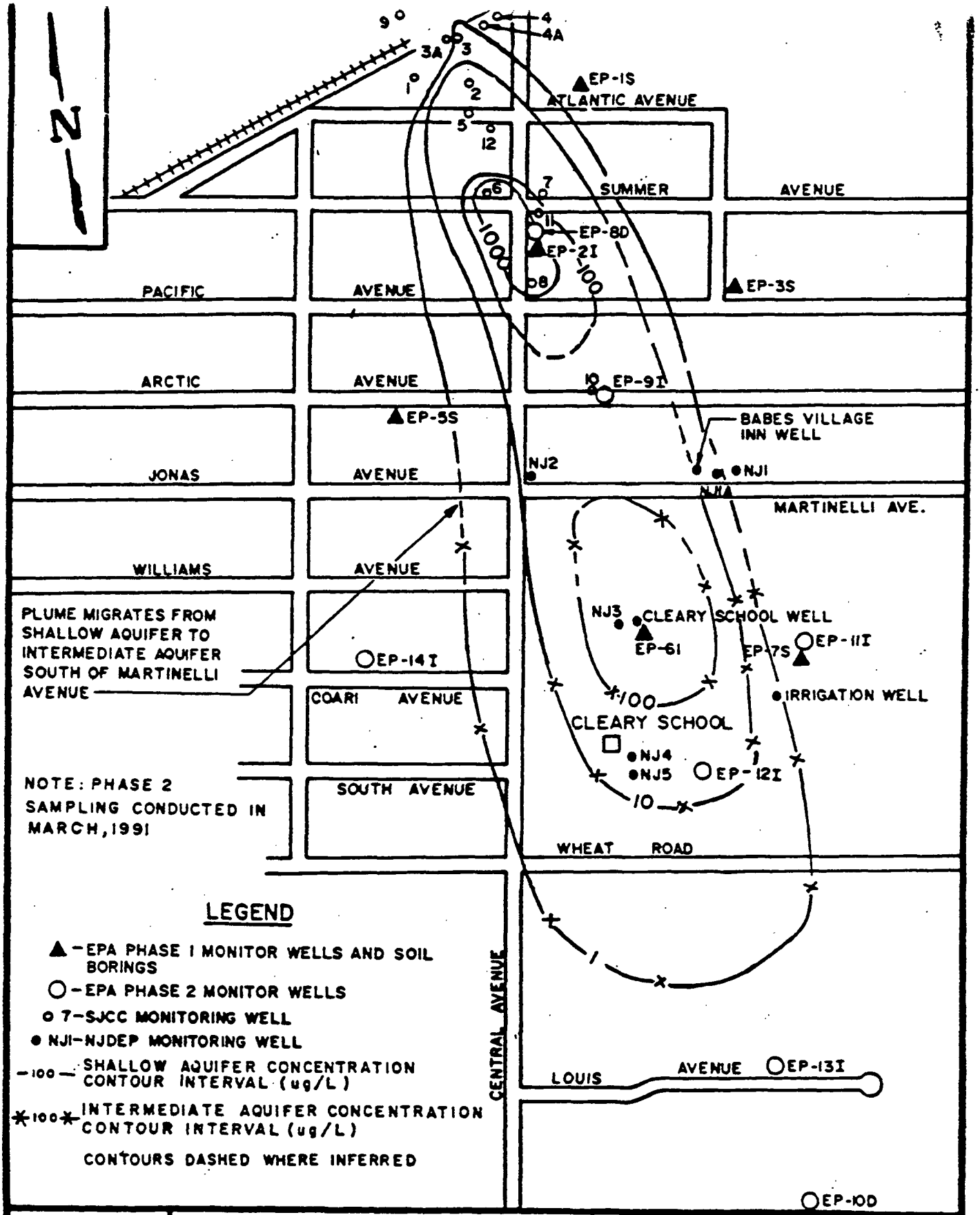
SCALE	ARCS II	FIGURE
1" = 20'	SOUTH JERSEY CLOTHING CO./GARDEN STATE CLEANERS	4
DATE	AREA OF SOIL EXCEEDING VOC CLEAN UP LEVELS AND AREA	
JUNE 1991	RECOMMENDED FOR REMEDIATION	



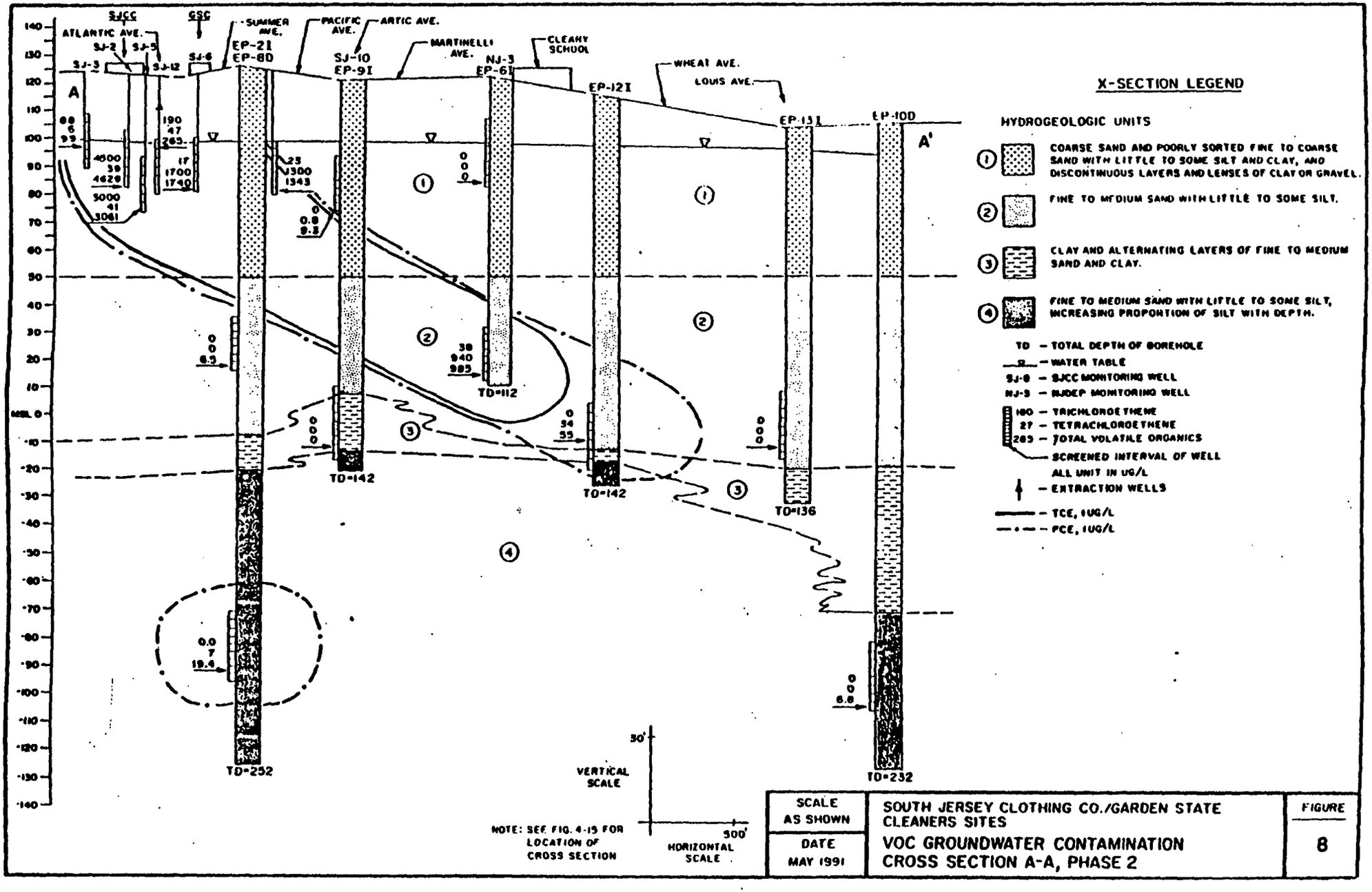
SCALE 1" = 15'	ARCS II SOUTH JERSEY CLOTHING CO./GARDEN STATE CLEANERS SITES AREA OF SOIL EXCEEDING VOC CLEAN UP LEVELS AND AREA RECOMMENDED FOR REMEDIATION	FIGURE 5
DATE JULY 1991		



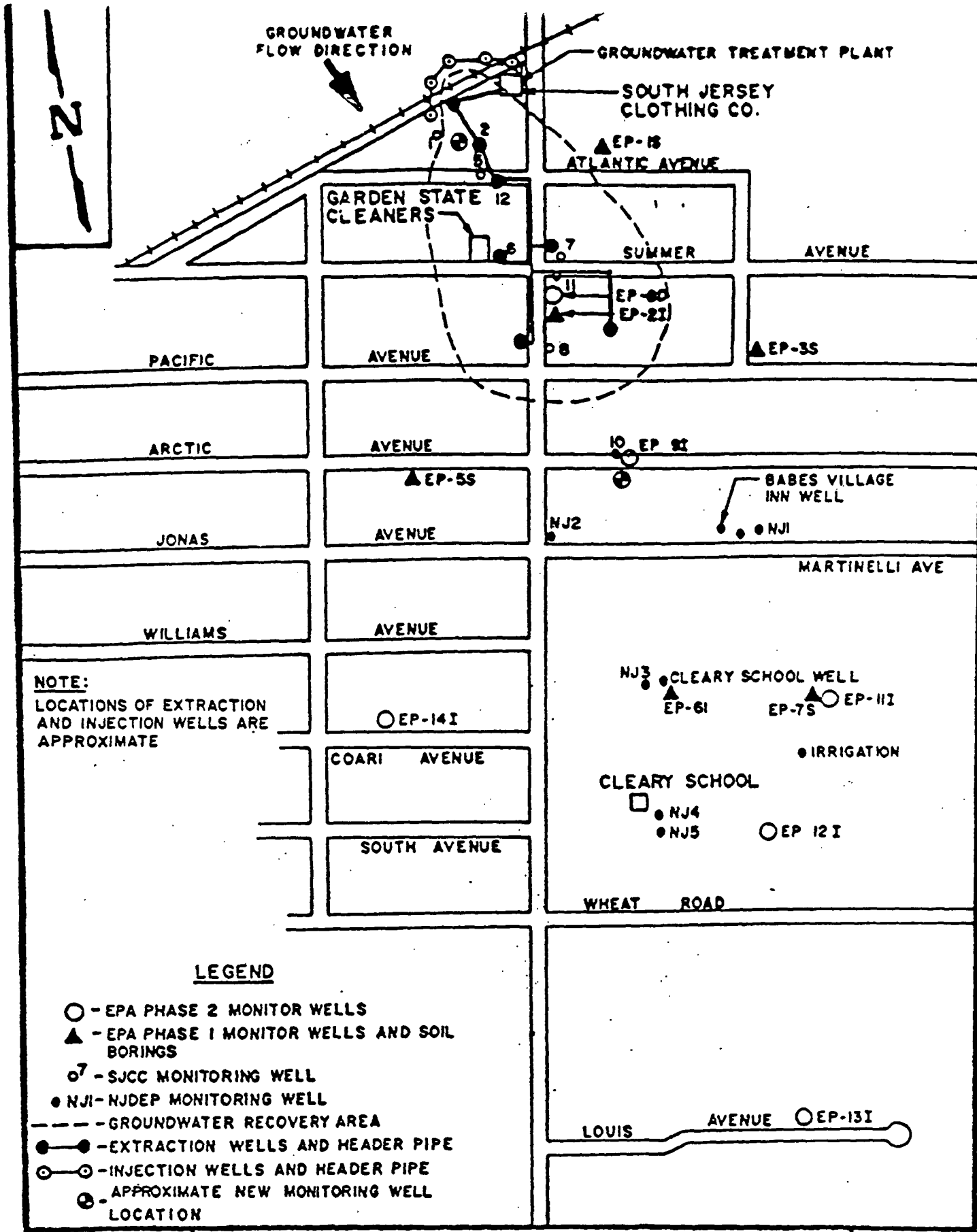
SCALE	ARCS II	FIGURE
1" = 500'	SOUTH JERSEY CLOTHING CO./GARDEN STATE CLEANERS SITES	6
DATE JUNE 1991	TCE CONCENTRATION CONTOURS-PHASE 2	



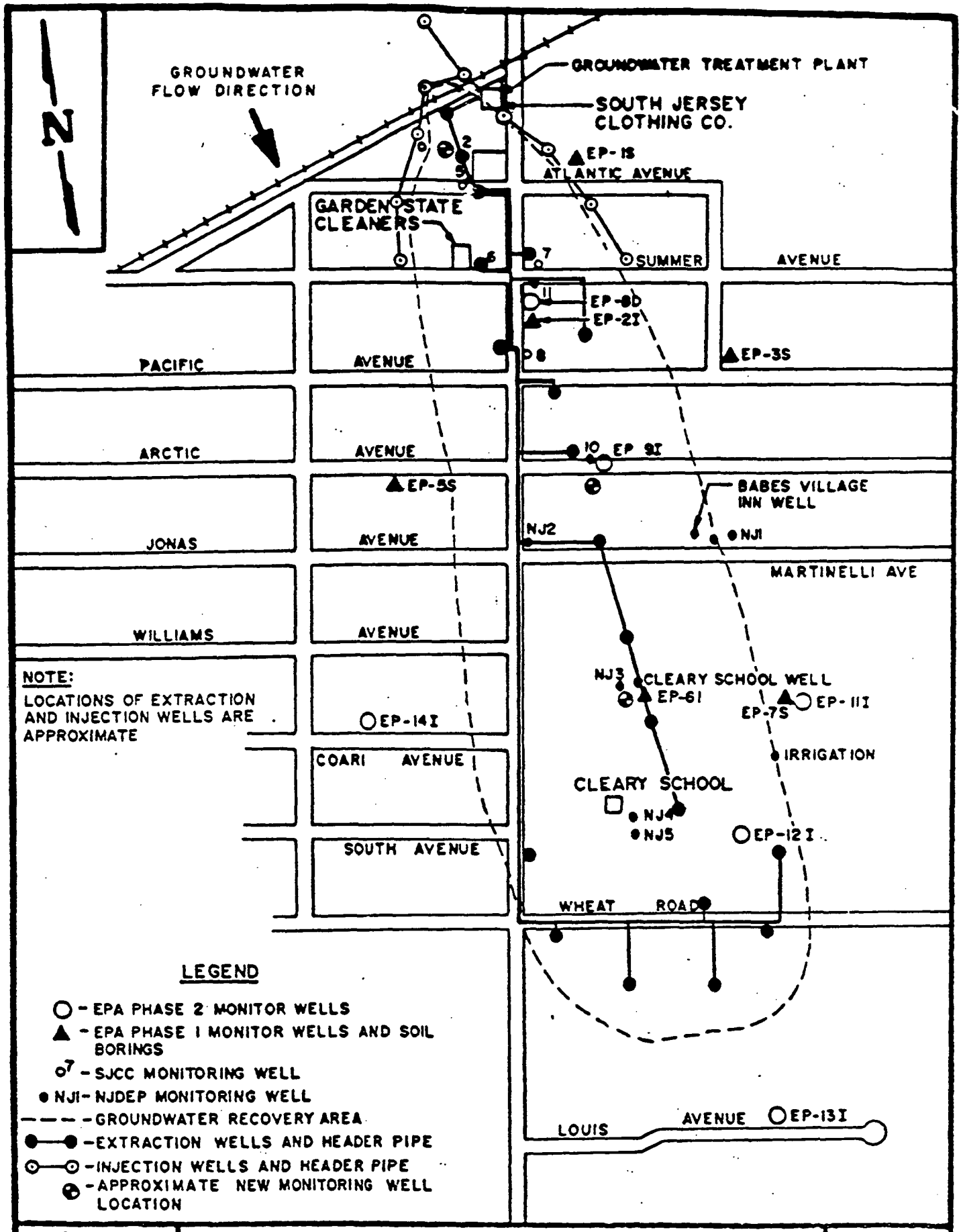
SCALE 1" = 500'	ARCS II SOUTH JERSEY CLOTHING CO./GARDEN STATE CLEANERS SITES PCE CONCENTRATION CONTOURS-PHASE 2	FIGURE 7
DATE JUNE 1991		



SCALE AS SHOWN	SOUTH JERSEY CLOTHING CO./GARDEN STATE CLEANERS SITES	FIGURE
DATE MAY 1991	VOC GROUNDWATER CONTAMINATION CROSS SECTION A-A, PHASE 2	8



SCALE. 1" = 500'	ARCS II SOUTH JERSEY CLOTHING CO./GARDEN STATE CLEANERS SITES LIMITED EXTRACTION AND TREATMENT FOR ALTERNATIVES 2A & 3A (200 GPM)	FIGURE 9
DATE JULY 1991		



SCALE	ARCS II	FIGURE
1" = 500'	SOUTH JERSEY CLOTHING CO./GARDEN STATE CLEANERS SITES	10
DATE	TOTAL PLUME EXTRACTION & TREATMENT	
JULY 1991	FOR ALTERNATIVES 2B & 3B (1000 GPM)	

APPENDIX B

TABLES

TABLE 1

SOUTH JERSEY CLOTHING COMPANY SITE

SOIL CLP DATA SUMMARY

COMPOUNDS	Range Of Values	EPA/NJDEP cleanup level goals
Methylene Chloride	11-520	1,000
Acetone	210-2,000	1,000
1,2-Dichloroethene (total)	1-640	1,000
Chloroform	8	1,000
2-Butanone	18-860	1,000
1,1,1-Trichloroethane	15	1,000
Trichloroethene	3-68,000	1,000
1,1,2-Trichloroethane	2	1,000
Benzene	1	1,000
Tetrachloroethene	3-5,800	1,000
1,1,2,2-Tetrachloroethane	17	1,000
Toluene	1-23	1,000
Chlorobenzene	1-2	1,000

Notes:

1) All concentrations are in ug/kg.
2) Data qualifers are not included.

TABLE 2

GARDEN STATE CLEANERS SITE

SOIL CLP DATA SUMMARY

COMPOUNDS	Range Of Values	EPA/NJDEP cleanup level goals
Methylene Chloride	180	1,000
Acetone	80-4,700	1,000
Trichloroethene	3-100	1,000
Tetrachloroethene	2-1,100,000	1,000
1,1,2,2-Tetracholroethane	11-12	1,000
Toluene	2-3	1,000

Notes:

1) All concentrations are in ug/kg.
2) Data qualifers are not included.

TABLE 3

SOUTH JERSEY CLOTHING COMPANY/GARDEN STATE CLEANERS SITES

PHASE 2 GROUNDWATER CLP DATA SUMMARY

COMPOUNDS	Range Of Values	US MCL -	NJ MCL
Acetone	4.0		
Carbon Disulfide	0.3-0.5		
1,1-Dichloroethene	0.2-2.0	7	2
1,1-Dichloroethane	0.2-0.8		
Cis-1,2-Dichloroethene (5)	0.2-51.0	70	10
Chloroform (4)	0.8-8.0	100	100
2-Butanone	11.0		
1,1,1-Trichloroethane	4.-27.0	200	26
Carbon Tetrachloride	0.6-3.0	5	2
Bromodichloromethane (4)	0.6	100	100
1,2-Dichloropropane	0.6	5	
Trichoroethene	0.9-4500	5	1
1,1,2-Trichlorothane	1.0-6.0		
Benzene	0.6-12.0	5	1
Tetrachloroethene	6.0-1700.0	5	1
Toluene	0.6-1.0	1,000	
Ethylbenzene	0.4-0.1	700	
Styrene	1.0	100	
M&P Xylene (6)	0.9-1.0	10,000	44
1,3-Dichlorobenzene	3.0		60
1,4-Dichlorobenzene	0.4-2.0		75
4-Chlorotoluene	0.5		
Trans-1,2-Dichloroethene (5)	0.2-1.0	100	10
Hexachlorobutadiene	2.0		
Naphthalene	1.0		
N-Propylbenzene	0.4-0.3		
1,1,1,2-Tetrachloroethane	1.0		
1,2,3-Trichlorobenzene	1.0		8
1,2,4-Trichlorobenzene	1.0		8
1,3,5-Trimethylbenzene	0.9-0.6		
O-Xylene (6)	0.7-2.0	10,000	44

Notes:

1) All concentrations are in ug/l.
2) US MCL = US Safe Drinking Water Act MCL.
3) NJ MCL = US Safe Drinking Water Act MCL.
4) NJDEP and Federal MCLs are for Total Trihalomethanes.
5) NJDEP and Federal MCLs are for Total 1,2-Dichloroethene.
6) NJDEP and Federal MCLs are for Total Xylenes (O,M and P).
7) Data qualifers are not included.

Table 4

Contaminants of Concern (COCs) by Media
South Jersey Clothing Company/
Garden State Cleaners Sites

	Frequency of Detection	Range	95% UCL
Downgradient Groundwater		(in ug/L)	
Trichloroethylene (TCE)	14/23	.8 - 13,000	2,497.4
Tetrachloroethylene (PCE)	12/23	.9 - 1,900	328.0
cis-1,2-Dichloroethene	8/23	2 - 77	17.2
1,1,1-Trichloroethane	5/23	.7 - 13	5.2
Chloromethane	2/23	.7 - 8	4.2
Chloroform	5/23	1 - 3	3.0*
Carbon tetrachloride	2/23	1 - 2	2.0*
1,1,1,2-Tetrachloroethane	2/23	.6 - 2	2.0*
Surface Soil at SJCC		(in ug/kg)	
Trichloroethylene (TCE)	16/24	6 - 3,900	779.0
Acetone	3/22	16 - 1,500	319.9
Tetrachloroethylene (PCE)	14/24	1 - 820	152.7
Methylene chloride	6/24	11 - 520	105.5
1,1,2,2-Tetrachloroethane	1/18	17	10.0
1,2-Dichloroethene	4/20	3 - 16	9.9
1,1,1-Trichloroethane	1/18	15	9.8
Toluene	2/20	6 - 7	7.0*
Chlorobenzene	2/18	2 - 2	2.0*
1,1,2-Trichloroethane	1/18	2	2.0*
Benzene	1/18	1	1.0*
Surface Soil at GSC			
Tetrachloroethylene (PCE)	6/7	2 - 1,300,000	886,815.8
Acetone	1/7	8,100	4,888.3
Trichloroethylene (TCE)	2/7	84 - 6,100	3,017.3
Methylene chloride	1/7	180	109.6
1,1,2,2-Tetrachloroethane	1/7	11	11.0*
Ambient Air at SJCC and GSC			
Trichloroethylene (TCE)	NA		44.32
Tetrachloroethylene (PCE)	NA		.06

Note: These contaminants are listed in descending order of the representative concentrations for the contaminants.

95% UCL - 95th Percentile Upper Confidence Limit
* - Maximum detected value used
NA - Not applicable

Table 5

Receptor Groups and Relevant Exposure Routes
South Jersey Clothing Company/
Garden State Cleaners Site

Receptor Group	Relevant Exposure Routes
Adult Workers	Potential future use (ingestion, inhalation while showering, and dermal absorption) of groundwater (for workers who are residents of the site area).
	Dermal contact and incidental ingestion of surface soil (current and future).
	Inhalation of ambient air (current and future).
Adult Residents	Potential future use (ingestion, inhalation while showering, and dermal absorption) of groundwater.
	Dermal contact and incidental ingestion of surface soil (future).
	Inhalation of ambient air (future).
Adult Trespassers	Dermal contact and incidental ingestion of surface soil (current and future).
	Inhalation of ambient air (current and future).
Adult Customers	Inhalation of ambient air (current and future).
Adolescent Residents	Potential future use (ingestion, inhalation while showering, and dermal absorption) of groundwater.
	Dermal contact and incidental ingestion of surface soil (future).
	Inhalation of ambient air (future).
Adolescent Trespassers	Dermal contact and incidental ingestion of surface soil (current and future).
	Inhalation of ambient air (current and future).

Table 5 (continued)

Receptor Groups and Relevant Exposure Routes
South Jersey Clothing Company/
Garden State Cleaners Sites

Receptor Group	Relevant Exposure Routes
Child Residents	Potential future use (ingestion, inhalation while showering, and dermal absorption) of groundwater.
	Dermal contact and incidental ingestion of surface soil (future).
	Inhalation of ambient air (future).

Table 6

TOTAL ESTIMATED HAZARD INDICES FOR CURRENT EXPOSURE MEDIA

Exposure Medium	Adult Worker	Adult Trespasser	Adolescent Trespasser
Surface Soil-South Jersey	--	5.3E-06	2.1E-05
Surface Soil-Garden State	5.4E-01	2.2E-02	8.3E-02
Air - South Jersey	NC	NC	NC
Air - Garden State	NC	NC	NC
Total	5.4E-01	2.2E-02	8.3E-02

-- = Represents non-applicable exposure medium.

NC = Not calculated (toxicity values not available).

Table 7

TOTAL ESTIMATED HAZARD INDICES FOR FUTURE EXPOSURE MEDIA

Exposure Medium	Adult Worker/ Non-Resident	Adult Worker/ Off-Site Resident	Adult Off-Site Resident/ Trespasser	Adolescent Off-Site Resident/ Trespasser	Child Off-Site Resident	On-Site Resident		
						Adult	Adolescent	Child
Groundwater	--	1.0E+00	1.0E+00	1.6E+00	3.7E+00	1.0E+00	1.6E+00	3.7E+00
Surface Soil- South Jersey	--	--	5.3E-06	2.1E-05	--	2.0E-04	3.6E-04	9.0E-04
Surface Soil- Garden State	5.4E-01	5.4E-01	2.2E-02	8.3E-02	--	8.1E-01	1.5E+00	3.6E+00
Air - South Jersey	NC	NC	NC	NC	NC	NC	NC	NC
Air - Garden State	NC	NC	NC	NC	NC	NC	NC	NC
Total	5.4E-01	1.5E+00	1.0E+00	1.7E+00	3.7E+00	1.8E+00	3.1E+00	7.3E+00

-- = Represents non-applicable exposure medium.

NC = Not calculated (toxicity values not available).

Table 8

CHRONIC TOXICITY VALUES FOR SELECTED CHEMICALS OF CONCERN

CHEMICAL	ORAL		INHALATION		SOURCE
	RfD (mg/kg/day)	SF $(mg/kg/day)^{-1}$	RfC (mg/kg/day)	SF $(mg/kg/day)^{-1}$	
Acetone	1E-1	--	ND	--	IRIS
Benzene	--	2.9E-2/A	--	2.9E-2/A	IRIS
Carbon tetrachloride	7E-4	1.3E-1/B2	ND	1.3E-1/B2	IRIS, HEAST
Chlorobenzene	2E-2	--	5E-3	--	IRIS, HEAST
Chloroform	1E-2	6.1E-3/B2	ND	8.1E-2/B2	IRIS, HEAST
Chloromethane	--	1.3E-2/C	--	6.3E-3/C	HEAST
1,2-Dichloroethene	1E-2	--	ND	--	HEAST
Methylene chloride	6E-2	7.5E-3/B2	9E-1	1.6E-3/B2	IRIS, HEAST
1,1,1,2-Tetrachloroethane	--	2.6E-2/C	--	2.6E-2/C	IRIS, HEAST
1,1,2,2-Tetrachloroethane	--	2.0E-1/C	--	2.0E-1/C	IRIS, HEAST
Tetrachloroethene	1E-2	5.1E-2/B2	ND	1.8E-3/B2	IRIS
Toluene	2E-1	--	6E-1	--	IRIS, HEAST
1,1,1-Trichloroethane	9E-2	--	3E-1	--	HEAST
1,1,2-Trichloroethane	4 E-3	5.7E-2/C	ND	5.7E-2/C	IRIS, HEAST
Trichloroethene	--	1.1E-2/B2	--	1.7E-2/B2	HEAST

Rfd = Reference Dose
RfC = Reference Concentration
SF = Slope Factor
ND = Not determined
-- = Not available
Source = Integrated Risk Information System (IRIS) data base; Health Effects Assessment Summary Tables (HEAST), U.S. EPA, January 1991.
A = Human Carcinogen
B1 or B2 = Probable human carcinogen (B1 indicates limited human evidence and B2 indicates sufficient evidence in animals and inadequate or no evidence in humans).
C = Possible human carcinogen

Table 9

TOTAL LIFETIME EXCESS CANCER RISK FOR CURRENT EXPOSURE MEDIA

Exposure Route	Adult Worker	Adult Trespasser	Adult Customer
Surface Soil-South Jersey	--	1.6E-09	--
Surface Soil-Garden State	9.8E-05	3.8E-06	--
Air - South Jersey*	--	5.0E-07	--
Air - Garden State*	7.6E-09	7.2E-11	2.0E-11
Total	9.8E-05	4.3E-06	2.0E-11

-- = Represents non-applicable exposure medium.

* = Receptor at a distance of 100 m.

Table 10

TOTAL LIFETIME EXCESS CANCER RISK FOR FUTURE EXPOSURE MEDIA

Exposure Route	Adult Worker/ Non-Resident	Adult Worker/ Off-Site Resident	Adult Customer	Adult Off-Site Resident/ Trespasser	Adult On-Site Resident
Groundwater	--	9.7E-04	--	9.7E-04	9.7E-04
Surface Soil- South Jersey	--	--	--	1.6E-09	6.1E-08
Surface Soil- Garden State	9.8E-05	9.8E-05	--	3.8E-06	1.4E-04
Air - South Jersey*	--	--	--	5.0E-07	8.8E-05
Air - Garden State*	7.6E-09	7.6E-09	2.0E-11	7.2E-11	1.3E-08
Total	9.8E-05	1.1E-03	2.0E-11	9.7E-04	1.2E-03

-- = Represents non-applicable exposure medium.

* = Receptor at a distance of 100 m.

The incremental cancer risk calculations are presented in Appendix.