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REMEDIAL INVESTIGATION/FEASIBILITY STUDY
FOR THE CONRAIL SITE
ELKHART, INDIANA

ALTERNATIVES ARRAY DOCUMENT

ARCS CONTRACT NO. 68-W8-0086
WORK ASSIGNMENT NO. 01-5L7Y

ecology and environment, inc.
International Specialists in the Environment

ZF3902 C8397

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April 5, 1993

Prepared for:

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1. INTRODUCTION

1.1 PURPOSE

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), authorizes the United States Environmental Protection Agency (EPA) to conduct remedial planning activities at uncontrolled hazardous waste sites placed on the National Priorities List (NPL). Subpart F of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes methods and criteria for determining the appropriate extent of response authorized by CERCLA, as amended by SARA, and outlines procedures for determining the nature and extent of contamination at a site, as well as the appropriate considerations for remediation for the site. In accordance with CERCLA, SARA, and the NCP, EPA developed a program for remediation and enforcement response activities at selected uncontrolled hazardous waste sites. As part of this program, EPA issued Work Assignment No. 01-5L7Y to Ecology and Environment, Inc. (E & E), under the Region V Alternative Remedial Contracting Strategy (ARCS) Contract No. 68-W8-0086. Under this work assignment, E & E is conducting a Feasibility Study (FS) that addresses permanent remedies for source/soil and groundwater contamination at the Conrail NPL site located in Elkhart, Indiana. The FS is based on the results from Phases I, II, and III of the Remedial Investigation (RI) and guidance provided by EPA. The purpose of the FS is to ensure that suitable remedial alternatives are developed and evaluated; relevant information regarding these remedial alternatives will be presented to EPA so that an appropriate remedy can be selected.

This Alternatives Array Document was prepared as a part of the FS. It presents information on the background and characteristics of the site, available analytical results from site investigations, a preliminary evaluation of exposure pathways, and tentatively identified state and federal applicable or relevant and appropriate requirements (ARARs). It also discusses the initial identification and screening of remedial technologies and a preliminary identification of appropriate remedial alternatives.

This information is intended to provide regulatory officials with the basis for identifying ARARs for the range of alternatives being considered. These ARARs may be developed by considering promulgated standards affecting the contaminant pathways and the potential receptors of the site contaminants. As part of the future detailed analysis of remedial alternatives, each alternative will be evaluated for compliance with the identified ARARs.

1.2 SITE DESCRIPTION/BACKGROUND

The Conrail site is located approximately 1 mile southwest of the city of Elkhart, Indiana, as shown on Figure 1-1. The site consists of contaminated areas in the Conrail railyard, and adjacent areas extending to the northwest and northeast from the railyard. The site is bounded to the east by Nappanee Avenue, to the south by the southernmost property line of the Conrail railyard, to the west by Baugo Bay, and to the north by the St. Joseph River. The study area encompasses approximately 2,500 acres and includes the 675-acre Conrail railyard, as well as several light industrial properties located to the north and northwest of the railyard (see Figure 1-1). The study area also includes residential areas south of the St. Joseph River in which groundwater contamination has been identified based on analytical data from previous sampling efforts. The residential areas, designated as the County Road 1, La Rue Street, Vistula Avenue, and Charles Avenue areas, are located to the northeast and northwest of the Conrail railyard.

The Conrail railyard began operations in 1956 as part of New York Central Railroad, and continued operations as a subsidiary of Penn Central Transportation Company. In April 1976, Penn Central Transportation Company transferred its railroad operations to Consolidated Rail Corporation (Conrail). In October 1978, Penn Central Transportation finalized a reorganization plan that transferred all of its rail assets to Conrail. The Conrail railyard currently serves as a classification and distribution yard for freight cars and is the primary connection between the Chicago area and Conrail's northeastern rail system. Other on-site operations include car repair, car cleaning, and diesel refueling.

From July to September 1986, investigations of the study area were conducted by the EPA Technical Assistance Team (EPA/TAT), the EPA Emergency Response Team (EPA/ERT), and Peerless-Midwest, Inc. Carbon tetrachloride (CCl_4), trichloroethene (TCE), and other volatile organic compounds (VOCs) were detected in groundwater during these investigations. As a result, bottled water and activated carbon filter units were provided/ installed to residents whose wells were affected.

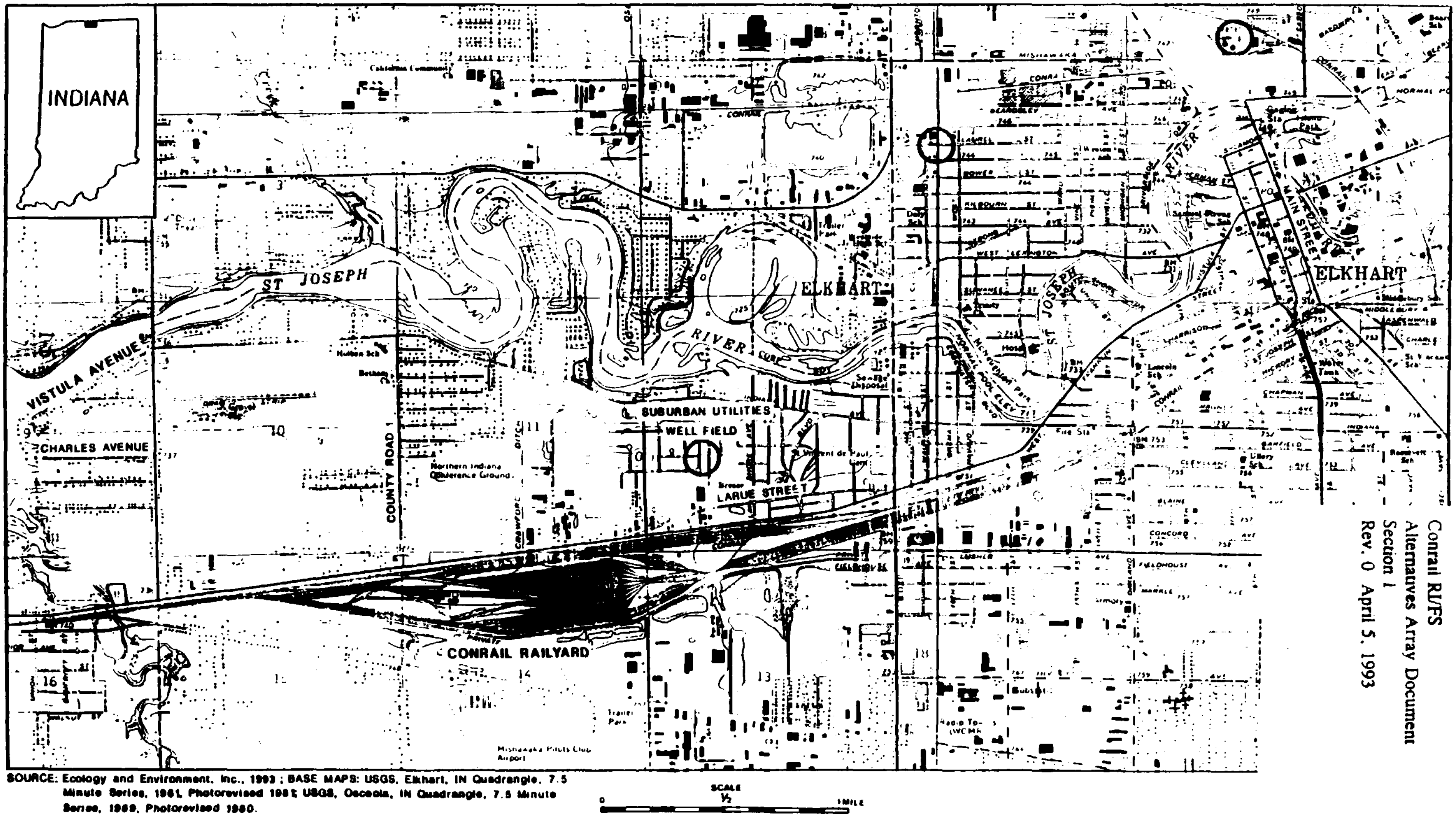
Beginning in July 1989, E & E conducted a Phase I RI at the Conrail site. Following an evaluation of the data collected during the Phase I RI, E & E recommended, with EPA's concurrence, that a second phase of investigation be conducted to address project directives. E & E completed a Phased Feasibility Study (PFS) in April 1991 (E & E 1991). A Record of Decision (ROD) for interim groundwater remedial action at the Conrail site was signed in June 1991, selecting a remedy that followed the findings presented in the PFS. On July 7, 1992, EPA issued a Unilateral Administrative Order for Remedial Design and Remedial Action, which binds Conrail and the Penn Central Transportation Corporation to perform remedial activities described in the Statement of Work (SOW) attached to the Order. The interim remedial action for the Conrail site, as described in the SOW, will consist of the following elements:

- Fence Installation to enclose groundwater extraction and treatment facilities;
- Institutional Controls including deed restrictions for future use of the railyard executed through the Elkhart County Recorder; restrictive covenants ensuring that property outside the Conrail railyard on which components of the remedy will be located (e.g., monitoring wells, treatment facilities) will not be disturbed; and abandonment of residential wells located within the area of contamination;
- Monitoring Program including groundwater monitoring in and around the area of contamination and air monitoring of the treatment system;
- Groundwater Extraction, Collection, Treatment, and Discharge System will be designed, constructed, operated, and maintained to prevent further horizontal and vertical migration of contaminated groundwater located northwest, downgradient from the Conrail railyard by extracting water from the plume, treating it using air stripping, and discharging it to the St. Joseph River;

- Provision of an Alternate Water Supply through the design, construction, and first-year operation and maintenance of a distribution system extending from the City of Elkhart water supply to affected residential/business areas located downgradient from the Conrail railyard, and maintenance of individual water filter units or provision of bottled water for those areas until the distribution system is operational.

Conrail has retained a contractor to design and implement the interim groundwater remedial actions outlined in the SOW.

Beginning in July 1991, E & E conducted the Phase II RI at the Conrail site. In July 1992, E & E submitted the *Conrail RI/FS, Phase II Technical Memorandum* to EPA (E & E 1992). The *Phase II Technical Memorandum* summarized, integrated, and presented interpretations and conclusions of data gathered during Phase I and Phase II field investigations. E & E recommended, with EPA's concurrence, that a third phase of investigation be conducted. E & E is conducting the Phase III RI, which is presently near completion. The purpose of this phase of the RI is to further define the extent and/or pathways of known contamination sources and plumes and to investigate other potential source areas of contamination.



SOURCE: Ecology and Environment, Inc., 1993; BASE MAPS: USGS, Elkhart, IN Quadrangle, 7.5 Minute Series, 1961, Photorevised 1981; USGS, Osceola, IN Quadrangle, 7.5 Minute Series, 1969, Photorevised 1980.

FIGURE 1-1 CONRAIL SITE LOCATION MAP

2. SITE CHARACTERIZATION AND OBJECTIVES

The information presented in this section addresses the physical conditions and contaminants of concern at the Conrail site. In addition, preliminary federal and state ARARs applicable to the Conrail site are presented, as well as the preliminary remedial action objectives.

2.1 SITE CHARACTERIZATION

2.1.1 Site Geology

The subsurface soil information collected by E & E during three phases of field investigation is used to describe geological conditions present in the study area. The 52 soil borings (see Figures 2-1 and 2-2) and 77 boreholes for monitoring well installation (see Figure 2-3) allow for extensive coverage of the area and depth of the study area. The combined results of the subsurface soil investigations show that the study area consists of unstratified sand and gravel glacial outwash deposits. Figure 2-4 is a cross-section from A-A' with an approximate east-west trend that parallels U.S. Highway 33 and the northern boundary of the railyard. This cross-section extends from MW12 to MW40, and was constructed to illustrate the extent of the most conspicuous low-permeability unit identified in the study area, which is centered near MW15. This gray silty clay can be correlated from MW15 to the west toward MW18, to the east toward MW51, and to the southeast toward MW36 (see Figure 2-5). The gray silty clay apparently grades into other low-permeability units by becoming less clayey and brown in color. These silty brown units are not as extensive as the gray silty clay. Evaluation of the lateral continuity of clay and silt units shows that the silt and clay are present as discrete lenses or masses and that no clay or silt exists as a continuous unit throughout the study area. Figure 2-5 is a cross-section from B-B' along a line bearing approximately southwest to northeast, from monitoring well location MW13 to MW16. This geologic cross-section was constructed because it is roughly perpendicular to the groundwater flow direction. Figures 2-4 and 2-5 clearly show that there is no continuous confining layer present in the study area. Below and above the relatively low-permeability silt and clay lenses, the study area is dominated by interbedded brown sand and brown sand and gravel.

Table 2-1 shows the results of laboratory grain-size analyses for soil samples collected during the installation of the Phase III monitoring wells. Ten samples were submitted for grain-size analysis; Table 2-1 summarizes the results and applies the United Soil Classification System (ASTM D 2487-85) to the data. The soil samples were collected from locations that correspond to the placement of the screened interval of the monitoring wells. The soil samples were collected at depths ranging from 1 foot to 6 feet. Because the length of all Phase III monitoring well screens is 10 feet, the samples do not reflect the entire interval over which the monitoring wells are screened. Although it is rare for the grain-size distribution of the aquifer material to be constant over a 10-foot depth interval, these samples provide a reliable characterization of the soil type in which the Phase III monitoring wells are screened. The predominant soil type shown in Table 2-1 is poorly graded sand (SP), based upon United Soil Classification System terminology. For practical purposes, the sand and sand and gravel unit (in which most of the monitoring wells from all three phases are screened) is best characterized as being near the dividing point of the classification groups: poorly graded sand (SP) and well graded sand (SW). As shown in Table 2-1, the percentage of sand present in these samples ranges from 59.0 to 97.0. Four of the ten samples contain over 15 percent gravel. The results in Table 2-1 are consistent with the cross-sections (Figures 2-4 and 2-5) in that the predominant unit which underlies the study area is interbedded brown sand with localized sand and gravel lenses.

The bedrock underlying the site consists of the Coldwater Shale of Mississippian age and the Sunbury and the Ellsworth Shales of Devonian and Mississippian age (Imbrigiotta and Martin 1981). Shale was encountered and sampled while drilling at seven locations, and in all cases the shale was bluish-gray to greenish-gray in color, pristine, dry, and extremely dense. Four of the seven locations were boreholes drilled for monitoring well installation: MW02BR, MW30BR, MW43BR, and MW49BR. Two locations were lead-screen auger borings: LSA 40 and LSA 42, and one location was soil boring B40. The locations where bedrock was encountered are widely spaced. For example, MW43BR and B40 are separated by a distance of over 2 miles. For the purposes of this investigation, the surface topography of the shale bedrock can be adequately described in the study area. The areal distribution of the seven locations is roughly linear, which allows for an apparent dip or slope of the bedrock surface to be determined. The greatest apparent dip between any two of the seven locations is 1 degree to the southwest. Comparisons between other pairs of locations result in apparent dips of less than 1 degree and reveal no trend or systematic pattern in the direction of dip. For the seven locations, the median depth to bedrock is approximately 150 feet below ground surface (BGS). No values deviate from the median by more than 14 percent, which indicates that 150 feet is a statistically accurate figure for the thickness of the overburden. The median elevation of the bedrock surface is 600 feet above Mean Sea Level (MSL), and none of the seven values deviate from this median value by more than 5 percent. This indicates that the bedrock is essentially horizontal beneath the study area.

2.1.2 Site Hydrogeology

The depth to the water table in the study area varies from approximately 3 feet to nearly 20 feet BGS. The observed depth to water depends on geographic location, season, and elevation of the ground surface. The Phase III water level elevation data collected from the Phase I, II, and III wells are presented in Table 2-2. Between December 1989 and January 1993, water level measurements were collected from all existing wells on numerous separate occasions. The systematic variation of water levels for the wells present in the study area on all measurement occasions (i.e., the Phase I wells) is less than 3 feet.

Shallow, intermediate, and deep potentiometric surface maps were constructed to interpret groundwater flow patterns based on water level measurements collected on January 23 and 24, 1993 (see Figures 2-6, 2-7, and 2-8). The aquifer was divided into three monitoring zones based on monitoring well depths that allow for the zones to be approximately equal in thickness. The shallow zone extends from the water table to approximately 35 feet BGS. The intermediate zone spans from 35 feet BGS to 85 feet BGS. The deep zone extends from 85 feet BGS to the top of bedrock. The maps were constructed using the data from Table 2-2 and enable comparison for three zone depths in the unconfined aquifer. These maps are consistent with and show similar flow patterns as maps constructed from data collected during Phases I and II of the investigation.

Several features are consistent among the potentiometric maps. There are relatively large groundwater mounds at monitoring well locations MW18 and MW43S. A smaller groundwater mound is present at MW30S. The MW30S and MW18 mounds are probably related to the gray silty clay unit under the northern part of the classification yard and shown in Figure 2-4. The proximity and shape of the St. Joseph River are also contributing factors to the curvature in the equipotential contours that are observed surrounding monitoring well location MW18. The groundwater mound at MW43S is probably related to clayey silt, which extends from 14 to 18 feet BGS at this location. The bottom of the screened interval for MW43S is 16 feet BGS. The general flow direction in all three zones is to the northwest. However, in the LaRue Street area, the general flow direction is north. In the eastern portion of the classification yard, the horizontal groundwater gradient is smaller than the gradient in the remainder of the study area. The median Phase III horizontal groundwater gradient is 0.0020 ft/ft for the shallow zone, 0.0019 ft/ft for the intermediate zone, and 0.0020 ft/ft for the deep zone.

Table 2-3 lists the vertical hydraulic gradients for the January 23 and 24, 1993, water elevation data set. These results show the general downward gradient (as evidenced by the "+" signs) in the study area that has been observed during the previous phases. The vertical hydraulic gradients and the respective locations of the monitoring well nests in the study area are consistent with groundwater recharge in the railyard and subsequent groundwater discharge to the St. Joseph River.

The results of the slug tests conducted during the RI are listed in Table 2-4. Results of these tests range from 9.6×10^{-5} ft/sec to 3.5×10^{-3} ft/sec and have a geometric mean of 8.0×10^{-4} ft/sec. The range of values is typical for unconsolidated silty sand, clean sand, and gravel (Freeze and Cherry 1979). Also, the greater than one order of magnitude difference between the high and low values reflects the range of aquifer materials observed during the geologic logging of soil and monitoring well borings. Of the 12 wells tested, the four lowest hydraulic conductivity values were obtained for the wells that were installed using the mud rotary drilling technique. The remaining eight wells tested were installed using the hollow-stem auger drilling technique.

2.2 CONTAMINANTS OF CONCERN

The primary contaminants of concern at the Conrail site are two volatile organic compounds (VOCs), carbon tetrachloride (CCl_4) and trichloroethene (TCE). Other VOCs that have been detected in soil and/or groundwater samples from the site include chloroform, benzene, 1,1-dichloroethane, 1,1-dichloroethene, 1,1,2-trichloroethane, 1,1,1-trichloroethane, dibromochloromethane, chloromethane, 1,2-dichloroethene, tetrachloroethene, 1,2-dichloroethane, 2-butanone, and carbon disulfide. These compounds generally have been detected in samples that also contained CCl_4 or TCE at higher concentrations. Although the FS and this Alternatives Array Document focus on the treatment of the primary contaminants, other VOCs detected on site will be addressed by any remedial activities that focus on the primary contaminants. In addition, other compounds, including polynuclear aromatic hydrocarbons, have been detected in soil samples from the site. For the purposes of this Alternatives Array Document and FS, remedial action will not focus on these other compounds.

2.2.1 Soil Contamination

A subsurface soil investigation was conducted by E & E to locate and define source areas contributing to the CCl_4 and TCE groundwater contamination. Figure 2-1 presents the locations of the Phase I and III soil borings conducted as part of the investigation. Analysis of subsurface soil samples collected from soil borings B-01 through B-19, conducted as part of the Phase I investigation, did not detect any VOCs above the method detection limit. Analysis of selected soil samples collected from soil borings B-20 through B-39, conducted as part of the Phase II investigation, revealed high concentrations of CCl_4 and TCE, respectively, in two areas on the Conrail facility. Figure 2-2 presents the Phase II soil boring locations and the sample interval analytical results. Appendix A presents all Phase II soil sample analytical results. Soil borings B-40 through B-52 were conducted as part of the Phase III investigation and the analytical results from the subsurface soil samples collected from these borings are still pending receipt.

Based on Phase II analytical data, a CCl_4 source located in the track 69 area, in the eastern end of the classification yard, was identified based on analytical results of soil samples collected from soil borings B-24 and B-25. Figure 2-2 presents CCl_4, TCE, and other selected organic analytical results for all soil samples analyzed. The deepest CCl_4 contamination detected in this area occurs at a depth of 25.5 feet BGS in soil boring B-25, at a concentration of 23,000 μg/kg. Similar levels and depths of contamination were detected in B-24. E & E anticipates that the vertical extent of this source contamination will be determined upon receipt of the Phase III subsurface soil results. Soil samples from similar depths analyzed from B-26, located 40 feet east of B-25, revealed CCl_4 at 2 μg/kg or not detected. These data suggest that large changes in CCl_4 concentrations in the soil occur over relatively small, lateral distances. The determination of the areal extent of this source will be based on the pending Phase III subsurface soil results.

A TCE source area is located in the west end of the classification yard between tracks 65 and 66, and is identified based on analytical results of soil samples collected from borings B-28 and B-32. A contamination pattern exists similar to that observed in the track 69 area; that is, a sharp difference in contaminant concentration between samples separated by a small lateral distance. For instance, the 0- to 2-foot depth interval soil sample from B-29 revealed TCE at 13 μg/kg, while the soil sample from the same interval from B-28, located 40 feet east of B-29, had a TCE concentration of 15,000 μg/kg. The east-west spatial boundaries of this source appear to be well determined, and based on analytical results and sample intervals, this appears to be a surface source of TCE. E & E anticipates that definition of the north-south spatial boundaries of this source will be possible following receipt of the Phase III subsurface soil results.

2.2.2 Groundwater Contamination

Based on Phase III analytical results for groundwater samples, groundwater flow direction, and Phase II analytical results for subsurface soil samples, it is confirmed that sources contributing VOCs, primarily CCl_4 and TCE, to the groundwater contamination plume are present on the Conrail railyard. Appendix B contains a table of the analytical results for the Phase III groundwater samples collected from Phase I, II, and III monitoring wells as presented on Figure 2-3. Based upon the groundwater flow in the aquifer, groundwater samples upgradient of the railyard show no detectable levels of CCl_4 and TCE. Groundwater samples from monitoring wells within the railyard contain both CCl_4 and TCE; 110,000 μg/L is the maximum CCl_4 concentratioh at location MW46S, and 7,900 μg/L is the maximum TCE concentration at location MW30I. The CCl_4 and TCE groundwater contamination is effectively tracked directly off the Conrail railyard in a groundwater plume which follows the established groundwater flow direction to the St. Joseph River and slightly west toward Baugo Bay. The maximum concentrations of CCl_4 and TCE detected directly downgradient of the Conrail railyard, prior to any other potential source(s), are 150 μg/L at location MW42I and 15,000 μg/L at location MW41, respectively. The data also corroborate conclusions presented in the *Preliminary Evaluation of Phase I Results and Interim Remedial Alternatives* (E & E 1990) report of a "hot zone" of TCE groundwater contamination in the northern section of the plume as it flows through the County Road 1 residential area and a "hot zone" of CCl_4 groundwater contamination in the southern section of the plume through the same area. Figure 2-9 shows the inferred boundaries of the TCE and CCl_4 plume, as initially identified and supported with the most recent RI data. The groundwater analytical data and distribution of the CCl_4 and TCE plume(s) in the study area strongly suggest contributions from more than a single on-site source for both compounds.

2.3 PRELIMINARY IDENTIFICATION OF ARARS

For each hazardous waste site governed by CERCLA and SARA, Congress has directed EPA to consider the degree of public health or environmental protection afforded by each remedial alternative considered.

Section 121(d) of SARA requires that remedial actions be consistent with and in accordance with other environmental laws. These laws may include: the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Clean Air Act (CAA), the Toxic Substances Control Act (TSCA), and the Safe Drinking Water Act (SDWA), among other federal laws, and any state law that has stricter requirements than the corresponding federal law.

These regulations and standards preliminarily identified for the Conrail site have been categorized as "applicable or relevant and appropriate requirements" (ARARs), or as "to be considered" (TBC). ARARs are legally binding. While TBCs are not legally binding, they will be considered along with ARARs as part of the site endangerment assessment and may be used in determining the necessary level of cleanup for protection of health or the environment.

ARARs may be further categorized as: chemical-specific requirements that may define acceptable exposure levels and therefore be used in establishing preliminary remediation goals; location-specific requirements that may set restrictions on activities within specific locations such as floodplains or wetlands; or action-specific requirements that may set controls or restrictions for particular treatment and disposal activities related to the management of hazardous wastes.

Based on these definitions, lists of federal ARARs and TBCs potentially applicable to the Conrail site have been identified and are shown in Tables 2-5 and 2-6, respectively. State ARARs and TBCs tentatively identified for this site are presented in Table 2-7. This preliminary identification of ARARs and TBCs was used in identifying potential remedial alternatives to be developed and evaluated in the FS. Because the FS is iterative in nature, both state and federal ARAR identification may continue throughout the FS process as additional information concerning remedial action alternatives is acquired. This alternatives array document is intended to solicit any additional ARARs from appropriate state and federal agencies.

2.4 PRELIMINARY REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are established under the broad guidelines of meeting all ARARs, consideration of TBCs, and/or reducing the risk of cancer in the target populations to below the 10^{-4} to 10^{-6} range as well as reducing the risk of other chronic health problems to an acceptable level.

Overall objectives will include the remediation of contaminated soil and groundwater in compliance with all ARARs, and the reduction of exposure risks to acceptable levels. A risk assessment is currently being conducted for the Conrail site as a part of the RI. The risk assessment will include an evaluation of contaminant migration pathways and receptors that could be affected by site contamination. For the purposes of this Alternatives Array Document, potentially significant exposure routes include:

- ingestion of contaminants in groundwater;
- inhalation of volatilized contaminants from soil and groundwater; and
- dermal exposure to contaminants in soil and groundwater.

As the risk assessment progresses, those migration pathways that pose a significant threat to human health or welfare will be identified, and the risks quantified. Specific RAOs for the site will be developed that focus on eliminating to reducing the potential for exposure via those pathways. RAOs will also include protecting uncontaminated groundwater and surface water for current and future use, restoring contaminated groundwater for future use, and protecting environmental receptors. Aquifer restoration time frames will be evaluated based upon further assessment of technical limitations to removing contaminants.

Cleanup levels for specific media (i.e., groundwater or soil) necessary to reduce the risk of cancer to below 10^{-6} will be developed based on the findings of the risk assessment. These risk-based cleanup levels have been identified as relevant risk-based cleanup levels that are required to be considered in the final remedy selection process by the National Contingency Plan (NCP) regulations set forth in 40 CFR 300.430 and EPA guidance (Office of Solid Waste and Emergency Response [OSWER] Directive 9355.0-30, April 22, 1991). Since these levels are not available presently, the preliminary cleanup goals discussed below are based on ARARs and TBCs, such as MCLs and the proposed RCRA corrective-action regulations action levels, for the purposes of this Alternatives Array Document.

Since the groundwater in the Conrail study area has been used as a potable water source, the MCLs are used as cleanup goals for contaminated groundwater. MCLs for the contaminants of concern are set forth in the SDWA, 40 CFR 141.11-141.16 and are summarized in Table 2-8.

The proposed RCRA corrective action regulations (set forth in 55 FR 30865, July 27, 1990) identify a number of "action levels" for contaminants of concern at the Conrail site. For purposes of this Alternatives Array Document, these action levels have been identified as TBCs because the regulations have not yet been finalized; furthermore, by definition these regulations are not intended to establish final cleanup goals, but rather the need for a RCRA corrective measures study.

Thus, action levels for groundwater are used as cleanup goals only for contaminants of concern that do not have reported MCLs. In the case of soils, however, only action levels are used as the cleanup goals since the risk-based values are not available yet. Action levels and selected preliminary cleanup goals for both groundwater and soil are summarized in Table 2-8.

Final cleanup goals will be set based on risks identified at the site in the risk assessment, ARARs, and other EPA guidance. Again, E & E is currently conducting a human health risk assessment and ecological evaluation. The results of these studies will be considered in the development of the final cleanup goals. As a result, they will be further defined and developed as the FS progresses. General response actions (GRAs) that address remedial objectives are discussed in Section 3.

2.5 EXTENT OF REMEDIAL ACTION

Based upon the RAOs identified in Section 2.4, remedial efforts contemplated during this FS will focus on the two identified soil source areas and on identified groundwater contaminant plumes. The TCE source area, located at the west end of the classification yard, consists of TCE-contaminated silt/sand extending from ground surface to approximately a depth of 6 feet. The lateral extent of contamination will be better defined by Phase III RI data that is not yet available. The CCl_4 source area, located at the east end of the classification yard in the vicinity of Track 69, consists of CCl_4-contaminated silt/sand at depths ranging from approximately 18 to 28 feet below ground surface. This source area is overlain and underlain by more permeable sand and gravel, and the water table is located approximately 8 to 10 feet below ground surface.

Remedial efforts for groundwater will address contamination identified beneath the Conrail railyard and contamination that has migrated downgradient from the railyard. The approximate areal boundaries of this downgradient contamination are delineated on Figure 2-9.

Remedial alternatives contemplated during this FS, beyond the No Action Alternative, will take into consideration the interim action being conducted at the site, which was described in Section 1.2.

In Sections 3 and 4, GRAs and remedial technologies will be identified that are appropriate to address the two soil source areas and the identified groundwater contamination.

Table 2-1

GRAIN-SIZE RESULTS FOR SOIL SAMPLES COLLECTED DURING INSTALLATION OF PHASE III MONITORING WELLS

Monitoring Well Number	Depth of Soil Sample (feet)	Specific Gravity	Percent Gravel	Percent Sand	Percent Fines	Unified Soil Classification System Group Symbol	Unified Soil Classification System Group Name
MW07D	124 - 126	2.64	15.8	80.3	3.9	SP	Poorly graded sand with gravel
MW45	22.5 - 24.5	2.62	4.6	90.2	5.2	SP-SM	Poorly graded sand with silt
MW46S	21 - 27	2.72	13.2	59.0	27.8	SM	Silty sand
MW46I	56 - 62	2.65	0.0	87.9	12.1	SP/SW-SM	Poorly to well graded sand with silt
MW47	32.5 - 34.5	2.66	34.5	59.7	5.8	SW-SM	Well graded sand with gravel and silt
MW48	21 - 22	2.61	0.0	97.0	3.0	SP	Poorly graded sand
MW49D	80 - 82	2.71	10.3	83.4	6.3	SP/SW-SM	Poorly to well graded sand with silt
MW49BR	138 - 140	2.67	8.6	89.1	2.3	SP	Poorly graded sand
MW50	114 - 116	2.69	23.8	73.3	2.9	SP/SW	Poorly to well graded sand with gravel
MW51	106 - 108	2.67	15.2	82.1	2.7	SP	Poorly graded sand with gravel

Table 2-2

GROUNDWATER ELEVATIONS

Well ID	Top of Inner Casing Elevation (feet above Mean Sea Level)	January 23-24, 1993	
		Depth to Water (feet)	Water Level Elevation (feet above Mean Sea Level)
MW01	740.87	12.32	728.55
MW02S	742.44	12.86	729.58
MW02D	742.30	12.78	729.52
MW02BR	742.53	12.97	729.56
MW03	738.80	7.33	731.47
MW04S	740.80	15.79	725.01
MW04D	741.24	16.44	724.80
MW05S	734.86	11.01	723.85
MW05D	734.13	11.20	722.93
MW06	740.18	17.91	722.27
MW07	731.64	12.49	719.15
MW07D	730.67	12.38	718.29
MW08S	731.65	12.24	719.41
MW08D	731.57	12.28	719.29
MW08BR	731.93	12.65	719.28
MW09	740.43	19.86	720.57
MW10S	728.70	10.84	717.86
MW10D	728.26	6.90	721.36
MW11	739.50	15.94	723.56
MW11D	739.28	15.78	723.50
MW12	741.59	9.79	731.80
MW13S	750.20	10.94	739.26
MW13D	750.50	11.24	739.26
MW14	740.87	4.93	735.94
MW15	742.44	4.11	738.33

Table 2-2

GROUNDWATER ELEVATIONS

Well ID	Top of Inner Casing Elevation (feet above Mean Sea Level)	January 23-24, 1993	
		Depth to Water (feet)	Water Level Elevation (feet above Mean Sea Level)
MW16	743.51	4.27	739.24
MW18	747.18	3.81	743.37
MW19S	752.30	11.97	740.33
MW19D	752.37	12.04	740.33
MW20S	748.41	11.59	736.82
MW20D	748.65	11.44	737.21
MW21S	754.83	13.02	741.81
MW21D	754.87	13.14	741.73
MW23S	741.82	6.92	734.90
MW23D	742.29	8.32	733.97
MW24	745.12	9.08	736.04
MW25	743.72	8.21	735.51
MW26	752.02	14.24	737.78
MW27S	751.87	10.30	741.57
MW27I	752.13	10.95	741.18
MW28S	750.83	10.74	740.09
MW28I	750.91	11.11	739.80
MW29S	751.77	10.09	741.68
MW29I	752.37	10.63	741.74
MW30S	748.13	8.06	740.07
MW30I	748.18	8.77	739.41
MW30D	748.09	8.67	739.42
MW30BR	747.94	8.54	739.40
MW31S	751.45	9.96	741.49
MW31I	751.82	10.35	741.47

Page 3 of 4

Table 2-2

GROUNDWATER ELEVATIONS

Well ID	Top of Inner Casing Elevation (feet above Mean Sea Level)	January 23-24, 1993	
		Depth to Water (feet)	**Water Level Elevation (feet above Mean Sea Level)**
MW32S	746.99	5.97	741.02
MW32I	746.93	6.00	740.93
MW33S	745.40	6.30	739.10
MW33I	745.31	6.53	738.78
MW34I	744.33	8.04	736.29
MW35	748.50	6.61	741.89
MW36I	747.04	7.08	739.96
MW37S	741.47	15.09	726.38
MW37D	741.36	14.97	726.39
MW38S	737.15	14.43	722.72
MW38D	736.84	14.13	722.71
MW39	752.88	12.58	740.30
MW40	753.40	13.26	740.14
MW41D	741.55	6.29	735.26
MW42I	742.19	9.17	733.02
MW43S	728.92	6.75	722.17
MW43BR	728.60	8.42	720.18
MW44D	739.71	15.62	724.09
MW45	760.67	18.90	741.77
MW46S	747.05	6.07	740.98
MW46I	747.24	6.27	740.97
MW47	745.55	6.67	738.88
MW48	751.12	9.57	741.55
MW49D	745.62	6.31	739.31
MW49BR	745.61	6.28	739.33

Table 2-2

GROUNDWATER ELEVATIONS

Well ID	Top of Inner Casing Elevation (feet above Mean Sea Level)	January 23-24, 1993	
		Depth to Water (feet)	Water Level Elevation (feet above Mean Sea Level)
MW50	737.42	14.71	722.71
MW51	741.09	4.49	736.60
RIVER	736.21	20.56	715.65

Table 2-3

VERTICAL HYDRAULIC GRADIENTS

Well Nos.	January 23-24, 1993
Shallow/Intermediate Nest	
MW27S-MW27I	+.01111
MW28S-MW28I	+.00841
MW29S-MW29I	+.00220
MW30S-MW30I	+.01902
MW31S-MW31I	+.00060
MW32S-MW32I	+00409
MW33S-MW33I	+.01730
MW46S-MW46I	+.00027
Shallow/Deep Nest	
MW02S-MW02D	+.00103
MW04S-MW04D	+.00609
MW05S-MW05D	+.01386
MW08S-MW08D	+.00233
MW10S-MW10D	-.05645
MW11S-MW11D	+.00135
MW13S-MW13D	+.00000
MW19S-MW19D	+.00000
MW20S-MW20D	-.00709
MW21S-MW21D	+.00158
MW23S-MW23D	+.01691
MW30S-MW30D	+.00750
MW37S-MW37D	-.00013
MW38S-MW38D	+.00013
MW07S-MW07D	+.00768
Shallow/Bedrock Nest	
MW02S-MW02BR	+.00014
MW08S-MW08BR	+.00122

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Table 2-3

VERTICAL HYDRAULIC GRADIENTS

Well Nos.	January 23-24, 1993
Shallow/Bedrock Nest (Cont.)	
MW30S-MW30BR	+.00519
MW43S-MW43BR	+.01416
Intermediate/Deep Nest	
MW30I-MW30D	-.00019
Intermediate/Bedrock Nest	
MW30I-MW30BR	+.00011
Deep/Bedrock Nest	
MW02D-MW02BR	-.00045
MW08D-MW08BR	+.00018
MW30D-MW30BR	+.00047
MW49D-MW49BR	-.00034

Table 2-4

PHASE II SLUG TEST RESULTS

Well	**Hydraulic Conductivity (feet/second)**
MW02BR	3.2×10^{-4}
MW08BR	1.3×10^{-4}
MW30S	3.3×10^{-3}
MW30I	7.9×10^{-4}
MW30D	1.3×10^{-3}
MW30BR	5.3×10^{-4}
MW31S	6.1×10^{-4}
MW31I	1.7×10^{-3}
MW32S	1.8×10^{-3}
MW32I	1.6×10^{-3}
MW37S	3.5×10^{-3}
MW37D	9.6×10^{-5}
Geometric Mean = 8.0×10^{-4}	

TABLE 2-5

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

1. Office of Solid Waste
   - Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901) b/
     a. 40 CFR Part 264, applicable for permitted facilities c/, and 40 CFR Part 265, for interim status facilities.
        - Groundwater Protection (40 CFR 264.90-264.101)
        - Groundwater Monitoring, Subpart F (40 CFR 264.98-264.100) d/
        - Closure and Post-Closure (40 CFR 264.110-264.120, 265.110-265.120)
        - Containers (40 CFR 264.170-264.178, 265.190-265.177)
        - Land Treatment (40 CFR 264.270-264.299, 265.270-265.282)
        - Incinerators (40 CFR 264.340-264.999, 265.340-265.369)
        - Land Disposal Restrictions (40 CFR 268.1-268.50)

     b. Statutory requirements, including:
        - Liquids in Landfills (RCRA §3004(c))
        - Minimum Technology Requirements (RCRA §3004(o), 3005(j))
        - Dust Suppression (RCRA §3004(e))
        - Hazardous Waste Used as Fuel (RCRA §3004(q))

2. Office of Water
   - The Safe Drinking Water Act (42 U.S.C. 300(f))
     a. Maximum Contaminant Levels (chemicals, turbidity, and microbiological contamination) (for drinking water or human consumption) (40 CFR 141.11-141.16).
     b. Maximum Contaminant Level Goals (40 CFR 141.50-141.51, 50 FR 46936).

   - Clean Water Act (33 U.S.C. 1251)
     Requirements established pursuant to sections 301 (effluent limitations), 302 (effluent limitations), 303 (water quality standards, including State water quality standards), 304 (Federal water quality criteria), 306 (national performance standards), 307 (toxic and pretreatment standards, including Federal pretreatment standards for discharge into publicly owned treatment works, and numeric standards for toxics), 402 (national pollutant discharge elimination system), and 404 (dredged or fill material) of the Clean Water Act, (33 CFR Parts 320-330, 40 CFR Parts 122, 123, 125, 131, 230, 231, 233, 400-469). Available ambient Water Quality Criteria Documents are listed at 45 FR 79318, November 28, 1980; 49 FR 5831, February 15, 1984; 50 FR 30784, July 29, 1985; 51 FR 22978, June 28, 1986; 51 FR 43665, December 3, 1986; 51 FR 8012, March 7, 1986; 52 FR 6213, March 2, 1987.

TABLE 2-5 (CONT.)

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

2. Office of Water (Cont.)
   - EPA's Statement of Procedures on Floodplains Management and Wetlands Protection. (40 CFR Part 6 Appendix A) e/

3. Office of Air and Radiation
   - Clean Air Act (42 U.S.C. 7401)
     - a. National Emissions Standards for Hazardous Air Pollutants for Asbestos and Wet Dust particulates, (40 CFR 61.140-61.156), and for other hazardous substances (40 CFR Part 61 generally). See also effluent limitations and pretreatment standards for Wet Dust Collection (40 CFR427.110-427.116) and 40 CFR Part 763.
     - b. Standards of performance for new stationary sources, including new incinerators (42 U.S.C. 7411), (40 CFR Part 60).

4. Other Federal Requirements
   - OSHA requirements for workers engaged in response or other hazardous waste operations (29 CFR 1910.120).
   - Occupational Safety and Health Act of 1970 (29 U.S.C. 651).
     - a. Occupational Safety and Health Standards (General Industry Standards) (29 CFR Part 1910).
     - b. The Safety and Health Standards for Federal Service Contracts (29 CFR Part 1926).
     - c. The Health and Safety Standards for Employees engaged in Hazardous Waste Operations. (50 FR 45654).
   - Department of Transportation Rules for the Transportation of Hazardous Materials, 49 CFR Parts 107, 171.1-172.558.
   - Endangered Species Act of 1973, 16 U.S.C. 1531. (Generally, 50 CFR Parts 81, 225, 402).
   - Wild and Scenic Rivers Act, 16 U.S.C. 1271.
   - Fish and Wildlife Coordination Act, 16 U.S.C. 661 note.
   - Fish and Wildlife Improvement Act of 1978, and Fish and Wildlife Act of 1956, 16 U.S.C. 742a note.
   - Fish and Wildlife Conservation Act of 1980, 16 U.S.C. 2901. (Generally, 50 CFR Part 83).
   - Farmland Protection Policy Act, 7 U.S.C. 4201. (Generally, 7 CFR Part 658).
   - Rivers and Harbors Act (33 U.S.C. 403).

TABLE 2-5 (CONT.)

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

a/ This is the list of potentially applicable or relevant and appropriate requirements found in the October 2, 1985, Compliance Policy with additions. As additional requirements are promulgated, they will be considered potentially applicable or relevant and appropriate and added to this list.

b/ In authorized States, Federal regulations promulgated under RCRA are not applicable as a State requirement until the State adopts those regulations through its own legislative process, but probably would be relevant and appropriate as a federal requirement. Federal regulations promulgated pursuant to the Hazardous and Solid Waste Amendments of 1984, however, are effective immediately in all 50 states, and are potentially applicable as Federal requirements.

c/ 40 CFR Part 264 regulations apply to permitted facilities and may be relevant and appropriate to other facilities.

d/ Only Subpart F groundwater monitoring requirements under 40 CFR 264 are ARAR. The Subpart F groundwater monitoring requirements under 40 CFR 265 are not ARAR.

e/ 40 CFR Part 6 Subpart A sets forth EPA policy for carrying out the provisions of Executive Orders 11988 (Floodplains Management) and 11990 (Protection of Wetlands).

TABLE 2-6

OTHER FEDERAL CRITERIA, ADVISORIES, AND GUIDANCE TO BE CONSIDERED a/

1. Federal Criteria, Advisories, and Procedures
    - Health Effects Assessments (HEAs) and Proposed HEAs, ("Health Effects Assessment for (Specific Chemicals), "ECAO, USEPA, 1985).
    - References Doses (RfDs), ("Verified Reference Doses of USEPA," ECAO-CIN 475, January 1986). See also Drinking Water Equivalent Levels (DWELs), a set of medium-specific drinking water levels derived from RfDs. (See USEPA Health Advisories, Office of Drinking Water, March 31, 1987).
    - Carcinogen Potency Factors (CPFs) (e.g., Q1 Stars, Carcinogen Assessment Group [CAG] Values), USEPA, OHEA/6008 82/005F, July 1985).
    - Waste load allocation procedures, EPA Office of Water (40 CFR Part 125, 130).
    - Federal Sole Source Aquifer requirements (see 52 FR 6873, March 5, 1987).
    - Public health criteria on which the decision to list pollutants as hazardous under Section 112 of the Clean Air Act was based.
    - Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy.
    - Advisories issued by PWS and NWPS under the Fish and Wildlife Coordination Act.
    - OSHA health and safety standards that may be used to protect public health (non-workplace).
    - Health Advisories, EPA Office of Water.
    - EPA Water Quality Advisories, EPA Office of Water, Criteria and Standards Division.

2. USEPA RCRA Guidance Documents
    - Interim Final Alternate Concentration Limit Guidance Part 1: ACL Policy and Information Requirements (July, 1987)
        a. EPA's RCRA Design Guidelines
        b. Permitting Guidance Manuals
        c. Technical Resource Documents (TRDs)
        d. Test Methods for Evaluating Solid Waste

3. USEPA Office of Water Guidance Documents
    a. Pretreatment Guidance Documents
    b. Water Quality Guidance Documents
    c. NPDES Guidance Documents
    d. Groundwater/UIC Guidance Documents
    e. Groundwater Protection Strategy (August 1984).
    f. Clean Water Act Guidance Documents

TABLE 2-6 (CONT.)

OTHER FEDERAL AND STATE CRITERIA, ADVISORIES, AND GUIDANCE TO BE CONSIDERED a/

4. USEPA Manuals from the Office of Research and Development
   - SW 846 methods - laboratory analytic methods (November 1986)
   - Lab protocols developed pursuant to Clean Water Act Section 304(h).

a/ This list updates the list of other federal criteria, advisories, and guidance to be considered in the October 5, 1985, Compliance Policy. As additional or revised criteria, advisories, or guidance are issued, they will be added to this list and also considered.

Source: EPA CERCLA COMPLIANCE WITH OTHER LAWS MANUAL; May 6, 1988 (OSWER Directive 9234.1-01).

Table 2-7

SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND REGULATIONS AND STANDARDS TO BE CONSIDERED (TBCS) FOR REMEDIAL ALTERNATIVES FOR THE CONRAIL SITE IN ELKHART, INDIANA

Program Enforcement Area	Response Action	Description of ARARs/TBCs	Regulatory Codes
IDEM OSHWM	Institutional Controls	• Deed Restrictions • Warning Signs • Zoning Controls, Property Condemnation	329 IAC 3-21-10, 3-21-7 329 IAC 3-16-5, 3-21-8(6) 329 IAC 3-21-8 (C)
	Containment	• *In situ* and aboveground containment systems	329 IAC 3
	Treatment	• Container management • Tank management • Miscellaneous unit management	329 IAC 3-48 329 IAC 3-49 329 IAC 3-54.9
	Disposal	• Land disposal restrictions • Record-keeping and manifest requirements	40 CFR 268 329 IAC 3-8, 3-10
IDEM OAM	Treatment	• Air Stripping Permit Review and VOC Rules • Emissions permit/registration and controls by IDEM commissioner • VOC emissions • Best available technology (BAT)	326 IAC 2-1, 8-1 326 IAC 2-1-1, 2-1-3 326 IAC 8 326 IAC 8-1-6
IDEM OWM	Treatment	• On-site carbon adsorption, filtration, air stripping, construction permits	327 IAC 3
	Disposal	• Discharge off site to water, NPDES permit and pretreatment • Discharge off site to POTW-NPDES permit or pretreatment	327 IAC 5-22, 5-2-8, 5-2-9, 5-2-10, 5-2-11.1, 5-2-17, and 5-4-2 327 IAC 5-12
	Potable Water Distribution	Indiana Drinking Water Quality Standards	327 IAC 2 (identical to SDWA standards)
DNR	Disposal	• Discharge to St. Joseph River construction in floodway, Flood Control Act	IAC 13-21-22

Key at end of table.

Table 2-7

SUMMARY OF STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND REGULATIONS AND STANDARDS TO BE CONSIDERED (TBCS) FOR REMEDIAL ALTERNATIVES FOR THE CONRAIL SITE IN ELKHART, INDIANA

Program Enforcement Area	Response Action	Description of ARARs/TBCs	Regulatory Codes
DNR (Cont.)	Groundwater Extraction	• Well registration with the DNR, Division of Water	–
Elkhart County	General	• Proposed Rules and Regulations for Groundwater Protection	Proposed Rules and Regulations, Elkhart County Groundwater Protection Ordinance, May 1, 1989

Key:

IDEM: Indiana Department of Environmental Management
OSHWM: Office of Solid and Hazardous Waste Management
OAM: Office of Air Management
OWM: Office of Water Management
DNR: Indiana Department of Natural Resources
IAC: Indiana Administrative Code
VOC: Volatile Organic Compound
SDWA: Safe Drinking Water Act
NPDES: National Pollutant Discharge Elimination System
POTW: Publicly Owned Treatment Works
–: Not Applicable

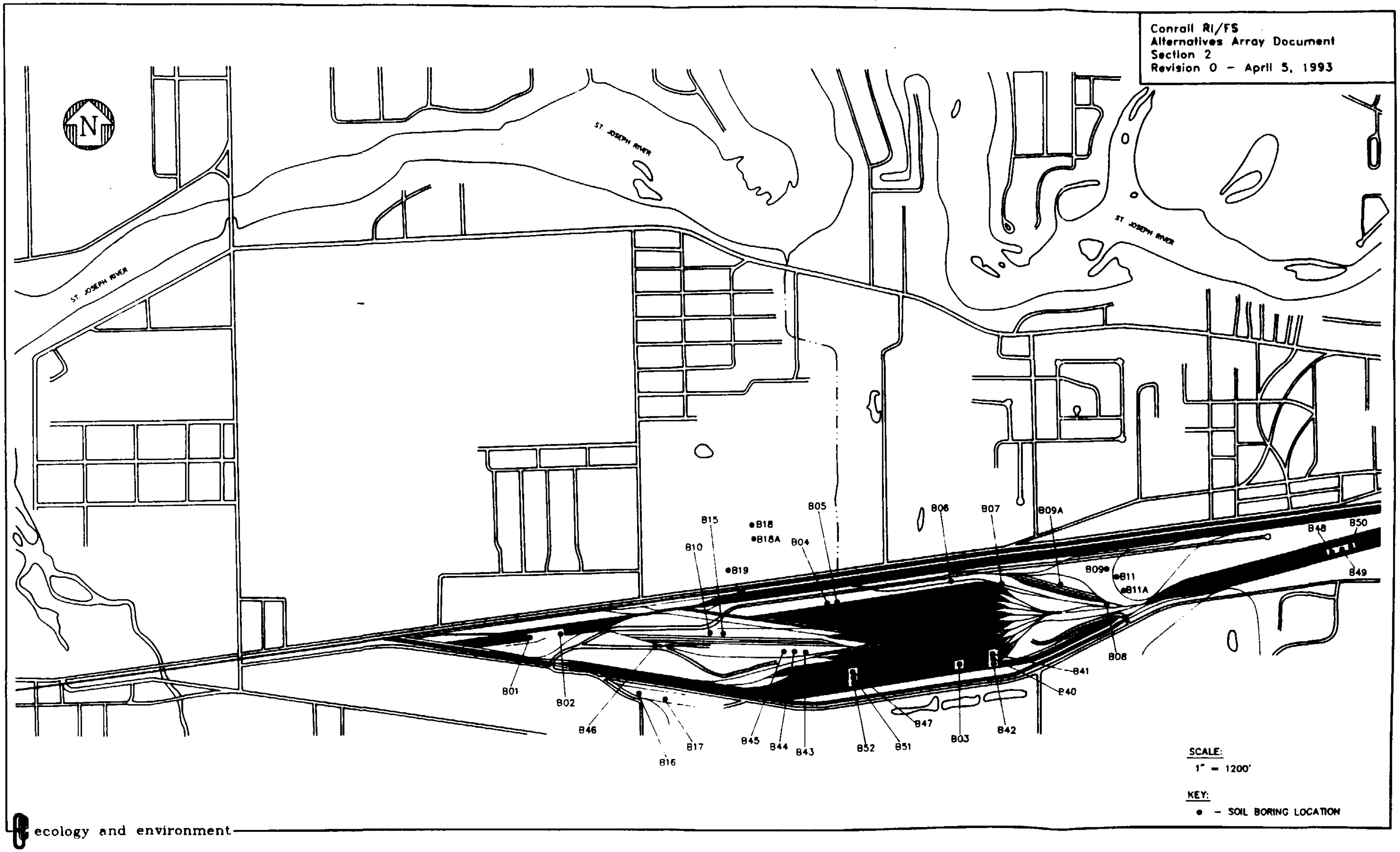
Table 2-8

SUMMARY OF PRELIMINARY CLEANUP GOALS FOR GROUNDWATER AND SOIL CONTAMINATION AT THE CONRAIL SITE

Contaminant of Concern	Groundwater (μg/L)			Soil (ppm)	
	MCL	RCRA Action-Level Standard	Cleanup Goal	RCRA Action-Level Standard	Cleanup Goal
Primary Contaminants					
carbon tetrachloride	5	0.3	5	5	5
trichloroethene	5	MCL	5	60	60
Other Volatile Organic Compounds					
1,1,1-trichloroethane	200	3,000	200	7,000	7,000
1,1,2-trichloroethane	5	6	5	100	100
1,1-dichloroethane	–	–	–	–	–
1,1-dichloroethene	7	MCL	7	10	10
1,2-dichloroethane	5	MCL	5	8	8
1,2-dichloroethene	70	–	70	–	–
2-butanone (MEK)	–	–	–	–	–
benzene	5	–	5	–	–
carbon dichloroethane	–	4,000	–	8,000	8,000
chloroethane	–	–	–	–	–
chloroform	–	6	6	100	100
chloromethane	–	–	–	–	–
dibromochloromethane	–	–	–	–	–
tetrachloroethene	5	0.7	5	10	10

ZF3CONAADFIG2-1

Conrail RI/FS
Alternatives Array Document
Section 2
Revision 0 - April 5, 1993



SCALE:
1" = 1200'

KEY:
● - SOIL BORING LOCATION

ecology and environment

FIGURE 2-1 PHASE I AND III SOIL BORING LOCATIONS

3. GENERAL RESPONSE ACTIONS

Based upon a review of the available data derived during the RI, general response actions (GRAs) were identified to address the remedial objectives for the Conrail site. GRAs can be considered as conceptual alternatives. The GRAs discussed here address the RAOs in some manner with the exception of the No Action Alternative. The No Action Alternative was included in the alternatives for each area of concern as a baseline for comparison with other potential GRAs. The No Action Alternative is also required to be evaluated by SARA.

The GRAs presented here will be considered for the remedial action. Although GRAs are introduced individually in this subsection, they are often used in combination with other GRAs (e.g., collection is frequently followed by treatment and/or discharge). Most of the remedial action alternatives developed in Section 5 use a combination of GRAs.

No Action

The no action GRA serves as a baseline for comparison with other potential GRAs. If no action is implemented at the Conrail site, substances would remain in the soil and groundwater, serving as a potential source of contamination to presently unaffected soil and groundwater. The human health and environmental risks posed by site contaminants would remain, and the RAOs would not be achieved. Natural biological processes would require a long period of time to degrade the organic constituents present at the site, and could possibly generate hazardous degradation byproducts. If no remedial action is implemented at the site, the volume and toxicity of contaminants would remain the same, and migration of contaminants in the soil and groundwater would continue unabated.

Additional Investigation

As a result of investigations at the Conrail site, it is suspected that some sources of contamination are currently contributing to groundwater contamination that have not been identified to date. The presence of unidentified sources can significantly impact the effectiveness of groundwater remedial actions, and potentially could lengthen the time frame required to achieve remedial action objectives. Additional investigation of site soils (possibly soil sample collection/analysis and/or additional monitoring well installation/sampling) would provide more information regarding potential sources to aid in the design of an effective groundwater remediation system. This GRA will in no way reduce or affect the contamination at the site, but could be an integral part of comprehensive site remedial action.

Institutional Actions

Institutional actions are administrative methods for preventing or limiting access to affected environmental media. For soil, institutional actions include issuing deed restrictions that limit site uses and erecting barriers such as fencing and warning signs that restrict persons' direct contact with contaminated soil. For groundwater, institutional actions include installing monitoring systems, issuing deed restrictions for the installation of new wells, abandonment of existing wells, and providing an alternate water supply. This GRA alone would not meet the remedial action objectives, but could be instituted along with other GRAs to reduce site workers' and area residents' potential exposure to contaminants before, during, and after remedial activities.

Containment

Soil and groundwater can be contained to prevent direct contact by receptors or to restrict the migration of contaminants into adjacent soil and groundwater. Containment is often accomplished through the use of a physical barrier but, in itself, would not reduce the toxicity or volume of the contaminants. Typical technologies applied include vertical barriers for groundwater containment and caps for soil containment. Containment can also be attained through the use of hydraulic gradient control.

Removal (Soil)/Collection (Groundwater)

These GRAs provide a means by which the source of contamination and/or the affected medium is physically collected and/or removed from the site for further treatment and/or disposal/discharge. Contaminated soil is frequently removed through excavation with standard construction equipment and replaced with clean fill. Contaminated groundwater can be collected through the use of extraction wells or subsurface drains (collection trenches). This GRA alone will not meet the remedial action objectives, but would be necessary prior to treatment, disposal, or discharge.

Treatment

Treatment technologies are processes that reduce the toxicity, mobility, or volume of contaminants. Typical technology types employed for treatment include physical, chemical, thermal, or biological processes. Depending on the characteristics of the wastes to be treated, a combination of processes may be necessary to properly treat the wastes. Treatment processes can be employed either on site, off site, or *in situ* and can potentially meet the remedial action objectives.

Disposal (Soil)/Discharge (Groundwater)

Once material has been removed or collected, it must be properly disposed of or discharged. Because disposal/discharge alone may not meet the remedial action objectives, this GRA is usually implemented following removal/collection and/or treatment. On-site and off-site disposal options will be considered for contaminated soils and residual solid waste material generated during remediation activities. On-site and off-site discharge options will be considered for treated or untreated groundwater and residual liquid wastes generated during remediation activities.

Specific remedial technologies have been identified for each of the GRA categories described above, with the exception of the No Action GRA. Technologies were identified that address soil and/or groundwater contamination by either:

- providing more information on the presence and migration of contaminants;

- limiting human exposure to contaminated media by eliminating or reducing exposure pathways;
- controlling further migration of contaminants; or
- eliminating or reducing the presence of contaminants.

Identified technologies are described, screened, and evaluated in Section 4.

4. IDENTIFICATION AND SCREENING OF APPLICABLE REMEDIAL TECHNOLOGIES

In order to meet the remedial action objectives established in Section 2, remedial technologies were identified and screened. The identification and screening processes are discussed in Sections 4.1 and 4.2. Subsequent subsections describe the technologies that were retained as a result of the screening. Technologies were identified and screened for the remediation of the two identified source soil areas and identified groundwater contamination.

4.1 IDENTIFICATION OF TECHNOLOGIES

Applicable remedial technologies were identified for each GRA identified in Section 3. These remedial technologies were identified based upon engineering judgement, taking the following factors into account:

- Site conditions and characteristics that may affect implementability;
- Physical and chemical characteristics of contaminants that determine the effectiveness of various technologies; and
- Performance and operating reliability of various technologies.

Cost criteria were not considered in the identification of applicable remedial technologies. Remedial action technology types can be thought of as a subcategory of GRAs and as encompassing a number of remedial action process options. Process options are defined as specific processes, systems, or actions that may be utilized to remediate or mitigate contamination. Process options are generally combined to form remedial action alternatives.

The technologies and process options that have been identified to address subsurface soils and groundwater are discussed below.

4.2 SCREENING OF TECHNOLOGIES

An initial screening of remedial technologies and process options, based upon the criteria of effectiveness, implementability, and cost, was conducted to refine the complete list of technologies initially identified. The criteria used are described as follows:

- Effectiveness - an evaluation of the potential effectiveness of process options in controlling the estimated areas or volumes of media and meeting the remedial action objectives.
- Implementability - an evaluation of the technical and administrative feasibility of a technological process. Processes unable to meet location- and action-specific ARARs will be eliminated from further consideration. Technologies requiring prohibitively extensive permitting will also be eliminated. If sufficient treatment, storage; or disposal capacity is not available for certain off-site options, these also may be discarded.
- Cost - a rough, relative estimate of capital, and operating and maintenance (O&M) costs. Cost will be a factor in comparing technologies that can produce similar levels of protection for potential receptors. This criterion plays a limited role in the screening of technologies.

The remedial technologies and process options that were identified to address soil and groundwater are listed in Tables 4-1 and 4-2, respectively. These tables also summarize the evaluation of each option based upon the criteria of effectiveness, implementability, and cost. These criteria were used to eliminate those remedial actions that are unproven, not applicable to site conditions, not expected to achieve an acceptable level of performance, or prohibitively expensive. Remedial actions that would be extremely difficult to implement were also discarded.

The evaluations of technologies summarized in Tables 4-1 and 4-2 are based upon available information and do not necessarily reflect factors such as the volume of contaminated media, which may affect the applicability of the technology, or the interrelationship of the various technologies. Some technologies that are considered for further evaluation may not be effective when evaluated alone but may provide a viable remedial action alternative when combined with other technologies. Those technologies that were retained for further evaluation are discussed below.

4.3 SOIL REMEDIAL TECHNOLOGIES

Remedial technologies have been identified under each GRA discussed in Section 3 to address contaminated soil at the Conrail site. The containment, removal, and treatment technology options have been identified specifically for the two soil contamination source areas identified at the site.

4.3.1 Additional Investigation

Further site investigation could be performed to locate and delineate contaminant sources that have not been identified to date. As a result of the RI, it is suspected that other source areas in the Conrail railyard (beyond the two soil sources discussed in this document) currently contribute to groundwater contamination. Identification and delineation of sources, and subsequent removal/treatment of these sources, could significantly reduce the time frame needed to achieve remedial action objectives for groundwater. Additional investigation could include such activities as soil sample collection and analysis or lead-screen auger borings.

4.3.2 Institutional Actions

Land use and deed restrictions, encompassing such items as warning signs, access restrictions (i.e., fences), and legal deed restrictions, can be utilized to limit receptor exposure to contaminated media. These options do not directly affect the chemicals or affected media and provide no means of remediation, but rather serve as a barrier to minimize or eliminate direct human contact with affected soil. Deed restrictions could be used to limit future development of the site property. Groundwater monitoring is another institutional control that will be an integral part of any remedial effort. Although monitoring is primarily used to track groundwater contamination, it can also be used to evaluate the effectiveness of remedial actions being implemented to address soil contamination. Although institutional actions will be conducted as part of the interim action for the site, these institutional controls may need to be expanded in scope to address long-term protection of human health and the environment.

4.3.3 Containment

Containment options do not directly affect the contaminated soil and provide no means of remediation, but serve as a barrier to limit further migration of contaminants within the soil. Because of the thickness and nature of the aquifer, the extent of contamination, and continual use of rails overlying contaminated areas, installation of physical barriers would be difficult and cost-prohibitive to install and maintain, and would be of questionable effectiveness. Therefore, caps and other physical barriers have been screened out of further consideration. However, containment of contaminants can also be achieved through groundwater extraction (i.e., hydraulic gradient control). This option is being retained and is discussed in Section 4.4 under groundwater containment.

4.3.4 Soil Removal

The removal of contaminated soils could be accomplished by excavating on-site soils. Excavation is an effective method for physically removing contaminated surface and subsurface soils from the site. Excavation involves the use of standard construction equipment that is adapted to minimize secondary migration. Excavation of the two identified source areas at the site would require the temporary removal and subsequent replacement of portions of track, resulting in interruptions to rail use. Removal of the CCl_4 source, located approximately 10 to 20 feet below the water table, would be extremely difficult to implement. In order to dewater the contaminated zone to allow excavation, a large volume of water would have to be extracted continuously during excavation. The nature of the site soil would also make excavation at depths up to 30 feet extremely difficult to implement. At this time, excavation will only be considered as a viable option for removal of the relatively shallow TCE-contaminated soil.

4.3.5 Soil Treatment

Potential soil treatment technologies can be employed either on site or off site using one of the following four general approaches:

- On-site treatment of excavated soil using mobile treatment systems;

- On-site construction and operation of treatment systems for excavated soil;
- *In situ* treatment of soil; and
- Transporting of excavated contaminated soil to an off-site treatment facility.

Treatment process options that were retained for further evaluation are discussed below.

Physical/Chemical Treatment Processes

Physical treatment processes can be used to separate the waste stream by either applying physical force or changing the physical form of the waste, while chemical treatment processes alter the chemical structure of the constituents to produce a waste residue that is less hazardous than the original waste. Further, the altered constituents may be easier to remove from the waste stream. Physical and chemical processes can also be used to immobilize contaminants within the waste material. Physical and chemical treatment processes are utilized to treat inorganic as well as organic hazardous waste that is either non-biodegradable or resistant to biodegradation. Possible treatment technologies that were initially identified and subsequently screened out include stabilization/solidification, soil washing, dechlorination, chemical oxidation, acid extraction, and solvent extraction. Because of the nature of site contaminants and the expected volume of contaminated soil, these process options are being excluded from further consideration, as shown on Table 4-1. *In situ* physical/chemical treatment processes, however, have been retained for evaluation and are discussed later in this section.

Thermal Treatment Processes

- **Incineration** at high temperatures is effective in permanently destroying organic contaminants. This process option entails high capital and energy costs. Several types of incinerators are technically feasible and have been used to treat hazardous waste. Options available include on-site incineration and off-site incineration. The relatively low anticipated volume of contaminated soil that would be excavated does not warrant construction of an on-site incinerator.

However, transportation of excavated soil to an off-site incinerator would provide an effective means of destroying the organic contaminants. The specific type of incinerator to be used will be further evaluated as the FS continues.

- **Thermal Desorption** is used to transfer volatile and semivolatile organic compounds from a solid matrix into a gas stream, typically using air, heat, and mechanical agitation. The organic compounds transferred into the gas stream are then subjected to further treatment (e.g., carbon adsorption or high-temperature incineration). Thermal desorption can be accomplished through the use of a mobile treatment unit that could be readily transported to the site.

Biological Treatment Processes

Biological treatment processes use indigenous or selectively cultured bacteria, yeast, or fungi to decompose hazardous organic compounds. Biological treatment processes are sensitive to temperature, pH, oxygen concentration, moisture content, availability of nutrients, and concentrations of inhibitory substances (e.g., metals). The site contaminants are not readily degradable and may yield toxic degradation by-products (e.g., vinyl chloride). Therefore, biological process options will not be retained for further evaluation.

***In situ* Treatment Processes**

In situ treatment processes are utilized to treat soil contamination that cannot be readily excavated. Soils are treated in place to either destroy or remove contaminants. *In situ* processes that have been retained for further evaluation include:

- **Soil Vapor Extraction** is a process for removing volatile organic compounds from permeable, unsaturated soils. A vacuum extraction system consists of a network of extraction wells connected to a vacuum extraction unit through a surface collection manifold. The vacuum induces a flow of air into the extraction wells in order to draw vapors from the soil, bringing about the release of volatile compounds. Depending on the nature and extent of contamination, the extracted gas can either be vented to the atmosphere or treated (e.g., through carbon adsorption or incineration) to remove VOCs prior to discharge to the atmosphere. This process can be augmented by the injection of air around the boundaries of contamination to increase the flow of air through the soil or by capping the surface to eliminate short-circuiting of air from the surface to the extraction system.

- **Air Sparging/Steam Injection** involves the injection of air or steam into saturated soils to volatilize VOCs and carry them upward into the overlying unsaturated zone. Ambient air from the surface or generated steam would be compressed and pumped through a series of injection wells into the area of contamination. The resulting air and vapors rising through the soil would need to be collected from the overlying unsaturated zone (via vapor extraction) or from the ground surface and vented to the atmosphere or treated (e.g., through carbon adsorption or incineration) to remove VOCs prior to discharge to the atmosphere.

- **Soil Flushing** is a process for washing organic and inorganic contaminants from soils. A liquid wash solution is injected into contaminated soil and then extracted to flush contaminants from the soil. During this flushing, sorbed contaminants are mobilized into solution through solubility, formation of an emulsion, or chemical reaction with the flushing solution. Spent wash solution requires treatment and/or disposal. This process option is only feasible if soils are relatively homogeneous and fairly coarse-grained. Otherwise, sufficient flow may not be obtained or channeling could occur, in which wash solution is diverted through a few pathways that offer little resistance, while the majority of the contaminated soil does not come into contact with the wash solution. Soil flushing can be enhanced with additives to increase the efficiency of contaminant removal from soil.

4.3.6 Soil Disposal

On-site disposal is not considered a viable option because of the shallow depth to groundwater and the present use of the site as an active railyard.

Off-site Disposal

Wastes generated during the site remediation, which may include either treated or untreated excavated soil or residual process wastes, could be transported off site to a commercial/RCRA disposal facility, as appropriate. Any such disposal must comply with land disposal restrictions and any other ARARs.

4.4 GROUNDWATER REMEDIAL TECHNOLOGIES

Groundwater remedial technologies can be applied to contain, collect, divert, or remove the groundwater beneath the Conrail site and the adjacent study area. It is anticipated that these technologies will have a two-fold effect: to prevent further migration of and to remediate identified contaminant plumes.

4.4.1 Institutional Actions

Land use and deed restrictions, encompassing such items as warning signs, access restrictions (i.e., fences), and legal deed restrictions, can be utilized to limit human exposure to contaminated media. An alternate water supply would also limit exposure to contaminated groundwater, and is currently being addressed under the interim action for the site. These options do not directly affect the on-site chemicals or affected media and provide no means of remediation, but rather serve to limit exposure pathways to minimize or eliminate direct human contact with affected groundwater. Deed restrictions could be used to prohibit future installation of groundwater wells in contaminated aquifers. Monitoring is another institutional control that will be an integral part of any remedial effort and would be used to evaluate the effectiveness of any remedial efforts. Although these institutional actions are currently included under the scope of the interim action, they may need to be expanded to meet remedial action objectives (e.g., through installation/monitoring of additional wells).

4.4.2 Groundwater Containment

Groundwater containment systems are used to limit the migration of contaminant plumes. Containment can be achieved by physically containing the plume or by restricting clean groundwater from contacting the contaminant plume through the use of physical barriers (e.g., sheet piling, slurry walls) or through collection via trenches or extraction wells. Physical barriers to contain groundwater are not considered feasible for site conditions because of the lack of subsurface geologic formations to key into, the depth of contamination, and the high yield of the aquifer. The only containment option considered feasible for the site is extraction wells.

Groundwater Extraction

Through groundwater extraction, contaminant plumes can be contained to limit further migration. Groundwater extraction is also used to recover groundwater for treatment, in addition to gradient control, and is discussed in more detail in the following subsection. Groundwater extraction is currently included under the scope of the interim action to contain the contaminant plume migrating northwest away from the railyard. Containment of other areas of groundwater identified at the site could be accomplished using extraction wells.

4.4.3 Groundwater Collection

Groundwater collection systems are used to control, contain, or remove contaminant plumes in the groundwater. Collection technologies include extraction wells or subsurface drains. Subsurface drains are not feasible for addressing groundwater contamination at the depth of contamination identified at the site.

Extraction Wells

Collection can be achieved by pumping groundwater from extraction wells. Pump selection for the recovery wells would depend on the anticipated lift requirements and volume of groundwater to be extracted. To ensure that the system can effectively control the hydraulic gradient of the contaminant plume, the extraction wells must be strategically placed within the contaminated aquifer, and a sufficient pumping rate must be determined. Proper operation and maintenance of the extraction system must be provided throughout the course of groundwater recovery. Extracted groundwater must be properly treated and either properly disposed of or reinjected. Groundwater extraction is currently included under the interim action to achieve containment of groundwater contamination, but also serves to collect groundwater for treatment. However, the collection of groundwater will need to be expanded to achieve long-term remedial action objectives.

4.4.4 Groundwater Treatment

Potential groundwater treatment technologies can be employed either on site or off site using one of the following general approaches:

- On-site treatment using mobile treatment systems;
- On-site construction and operation of treatment systems;
- Pretreatment of contaminated groundwater, followed by discharge to a publicly owned treatment works (POTW) or to a surface water body;
- *In situ* treatment; and
- Collection and transportation of contaminated groundwater to an off-site treatment facility.

Groundwater treatment process options that have been identified for consideration for the Conrail site include the following:

Physical/Chemical Treatment Processes

Physical treatment processes can be used to separate contaminants from groundwater by either applying physical force or changing the physical form of the contaminants, while chemical treatment processes alter the chemical structure of the constituents to detoxify or convert to a form that is less hazardous than the original constituents. Further, the altered constituents may be easier to remove from the waste stream. Physical and chemical treatment processes are utilized to treat inorganic as well as organic groundwater contaminants that are either non-biodegradable or resistant to biodegradation.

- **Air Stripping** involves passing groundwater through a contacting vessel to maximize air:water contact and allow volatile organic constituents in the water to transfer to the air phase. The air stream may require treatment (e.g. scrubbing or vapor phase carbon adsorption) prior to discharge to the atmosphere to remove vapor phase volatile organic constituents. The treated aqueous stream may require further treatment (e.g., carbon adsorption) prior to ultimate discharge.
- **Chemical Oxidation** is used primarily for detoxification of cyanide and for treatment of dilute wastestreams containing oxidizable organics. Aldehyde, mercaptans, phenols, benzidine, unsaturated acids, and certain pesticides have been successfully treated by this method. Chemical oxidizers utilized include hydrogen dioxide, potassium permanganate, chlorine, ozone, and chlorine dioxide.

- **Activated Carbon Adsorption** removes organics from aqueous contaminated groundwater streams by adsorbing the compounds onto the large internal pore surface area of activated carbon. The process has been demonstrated on a variety of organics, particularly those exhibiting low solubility and high molecular weight. Activated carbon can be used in a treatment column or added in a powdered form to contaminated water. Carbon adsorption can be readily implemented at hazardous waste sites and can remove dissolved organics from aqueous wastes to levels below 1 part per billion (ppb). Cleanup efficiency can be reduced if high concentrations of suspended solids are present in the groundwater.

- **Ultraviolet Photolysis/Ozonation** uses a combination of ultraviolet (UV) light and ozone to chemically oxidize organic compounds present in water. Complex organic molecules are broken down into a series of less complex molecules, eventually terminating with carbon dioxide and water. Off-gasses may need to be collected/ treated. UV/ozonation treatment is effective in treating a wide variety of chlorinated hydrocarbons and other toxic organics. Ozone dosage and retention time can be adjusted to enhance degradation of certain organics. The treatment is only effective on clear water, so pretreatment of influent water may be required.

Pre-treatment/Secondary Treatment Processes

Specific groundwater treatment processes are often necessary, not as a means of contaminant removal, but as a component of a more complex treatment process. Often primary treatment processes will only be effective if used in conjunction with pre-treatment/ secondary treatment processes to either optimize performance, achieve final discharge limitations, or minimize interferences with proper operation (e.g., clogging, fouling). The following physical/chemical treatment processes have been retained for further consideration, not as primary treatment options, but to enhance overall treatment.

- **Precipitation/Coagulation/Flocculation** is a proven water treatment process that removes heavy metals and colloidal and dissolved solids from contaminated groundwater. The addition of precipitating agents and coagulants converts metals to forms that are less soluble in water. The metals and any dissolved or suspected solids agglomerate to form large particles that can be readily removed from the groundwater by a clarification or filtration process. The performance of the process is affected by chemical interactions, temperature, pH, solubility variances, and mixing effects.

- **Sedimentation** is the removal of particulate matter, chemical floc, and precipitates from suspension through gravity settling. Settling basins may be constructed in a wide variety of shapes and flow mechanisms and are designed to minimize large-scale turbulence, allowing for the efficient removal of particulates.

- **Filtration** is a treatment process whereby suspended solids (and any associated contaminants) are removed from solution by forcing the fluid through a filtering medium. The filtering medium may be a fibrous fabric (paper or cloth), a screen, or a bed of granular material. Filtration also can be used as a pretreatment for air stripping, carbon adsorption, or ion exchange to reduce the potential for clogging or overloading of these processes.

- **Chemical Neutralization/Detoxification** is used to increase or reduce the pH of a wastewater stream. Alkaline wastewater may by neutralized with hydrochloric acid, carbon dioxide, sulfur dioxide, and, most commonly, sulfuric acid. Acidic wastewaters may be neutralized with limestone or lime slurries, soda ash, caustic soda, or anhydrous ammonia. Often, a suitable pH can be achieved through the mixing of acidic and alkaline process wastewaters. Selection of neutralization agents is based on cost, availability, ease of use, reaction byproducts, reaction rates, and quantities of sludge formed. The adjustment of pH may be necessary to optimize treatment system performance.

- **Activated Carbon Adsorption**, as described earlier, removes organic contaminants from groundwater by adsorbing the contaminants onto the large internal pore surface area of the activated carbon. Because low effluent concentrations of contaminants can be achieved through this process, it is often used for secondary treatment, following another primary process option, to achieve required discharge limitations.

Biological Treatment Processes

All biological treatment systems are designed to expose wastewater containing biologically degradable organic compounds to a suitable mixture of microorganisms in a controlled environment that contains sufficient essential nutrients for the biological reaction to proceed. Biological treatment processes are widely used and, if properly designed and operated, are capable of achieving high organic removal efficiencies. However, CCl_4 and TCE are not readily degradable, and degradation that does take place may yield hazardous by-products (e.g., vinyl chloride). Therefore, biological processes are not retained for further evaluation.

Thermal Treatment Processes

Organic contaminants in groundwater can be removed or destroyed using thermal processes. The heat necessary to vaporize groundwater requires enormous amounts of energy.

- **Supercritical Oxidation,** also known as wet air oxidation, breaks down organic constituents in a high-temperature, high-pressure aqueous environment. Because of the high energy requirements for this process, it may be applicable to concentrated waste streams, but will not be evaluated further for the relatively dilute contaminated groundwater at the site.

In situ Treatment Processes

Based on the hydrologic conditions at the site, and the nature of site contaminants, the *in situ* process evaluated for groundwater treatment, steam injection, air sparging, enhanced biodegradation, and treatment beds will not be retained for further evaluation as a primary method of remediation. However, air sparging may be effective in enhancing the removal of VOCs from saturated soils and will be further considered for that application.

- **Air Sparging** reduces concentrations of hazardous compounds in groundwater by injecting air below the water table. The air bubbles contact contaminants, causing them to volatilize and migrate to the vadose zone. Further treatment, usually soil vapor extraction, would be required to remove contaminants from the vadose zone.

4.4.5 Groundwater Disposal

Four technologies were identified for groundwater disposal: POTW, deep well injection, reinjection to groundwater, and surface water discharge.

Aquifer Reinjection

Treated groundwater may be reinjected into the aquifer from which it was withdrawn. Reinjection can occur either upgradient or downgradient of the contaminant plume. Upgradient injection can be used to help direct the flow of contaminated groundwater toward extraction wells. Downgradient injection may act as a physical barrier to contaminant migration. Injection may also be used to enhance *in situ* soil flushing (discussed in Section 4.3.5). This option will be retained for further evaluation.

POTW

Contaminated groundwater from the site may be pretreated on site and then discharged to the nearby POTW for final disposal. POTW pretreatment standards must be met, and the POTW must be willing the accept the volume and type of groundwater being discharged for this to be a viable option. This option will be retained for further evaluation.

Deep Well Injection

Deep well injection is a method used for disposal of highly contaminated or very toxic wastes not easily treated or disposed of by other methods. The use of deep well injection is limited geographically because of geological requirements of the system. There must be an extensive impervious caprock stratum overlying a porous stratum that is not used as a water supply or for other withdrawal purposes. Pretreatment of the waste for corrosion control and especially for the removal of suspended solids is normally required to avoid plugging of the receiving strata. This disposal option would likely not be approved by regulatory agencies, does not provide permanent treatment of the waste stream, and will therefore not be retained for further evaluation.

Surface Water Discharge

Treated groundwater may be discharged to a nearby surface water body. A State Pollution Discharge Elimination System (SPDES) permit would be required for the discharge. The St. Joseph River, located north of the site, would be a potential receptor for discharge. This option will be retained for further evaluation.

Table 4-1

EVALUATION OF PROCESS OPTIONS FOR REMEDIATION OF CONTAMINATED SOIL

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
No Action	Not applicable	Not applicable	Does not achieve remedial action objectives	Not acceptable to public or government	None	Yes
Additional Investigation	Subsurface sampling	Soil sample collection/analysis/ lead-screen augering	Identification/delineation of any additional source areas will enhance the effectiveness of site-wide remedial actions	Readily implementable	Low-moderate capital, no O&M	Yes
Institutional Actions	Access Restrictions	Deed Restrictions/ fencing/warning signs	Does not reduce contamination; may reduce the potential for exposure to contaminated soils	Legal requirements and authority must be established	Very low	Yes
Containment	Cap	Multimedia Cap	Does not reduce contamination; is effective and long-lasting in preventing infiltration; shifting tracks may compromise the integrity of a cap	Difficult to implement in vicinity of tracks	Moderate capital, moderate O&M	No
	Vertical Barriers	Slurry walls/sheet piling/grout curtain	Does not reduce contamination; effective in preventing lateral migration, but not at depths of site contamination	No confining layer exists to key into at reasonable depth	Moderate-high capital, low O&M	No
	Horizontal Barriers	Grout Injection	Does not reduce contamination; conventional grout technology cannot produce a reliable impermeable horizontal barrier	Few horizontal barriers have been constructed; may not be commercially available	Moderate-high capital	No

Table 4-1

EVALUATION OF PROCESS OPTIONS FOR REMEDIATION OF CONTAMINATED SOIL

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
Removal	Excavation	Soil Excavation	Effective and reliable; commonly used	May require temporary track removal/replacement, shutdown of track service; not practical for deep contamination; may require dewatering and dust control	Moderate capital	Yes
Treatment	Physical/Chemical Treatment	Stabilization/ Solidification	Questionable effectiveness for VOCs; mixing process may volatilize VOCs	Relatively simple to implement; treated material would require disposal in a secure facility; treatability testing would be required	Low capital; moderate O&M	No
		Soil Washing	Effective in removing inorganics and organics from coarse soil fraction. Fine soil and wash solution require further treatment.	Washing systems are commercially available. Treatability testing would be required.	Moderate capital, moderate to high O&M.	No
		Dechlorination	Effective only for dioxin/ furan/PCB and halogenated phenol/creosol groups.	Dechlorination units are commercially available. Treatability testing would be required.	Moderate capital; moderate to high O&M.	No
		Chemical Oxidation	Effectively treats oxidizable contaminants in slurried soil or sludge.	Application in environmental remediation is limited.	Unknown	No
		Acid Extraction	Effective only for inorganics in soil, liquid component may require further treatment.	Extraction systems are commercially available. Treatability testing would be required.	Moderate capital, moderate-high O&M.	No

Table 4-1

EVALUATION OF PROCESS OPTIONS FOR REMEDIATION OF CONTAMINATED SOIL

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
Treatment (Cont.)	Physical/Chemical Treatment (Cont.)	Solvent extraction	May be effective in removing organics from soil. Liquid component may require further treatment/recycling/disposal.	Extraction systems are commercially available. Treatability testing would be required.	Moderate capital, moderate to high O&M	No
	Thermal Treatment	Incineration (rotary kiln)	Effectively destroys organics	Incinerators are commercially available, permitting would be required.	High capital, moderate O&M	Yes
		Incineration (infrared)	Effectively destroys organics	Mobile and stationary systems are commercially available.	High capital, moderate O&M	Yes
		Incineration (fluidized-bed)	Effectively destroys organics	Mobile fluidized-bed incinerators are commercially available	Moderate capital, moderate O&M	Yes
		Pyrolysis	Ineffective for metals; performance data are limited.	This process is commercially available.	Moderate capital, moderate O&M	No
		Thermal desorption	Effective for removing VOCs	Permitting would be required; treatability testing would be recommended.	Moderate capital; moderate O&M	Yes
	Biological Treatment	Solid- or slurry-phase	Site contaminants not readily degradable; may yield toxic by-products	Technology is commercially available.	Low to moderate capital, low O&M	No
		Landfarming	Site contaminants not readily degradable; may yield toxic by-products	Creation of an on-site facility would be difficult due to present use of the site as an active railyard	Low to moderate capital, low O&M	No

Table 4-1

EVALUATION OF PROCESS OPTIONS FOR REMEDIATION OF CONTAMINATED SOIL

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
Treatment (Cont.)	*In situ* Treatment	Vapor Extraction *(in situ)*	Effective in removing VOCs from permeable, unsaturated soils	Commercially available, only appropriate for unsaturated soils	Moderate capital, moderate O&M	Yes
		Air Sparging/ Steam Injection *(in situ)*	Effective in enhancing VOC removal from saturated zone	Emerging technology; treatability study required; vapor capture likely required	Moderate capital; moderate O&M	Yes
		Soil Flushing *(in situ)*	Effective in flushing inorganics and organics from soil. Extraction system must capture all injected water/additives	No barriers to implementation; treatability testing would be required	Moderate capital; moderate O&M	Yes
		Vitrification *(in situ)*	Effective in treating organics and nonvolatile organics in soil. Volatile metals (e.g., arsenic) may not be effectively captured and treated.	Not appropriate for saturated site soils. Vitrification has not yet been used to remediate a Superfund site in Region V. Treatability testing is recommended. Off-gasses require collection/treatment.	Moderate to high capital, high O&M	No
		In situ Bioremediation	Site contaminants not readily degraded; may yield toxic by-products	Process is commercially available, permitting would be required.	Low capital, low O&M	No
Disposal	Off-Site Disposal	Landfill (off site)	Disposal in a commercial/ RCRA disposal facility would be protective of human health	Would require securing a disposal facility capable of accepting the soil and compliance with land disposal restrictions; transportation of soil required.	Moderate-high capital	Yes

Table 4-1

EVALUATION OF PROCESS OPTIONS FOR REMEDIATION OF CONTAMINATED SOIL

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
Disposal (Cont.)	On-Site Disposal	Landfill (on site)	Design must be protective of human health and the environment.	Construction of an on-site facility that meets RCRA and/or state requirements is impractical due to the present use of the site as an active railyard, and the shallow depth to groundwater.	Moderate-high capital, low O&M	No

Table 4-2

EVALUATION OF PROCESS OPTIONS FOR REMEDIATION OF CONTAMINATED GROUNDWATER

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
No Action	Not applicable	Not applicable	Does not achieve remedial action objectives	Not acceptable to public or government	None	Yes
Institutional Actions	Access Restrictions	Deed Restrictions	Does not reduce contamination; effectiveness depends upon administrative implementation	Legal requirements and authority must be established	Very low	Yes
	Monitoring	Groundwater Monitoring	Does not reduce contamination; effective in assessing site conditions	Conventional construction	Low capital, low O&M	Yes
	Use Restrictions	Alternate Water Supply	Does not reduce contamination; does ensure permanent safe drinking water supply	Will be implemented under Interim Action	Moderate capital, low O&M	Yes (Interim Action)
Containment	Cap	Multimedia Cap	Does not reduce contamination; is effective in preventing infiltration but may be compromised by shifting tracks	Difficult to implement in vicinity of tracks	Moderate capital, moderate O&M	No
	Vertical Barriers	Slurry walls/sheet piling/grout curtain	Inappropriate for site hydrology, lack of suitable confining layer	Difficult to ensure proper bottom-sealing with confining layer	Moderate-high capital, low O&M	No

Table 4-2

EVALUATION OF PROCESS OPTIONS FOR REMEDIATION OF CONTAMINATED GROUNDWATER

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
Collection	Extraction	Extraction wells	Effective and reliable, commonly used; also effective for containment purposes	Readily implementable	Moderate capital, low O&M	Yes
	Subsurface Drains	Interceptor trenches	Will not be effective at collecting contamination at significant depths below ground surface	Subsurface placement difficult; not appropriate for thickness of aquifer at this time	High capital, low O&M	No
Treatment	Physical/Chemical Treatment	Sedimentation	Effective in removing precipitates and/or solids from wastestream	Easily implementable	Low capital, moderate O&M	Yes
		Filtration	Effective means of removing low levels of suspended solids	Readily available and easy to control	Low-moderate capital, low O&M	Yes
		Air Stripping	Effective in removing VOCs from groundwater	Requires treatment of air stream	Moderate capital, moderate O&M	Yes
		Reverse Osmosis/ Ultrafiltration	Effective in the removal of dissolved solids	Requires extensive pre-treatment to avoid fouling, susceptible to chemical attack	Moderate capital; moderate O&M	No
		Ultraviolet Photolysis/ Ozonation	Effective in chemical oxidation of organic compounds	Mobile units available	Moderate capital, moderate O&M	Yes
		Oil/Water Separation	Generally effective in removing immiscible liquids with sufficiently different densities (e.g., oil and water)	Easily implementable	Low capital; low O&M	No

Table 4-2

EVALUATION OF PROCESS OPTIONS FOR REMEDIATION OF CONTAMINATED GROUNDWATER

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
Treatment (Cont.)	Physical/Chemical Treatment (Cont.)	Precipitation	Well demonstrated as an effective treatment for removal of dissolved and suspended solids from wastewater	Easily implementable; requires solids disposal	Low-moderate capital, moderate O&M.	Yes
		Ion Exchange	Effective in removal of inorganics. Natural anions and cations in groundwater (Ca++, Na+, Cl-) may limit effective removal of contaminants of concern	Easily implementable and widely available	Moderate capital, moderate O&M	No
		Chemical Reduction	Effective in the reduction of metal ions	Conventional process with no barriers to its implementability	Low-moderate capital, low-moderate O&M	No
		Chemical Oxidation	Effective in treating oxidizable contaminants	Easily implementable	Moderate capital, moderate O&M	Yes
		Activated Carbon Adsorption	Effective in removing low solubility organics, spent carbon would require treatment/disposal	Conventional and easily implemented	Low-moderate capital, moderate O&M	Yes
		Dechlorination	Potentially effective in treating dioxins, PCP	Commercial availability may be limited	Unknown	No
		Chemical Neutralization/ Detoxification	Would not treat contaminants, but is effective in altering pH to optimize treatment system performance	Easily implemented	Low-moderate capital, low-moderate O&M	Yes

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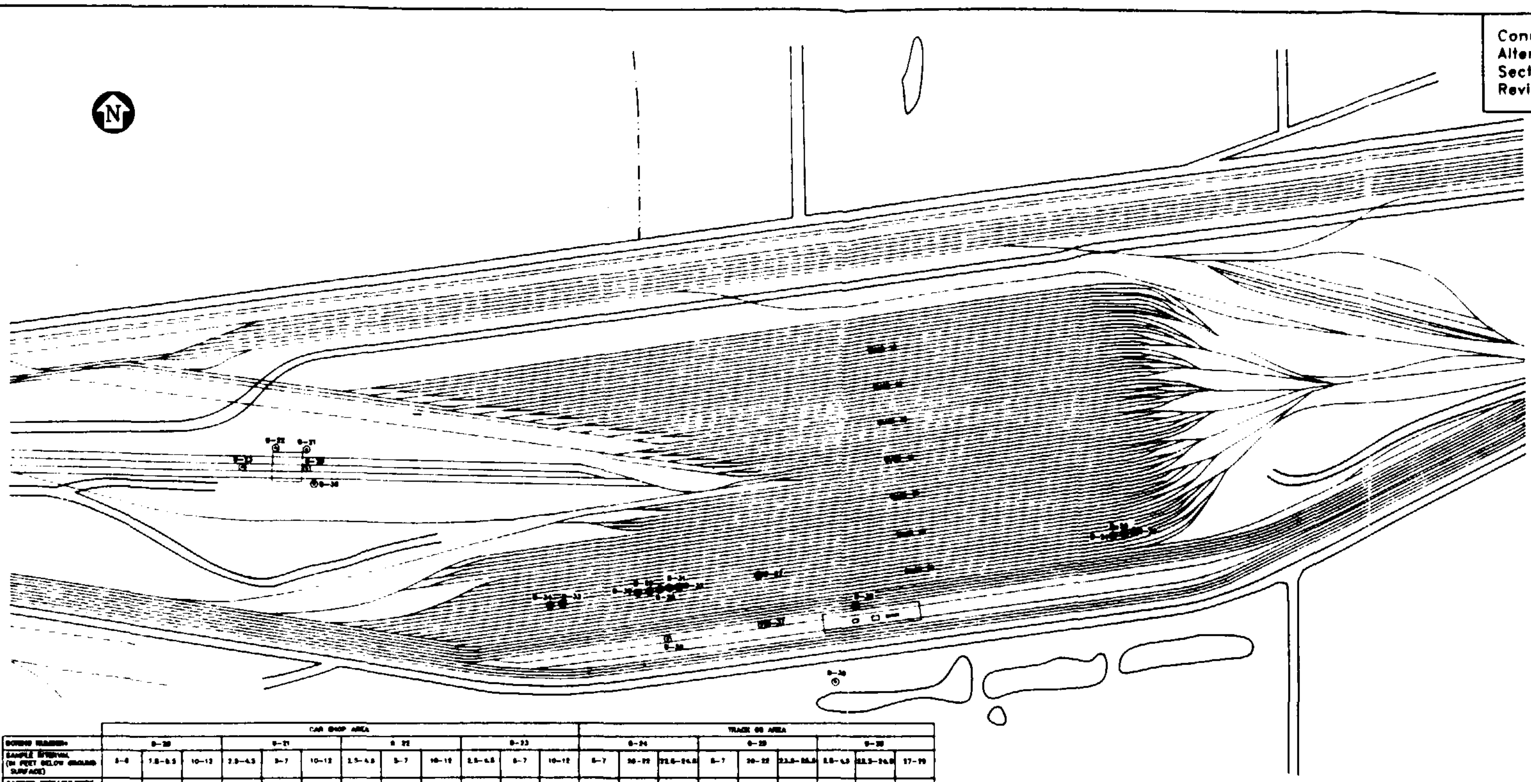
Conrail RI/FS
Alternatives Array Document
Section 2
Revision 0 - April 5, 1993



	CAR SHOP AREA												TRACK 88 AREA								
BORING NUMBER*	B-20			B-21			B-22			B-23			B-24			B-25			B-26		
SAMPLE INTERVAL (IN FEET BELOW GROUND SURFACE)	3-5	7.5-9.5	10-12	2.5-4.5	5-7	10-12	2.5-4.5	5-7	10-12	2.5-4.5	5-7	10-12	5-7	20-22	22.5-24.5	5-7	20-22	23.5-25.5	2.5-4.5	22.5-24.5	17-19
CARBON TETRACHLORIDE (IN ug/kg's)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4J	27,000	23,000	2J	8,000	13,000	ND	ND	2J
TRICHLOROETHENE (IN ug/kg's)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	ND	ND	ND	ND	ND	ND	6J	5J
COMMENTS	HIGH CONCENTRATION OF SEMIVOLATILES			NONE			NONE			NONE			2,300 ug/kg CHLOROFORM (20'-22') 3,300 ug/kg CHLOROFORM (22.5'-24.5')			1,200 ug/kg CHLOROFORM (23.5'-25.5')			NONE		

	BETWEEN TRACKS 86 AND 88 AREA						CAR SHOP AREA			POND AREA			CLEAN-OUT TRACKS AREA								
BORING NUMBER*	B-27	B-28			B-29	B-32	B-35			B-36			B-37			B-38			B-39		
SAMPLE INTERVAL (IN FEET BELOW GROUND SURFACE)	10-12	0-2	2.5-4.5	15-17	0-2	0-2	0-2	7.5-9.5	12.5-14.5	2.5-4.5	5-7	12.5-14.5	5-7	15-17	17.5-19.5	2.5-4.5	10-12	15-17	5-7	15-17	20-22
CARBON TETRACHLORIDE (IN ug/kg's)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE (IN ug/kg's)	5J	15,000	240	6J	13	170	5J	ND	1J	ND	ND	ND	ND	1J	ND	ND	ND	1J	ND	1J	ND
COMMENTS	NONE	110 ug/kg 1,2 DICHLOROETHENE (TOTAL) (0'-2')			SEE NOTE NO. 1	SEE NOTE NO. 2	NONE			NONE			NONE			NONE			NONE		

* - SOIL BORING SAMPLES NOT SENT FOR CLP ANALYSIS ARE NOT LISTED IN THIS TABLE. SOIL SAMPLES WERE NOT ANALYZED FROM EVERY SOIL BORING CONDUCTED.

NOTES

1. 100 ug/kg 1,2 DICHLOROETHENE (TOTAL)
2. 3,800 ug/kg 1,2 DICHLOROETHENE (TOTAL); HIGH CONCENTRATION OF SEMIVOLATILES

SCALE:
1" = 500'

ecology and environment

FIGURE 2-2 PHASE II SOIL BORING LOCATIONS AND SELECTED ORGANICS ANALYTICAL RESULTS

ZF3CONAADFIG2-3

Conrail RI/FS
Alternatives Array Document
Section 2
Revision 0 - April 5, 1993

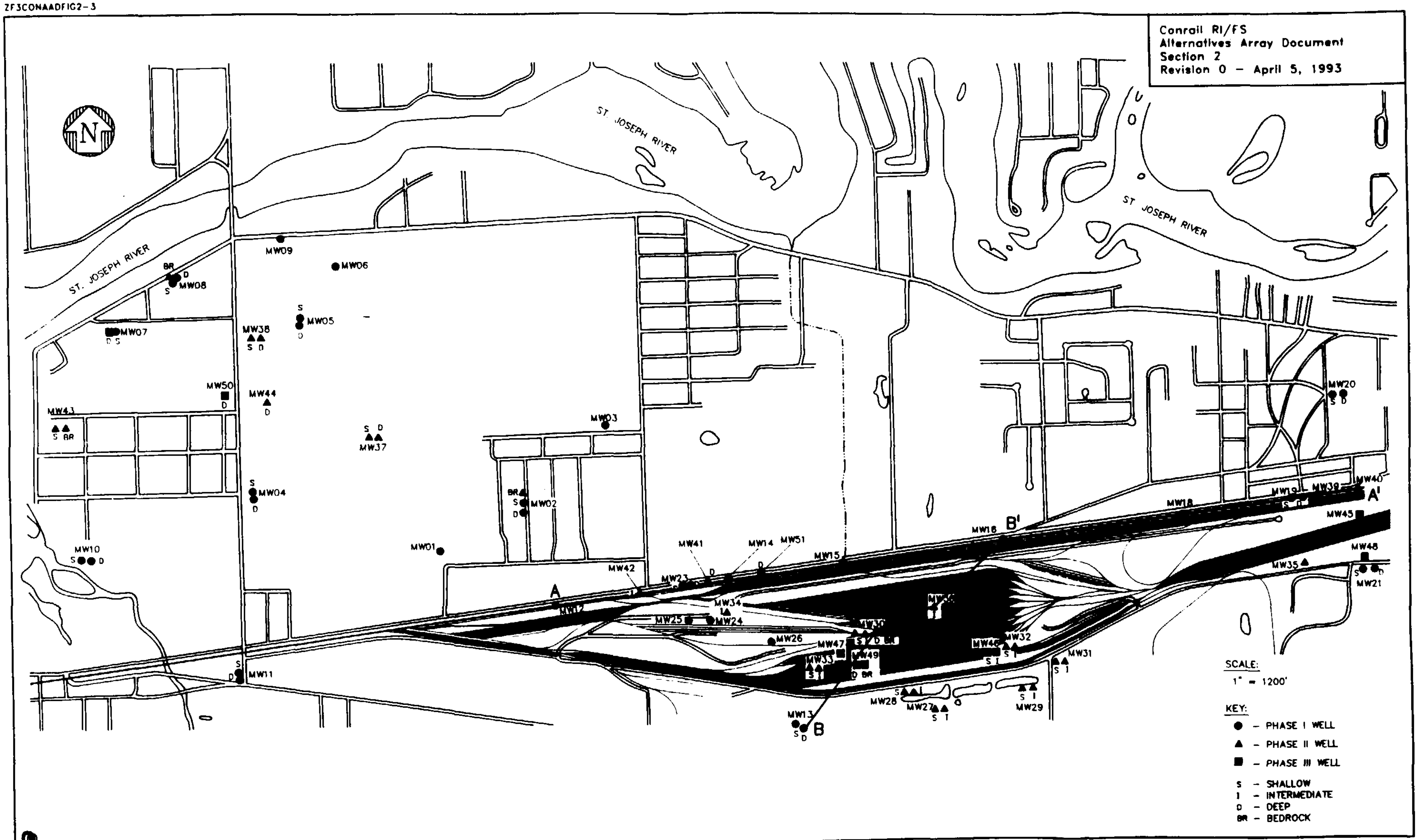


FIGURE 2-3 **PHASE I, II and III MONITORING WELL LOCATION MAP**

ZF3CONAADFIG2-4

Conrail RI/FS
Alternatives Array Document
Section 2
Revision 0 – April 5, 1993

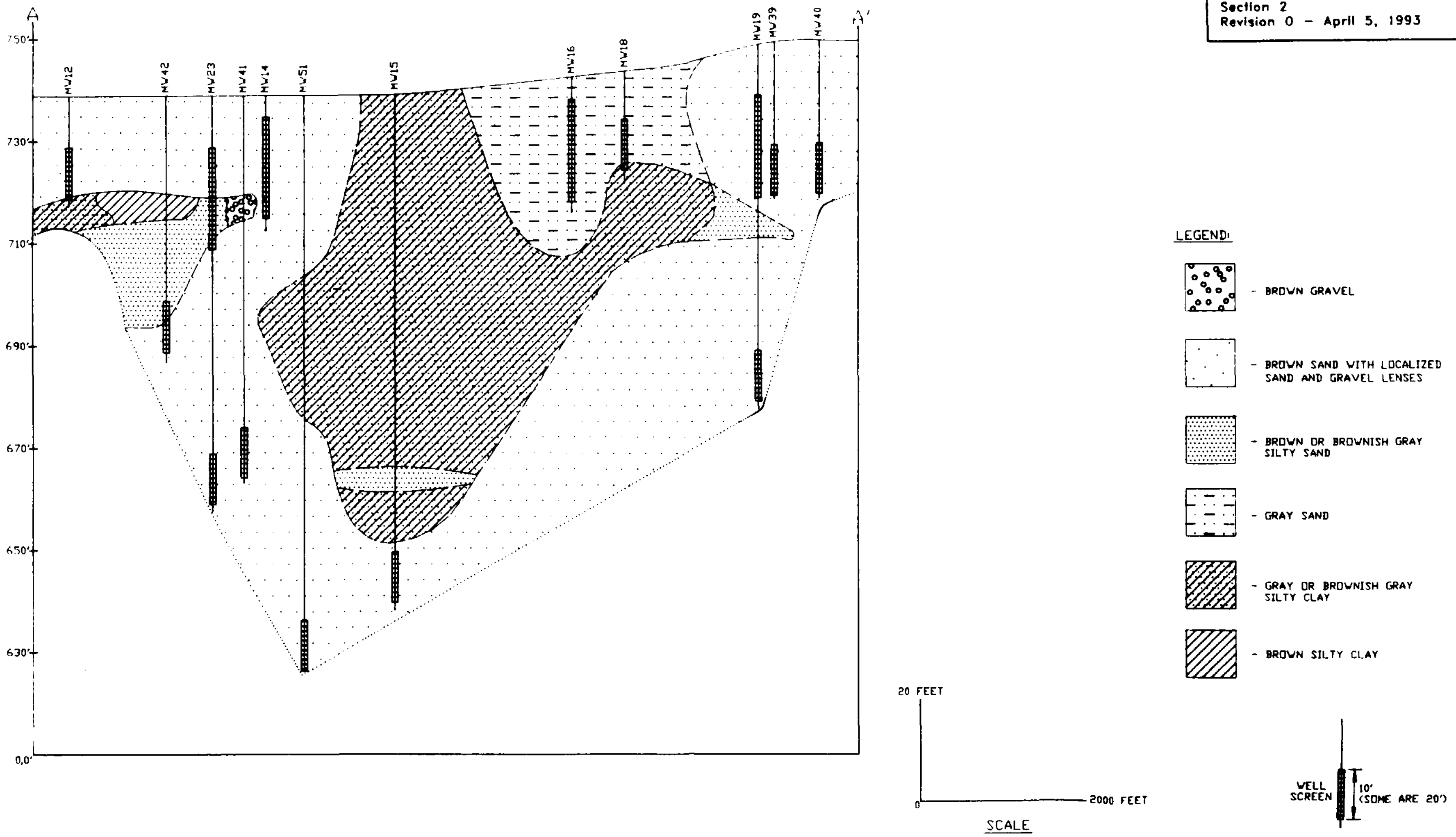


FIGURE 2–4 GEOLOGIC CROSS SECTION A–A'

ZF3CONAADFIG2-5

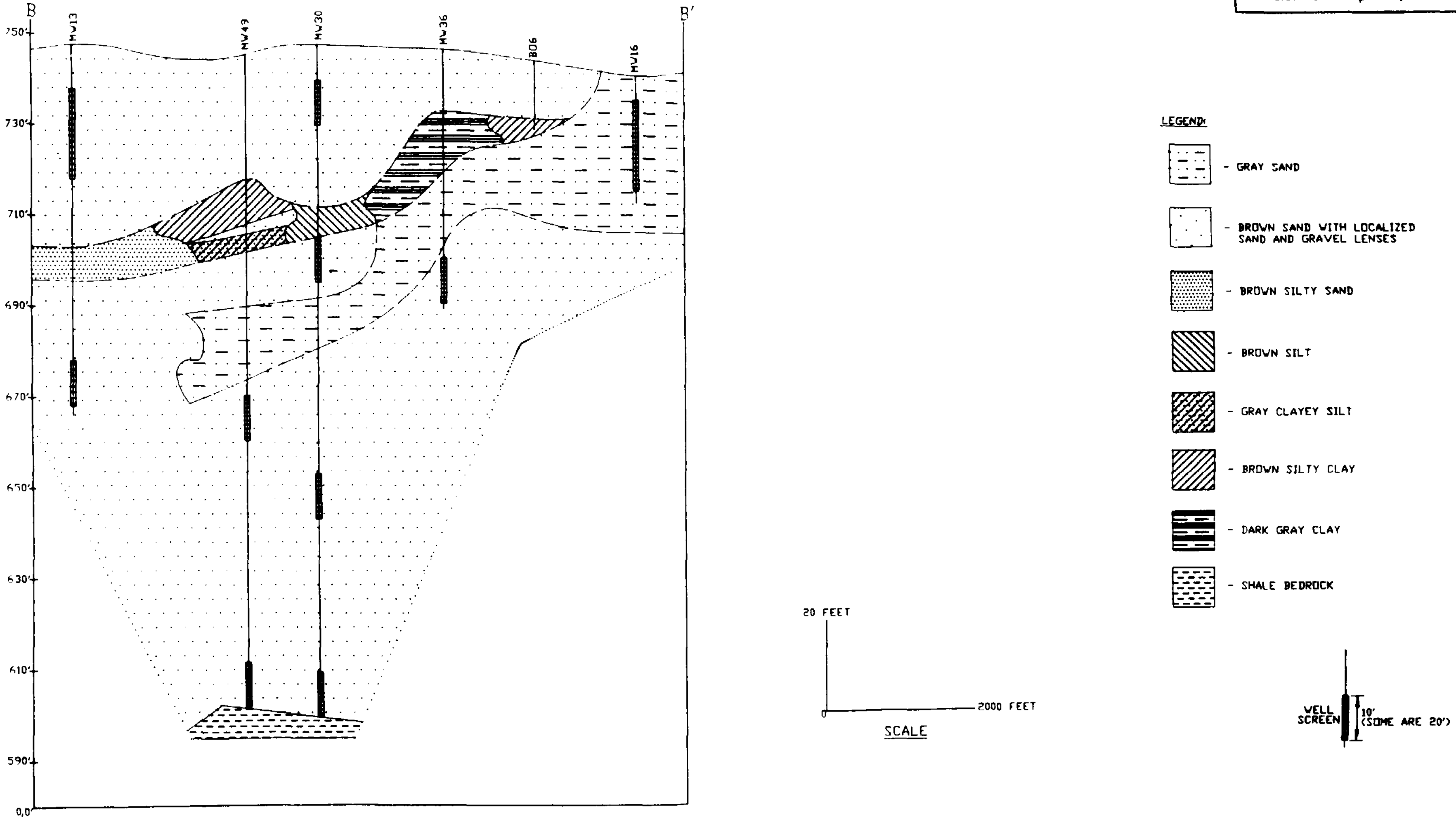


FIGURE 2-5 GEOLOGIC CROSS SECTION B-B'

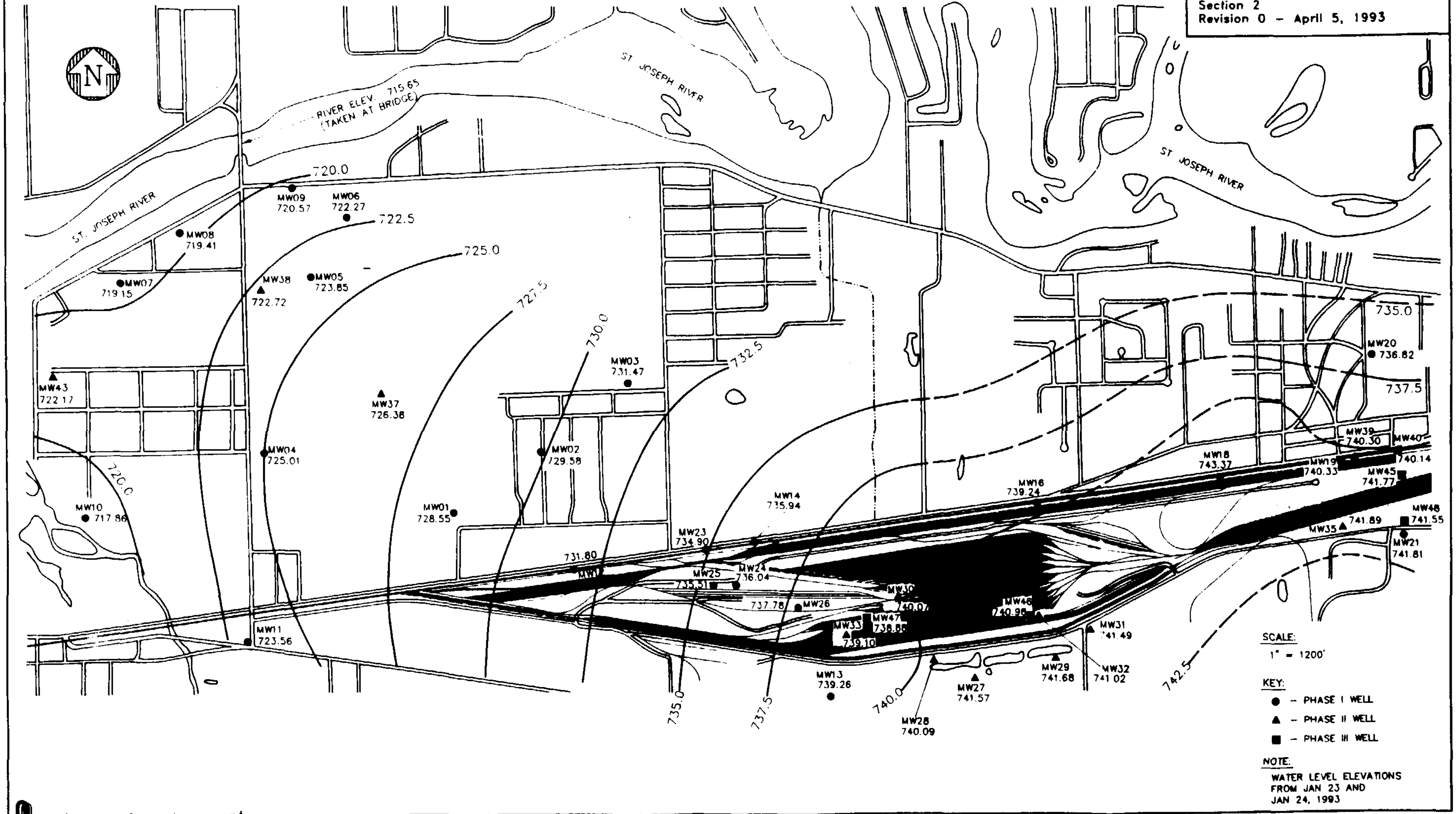
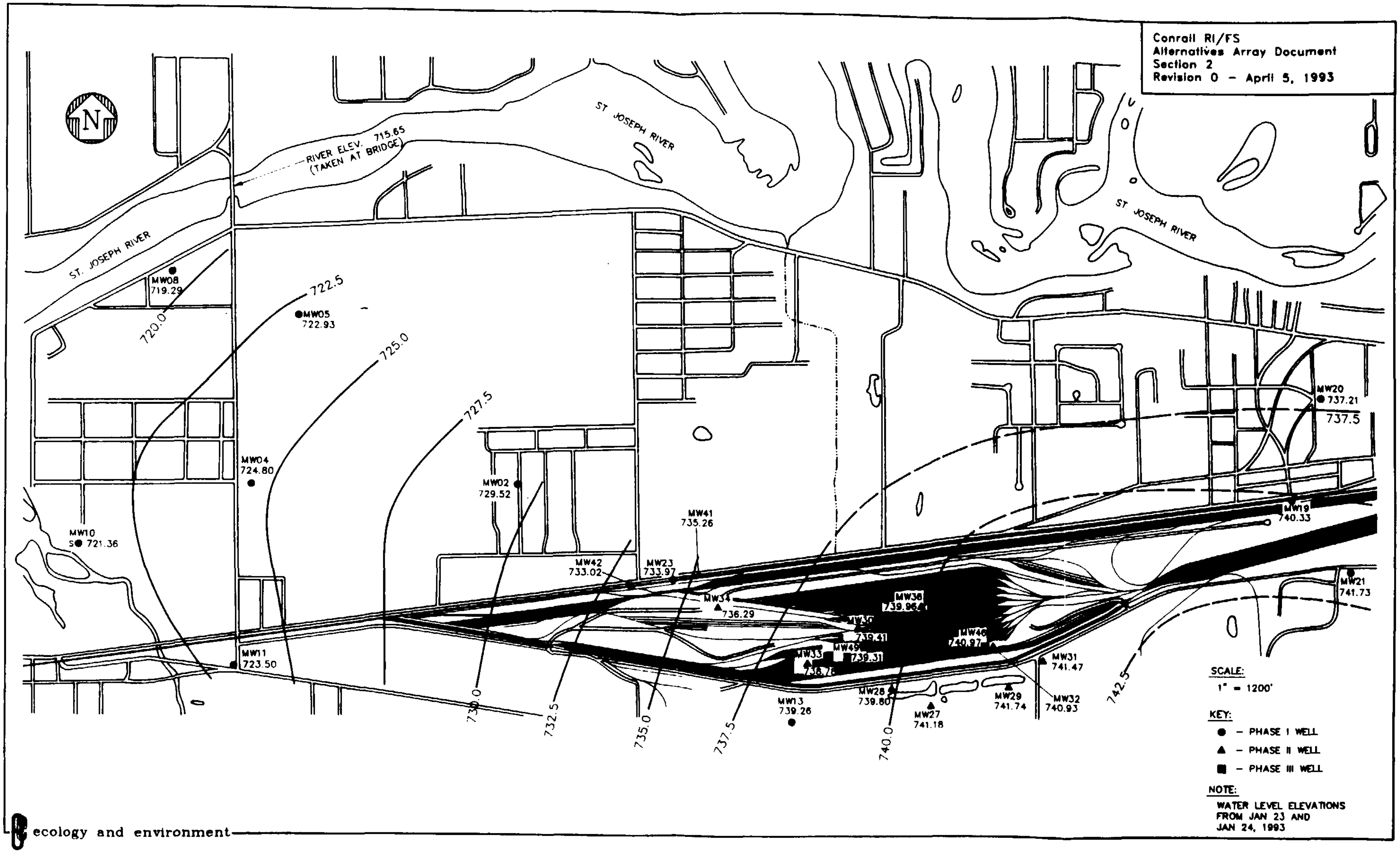


FIGURE 2-6 GROUNDWATER TABLE SURFACE MAP

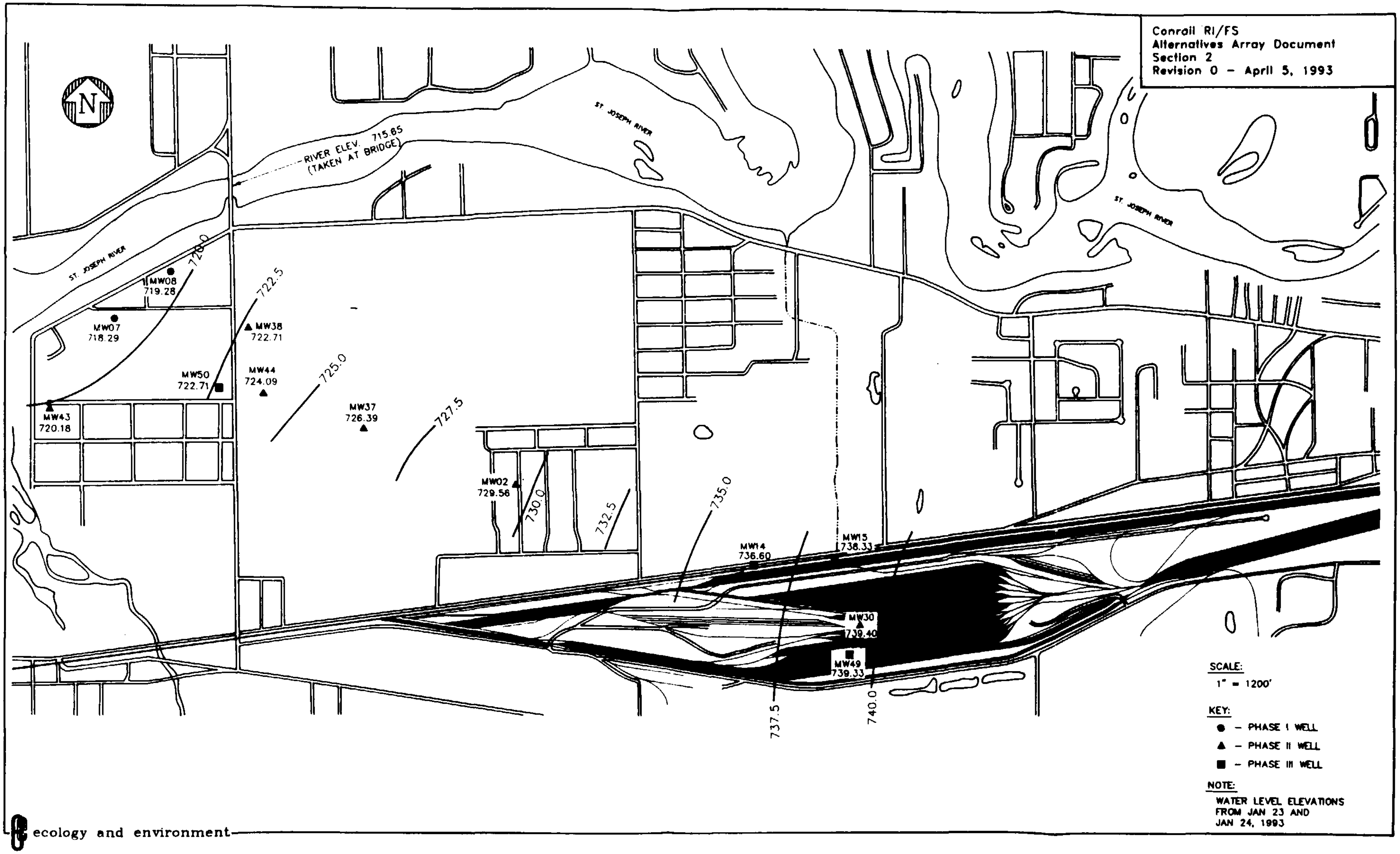
ZF3CONAADFIG2-7



NOTE:
WATER LEVEL ELEVATIONS FROM JAN 23 AND JAN 24, 1993

FIGURE 2-7 INTERMEDIATE GROUNDWATER POTENTIOMETRIC SURFACE MAP

ZF3CONAADFIG2-8

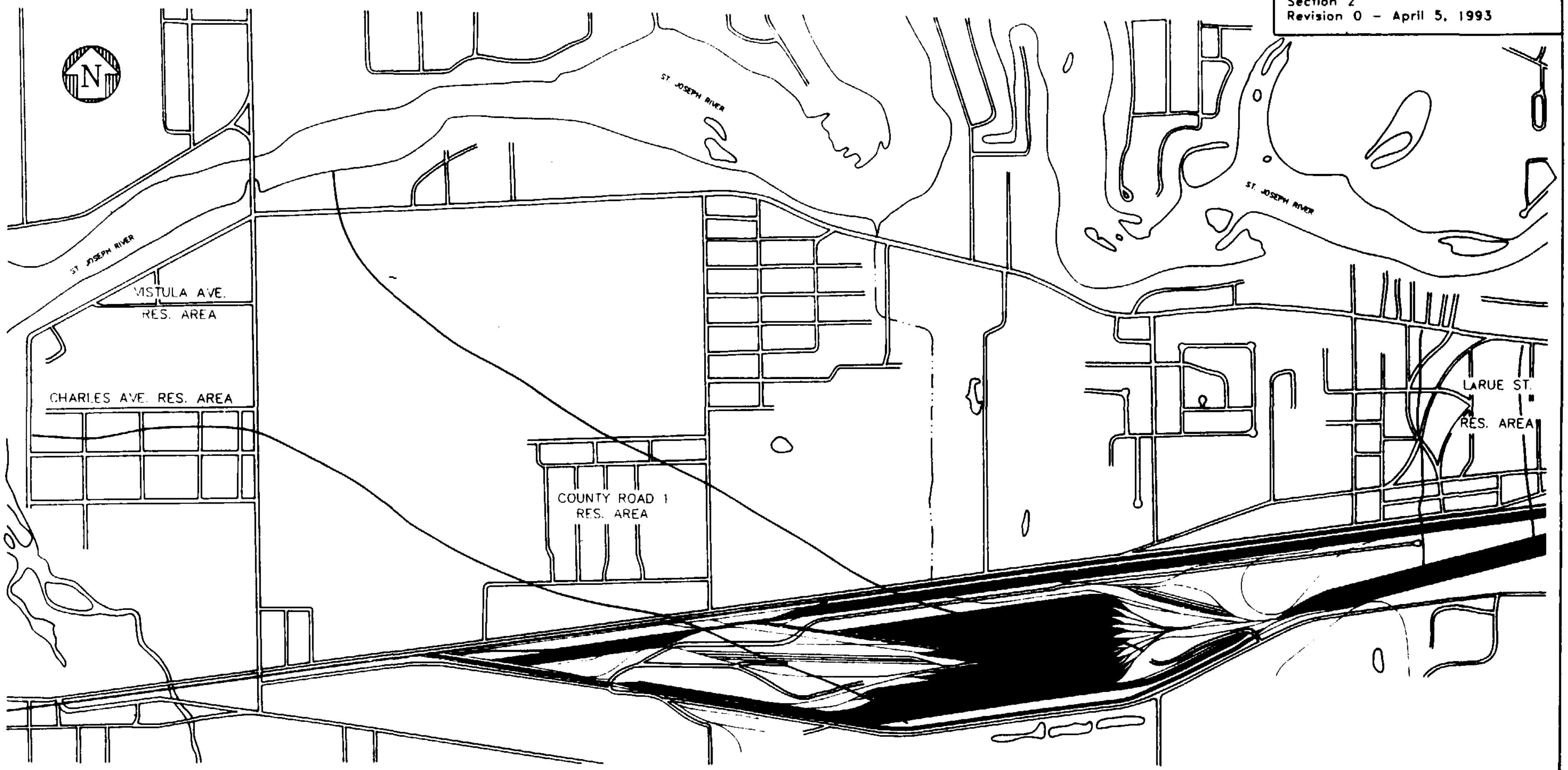


SCALE:
1" = 1200'

KEY:
● - PHASE I WELL
▲ - PHASE II WELL
■ - PHASE III WELL

NOTE:
WATER LEVEL ELEVATIONS
FROM JAN 23 AND
JAN 24, 1993

FIGURE 2-8 DEEP GROUNDWATER POTENTIOMETRIC SURFACE MAP



SCALE:
1" = 1200'

ecology and environment

FIGURE 2-9 APPROXIMATE BOUNDARIES OF CCl_4 AND TCE PLUMES

Table 4-2

EVALUATION OF PROCESS OPTIONS FOR REMEDIATION OF CONTAMINATED GROUNDWATER

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
Treatment (Cont.)	Biological Treatment	Fixed-film bioreactor	Site contaminants not readily degradable	Construction of treatment system; disposal required	Moderate capital, low-moderate O&M	No
		Activated sludge	Site contaminants not readily degradable	Construction of treatment system; solids disposal required; treatability testing required	High capital, high O&M	No
	Thermal	Supercritical oxidation	Effective in destroying organics	Requires use of large amounts of energy to sustain critical conditions	High capital, high O&M	No
	In situ Treatment	Steam Injection (NAPL)	Effective for recovering NAPLs	Limited number of commercial systems, permitting would be required	Moderate capital, moderate-high O&M	No
		Sparging	May enhance removal of VOCs	This process is implementable for relatively shallow contamination	Moderate capital, moderate O&M	Yes
		Enhanced biodegradation	Site contaminants not readily degradable	This process is implementable, permit required	Low capital, low O&M	No
		Treatment beds	Ineffective for meeting groundwater cleanup goals	Difficult to construct and place properly; not appropriate for aquifer thickness	Moderate-high capital, low O&M	No

Table 4-2

EVALUATION OF PROCESS OPTIONS FOR REMEDIATION OF CONTAMINATED GROUNDWATER

General Response Action	Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
Disposal	Discharge	Aquifer reinjection	Effective disposal as long as injection is part of overall design, may be used to enhance *in situ* soil flushing	Reinjection requires permitting and monitoring, must consider possibility of mobilizing contaminants in locating injection points; not feasible for total volume of water to be discharged	Moderate capital, moderate O&M	Yes
		Discharge to POTW	Effective assuming POTW acceptance of treated wastewater	Readily implemented, permit required	Moderate capital, low O&M	Yes
		Deep well injection	Not appropriate for site groundwater	Requires appropriate geologic conditions	High capital, low O&M	No
		Discharge to surface waters	Effective and reliable	NPDES permitting required	Moderate to high capital, low O&M	Yes

5. DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

Remedial action technologies and process options that are not appropriate for site conditions or that would not be effective in meeting the remedial action objectives, based upon the screening in Section 4, have been eliminated from further consideration at this time. Those technologies and options that have not been retained may be reevaluated in the future, if new information or changing site conditions significantly alter the present understanding of the extent and migration pathways of site contamination.

The objectives for the remedial action focus on the following areas of concern:

- Source soil contamination areas; and
- Contaminated groundwater.

The technologies and process options that have been retained for each area of concern include:

Contaminated soil

- No action;
- Institutional Actions
    - Access restrictions;
    - Deed restrictions; and
    - Additional source identification;
- Removal
    - Excavation;

- Soil Treatment
    - Incineration;
    - Thermal desorption;
    - *In situ* vapor extraction;
    - *In situ* air sparging/steam injection; and
    - *In situ* soil flushing;

- Disposal
    - Off-site landfill;

Contaminated groundwater

- No action;

- Institutional Actions
    - Access restrictions;
    - Deed restrictions; and
    - Groundwater monitoring;

- Containment
    - Groundwater extraction;

- Collection
    - Extraction wells;

- Treatment
    - Air stripping;
    - *In situ* sparging;
    - Ultraviolet/chemical oxidation;
    - Precipitation;
    - Carbon adsorption;
    - Chemical neutralization/detoxification;
    - Sedimentation; and
    - Filtration;

- Discharge
    - POTW;
    - Aquifer reinjection; and
    - Surface water body.

These technologies and process options have been retained because they are proven technologies that are suitable for implementation at the Conrail site. They have been proven effective under similar conditions at other contaminated sites. Technologies have been selected that, either alone or in combination with other selected technologies and options, can effectively meet the interim remedial action objectives. From the technologies and process options discussed above, alternatives have been assembled that address the two media, contaminated soil and contaminated groundwater.

The alternatives that were developed include the No Action alternative and alternatives that achieve varying degrees of remediation (as defined by the remedial action objectives). These alternatives may be revised, and/or new alternatives may be added if new site information warrants or further evaluation reveals the need to consider other alternatives.

5.1 CONTAMINATED SOIL

The remedial action alternatives developed for contaminated soils are presented below.

5.1.1 Alternative 1: No Action

The No Action alternative, while not meeting the remedial action objectives, must be included for evaluation purposes in accordance with the NCP. The No Action Alternative is used to establish a baseline against which the other alternatives can be compared. Under the No Action alternative, contaminated soil source areas would be left in their present condition; all contaminants would remain. The potential for continued migration of soil contaminants to groundwater would not be reduced.

5.1.2 Alternative 2: Institutional Actions; Soil Excavation; Off-site Incineration

This alternative and all remaining alternatives include institutional actions in the form of access restrictions (physical barriers to limit potential for human exposure to contaminated areas), deed restrictions (to ensure that any future use of the site is compatible with site conditions), and additional source identification (further sampling to delineate other sources of groundwater contamination). Under Alternative 2, contaminated soil would be excavated and transported off site for incineration. Excavation is only considered practical for the near-surface TCE-contaminated soil, not for the CCl_4-contaminated soil identified below the water table. Any excavation of site soils may affect overlying rail tracks, requiring support of tracks during excavation beneath tracks or temporary removal and subsequent replacement of tracks to allow excavation equipment access to the soil. Clean fill material would then be placed into the excavation and covered with rail ballast. Affected rails would not be available for rail traffic during excavation/backfilling activities. Source excavation and incineration would provide a reliable, permanent means of removing the identified TCE source.

5.1.3 Alternative 3: Institutional Actions; Soil Excavation; On-site Thermal Desorption

Alternative 3 consists of excavating TCE-contaminated soil, as described under Alternative 2 (Section 5.1.2), but also includes on-site treatment of the soil. Soil would be fed into a mobile thermal desorption unit to volatilize the TCE and then destroy it in the gas stream before discharge of off-gasses to the atmosphere. Thermal desorption units are commercially available and effective at reducing VOC concentrations in fairly permeable soils. Treated soil may be allowed to be backfilled on site if acceptable levels are attained through thermal treatment. Verification of proper soil treatment would be based on analytical results. If treated soil is not acceptable for backfilling on site, it could be transported off site for landfilling (if acceptable under land disposal restrictions).

5.1.4 Alternative 4: Institutional Actions; *In situ* Vapor Extraction

Alternative 4 includes the installation and operation of an *in situ* vapor extraction system to remove VOCs from contaminated soil. Vapor extraction is effective at removing VOCs from fairly permeable soils and would not require extensive excavation of site soils. Extracted air would require further treatment (e.g., vapor-phase carbon adsorption or incineration) to remove VOCs prior to discharge to the atmosphere. Although the system could be constructed between existing tracks, rail service on some tracks may be interrupted temporarily during installation of the system. Also, piping would have to be installed connecting the treatment areas to process equipment located in a clear area (not immediately adjacent to the tracks). This alternative would be appropriate for TCE-contaminated soils, but would not be appropriate alone for the CCl_4-contaminated soils located in the saturated zone. However, if air sparging is used in the saturated zone to enhance volatilization and upward movement of VOCs into the unsaturated zone, vapor extraction could then be utilized to capture vapors from the overlying unsaturated zone.

5.1.5 Alternative 5: Institutional Actions; *In situ* Air Sparging/Steam Injection

Under Alternative 5, an air sparging or steam injection system would be installed and operated to enhance removal of VOCs from saturated soils. Air or steam would be pumped into the zone of contamination, effectively stripping VOCs from the soil and carrying volatilized compounds upward into the overlying unsaturated zone. Vapor extraction in this zone (discussed under Section 5.1.4) could be utilized to capture the VOCs. Extracted air would likely require further treatment before discharge to the atmosphere (e.g., vapor-phase carbon adsorption or incineration).

5.1.6 Alternative 6: Institutional Actions; *In situ* Soil Flushing

Alternative 6 would consist of flushing water through contaminated soil to solubilize VOCs adsorbed to soil surfaces. Groundwater downgradient from contaminated soil must be extracted and treated/discharged to ultimately remove the contaminants. Soil flushing could be enhanced through the injection of additional water into the contaminated soil accompanied by increased groundwater extraction downgradient. A portion of the treated groundwater from the site (discussed below in Section 5.2) might be reinjected for this purpose. This process can also be enhanced through the use of additives (e.g., surfactants) injected into the aquifer to aid in the solubilization of VOCs into the groundwater. This process would only be practical for the CCl_4-contaminated soil present below the water table.

5.2 CONTAMINATED GROUNDWATER

The remedial action alternatives developed to address contaminated groundwater are presented below.

5.2.1 Alternative 1: No Action

The No Action Alternative, while not meeting the remedial action objectives, must be included for evaluation purposes. The No Action Alternative is used to establish a baseline against which the other alternatives can be compared. Under the No Action Alternative, no efforts would be made to remove the contaminant plume from the aquifer. The plume would continue to expand and contaminants would continue to migrate to surrounding groundwater.

There would be no reduction in the risks to human health and the environment posed by contaminants.

5.2.2 Alternative 2: Institutional Actions; Continued Operation of Interim Extraction System

This alternative and all remaining alternatives will include institutional actions in the form of access restrictions (physical barriers/signs to limit access to treatment facilities), deed restrictions (prohibiting installation of water supply wells in contaminated areas and limiting future use of contaminated areas), and groundwater monitoring (to track contaminant migration and evaluate the effectiveness of any operating remedial efforts). Alternative 2 includes a continuation of those institutional actions that will be taken under the interim action, including continued groundwater monitoring. Under Alternative 2, the groundwater extraction/treatment that will be implemented under the interim action would be continued to contain downgradient groundwater contamination currently migrating northwest from the Conrail railyard. The system being designed for the interim action will consist of approximately four extraction wells located along the centerline of the portion of the northwest contaminant plume that is downgradient from the Conrail railyard. Under Alternative 2, groundwater would continue to be extracted and treated using air stripping and subsequently discharged to the St. Joseph River. This alternative would not address other areas of groundwater contamination including areas identified beneath or the northeast of the Conrail railyard.

5.2.3 Alternative 3: Institutional Actions; Extraction of All Identified Contaminated Groundwater to Achieve MCLs As Soon As Possible; Air Stripping/Surface Water Discharge

Under this alternative, the monitoring system for the interim action would be expanded to provide more information on contaminant migration and the effectiveness of remediation efforts. Alternative 3 consists of extracting contaminated groundwater through a series of extraction wells located within and downgradient from identified contaminant plumes beneath the railyard and downgradient from the railyard to the northwest and northeast. This system would likely be much more extensive than the interim extraction system and would be intended to remove VOCs above MCLs to restore the aquifer. A wastewater treatment facility would be constructed to treat the large volume of extracted groundwater. This treatment facility would utilize air stripping as the primary process to remove VOCs, and then discharge treated groundwater to the St. Joseph River. The treatment system itself likely would also involve pre-treatment and/or secondary processes such as settling/filtration/precipitation to remove inorganic constituents of the groundwater to optimize the air stripping process, and carbon adsorption to remove residual organic compounds after air stripping to ensure compliance with wastewater discharge limitations. Water discharges would have to comply with discharge permit limitations, and air discharges would also have to comply with federal and state air emission standards and permit limitations. The air stream could be passed through vapor-phase carbon adsorption units or incinerated to remove VOCs prior to discharge to the atmosphere. Residual materials generated during treatment processes (e.g., sludges, spent carbon, filtered solids) would require appropriate disposal and/or regeneration. This alternative would result in restoration of the aquifer within the shortest practical time frame.

5.2.4 Alternative 4: Institutional Actions; Extraction of All Identified Contaminated Groundwater to Achieve MCLs As Soon As Possible; Ultraviolet/Chemical Oxidation/Discharge

Alternative 4 is similar to Alternative 3, differing only in that the primary treatment process for collected groundwater would consist of ultraviolet/chemical oxidation instead of air stripping. This treatment process would result in the destruction of organic contaminants, rather than simply transferring VOCs to the air phase (which requires subsequent treatment to remove VOCs).

5.2.5 Alternative 5: Institutional Actions; Extraction of All Identified Contaminated Groundwater to Achieve MCLs As Soon As Possible; Carbon Adsorption; Discharge

Alternative 5 is similar to Alternatives 3 and 4, differing only in that the primary treatment process for collected groundwater would consist of carbon adsorption. Carbon adsorption is reliable and effective at reducing organic contaminant concentrations to low levels. The treatment system would consist of pretreatment (as discussed under Alternative 3) to remove suspended solids to ensure proper functioning of the carbon adsorption units. Carbon would have to be replaced regularly, and spent carbon would require regeneration and/or treatment/disposal.

5.2.6 Alternative 6: Institutional Actions; Active Restoration of Downgradient Contamination; Containment of Groundwater Beneath the Conrail Railyard via Extraction Wells; Treatment/Discharge

Alternative 6 intends to actively restore the aquifer downgradient from the Conrail railyard and contain groundwater contamination currently beneath the railyard. Alternative 6 consists of extracting contaminated groundwater downgradient from the railyard through a series of extraction wells located within identified plumes. Extraction wells would also be installed on the downgradient boundary of the railyard to intercept any groundwater contamination presently beneath the railyard before contamination migrates beyond the property boundaries of the railyard. The treatment system for the interim action might be enlarged to accommodate the increased flow or a new treatment facility might have to be constructed. Treatment and discharge would be similar to that described under Alternative 3 (Section 5.2.3). This alternative would reduce the potential for exposure to contaminated groundwater and would limit the migration of contaminants. The extraction system at the railyard boundary should be designed so as to intercept contamination from other possible sources within the railyard; it appears that at the present time not all sources at the railyard contributing to groundwater contamination have been identified.

5.2.7 Alternative 7: Discharge of Treated Groundwater to POTW

Under this alternative, groundwater extracted and treated under Alternatives 2 through 6 would be discharged to the local POTW instead of to the St. Joseph River. Discharge to a POTW would incur higher operating costs than surface water discharge and would entail different discharge limitations. Discharge to a POTW would be more protective of the environment by eliminating the possibility of contaminant discharge (accidental release from the site treatment facility) to the river. Any discharge to the POTW would have to comply with the POTW pretreatment standards and the volume of discharge would have to be acceptable to the POTW.

5.2.8 Alternative 8: Reinjection of Portion of Treated Groundwater to Aquifer

Under this alternative, a portion of the groundwater extracted and treated under Alternative 2, 3, 4, 5, or 6, would be reinjected into the aquifer upgradient from soil contamination to enhance *in situ* soil flushing (Section 5.1.6). Only a small portion of the total treated water would be reinjected; the majority of water would still be discharged to the St. Joseph River (or to a POTW under Alternative 7). Additives may be injected with treated groundwater into the aquifer to enhance the removal of contaminants from the soil via a flushing process. Under this alternative, groundwater downgradient from the soil being flushed would have to be extracted to ensure sufficient capture of contaminants entering the groundwater from the soil and of any additives injected into the aquifer.

5.3 SUMMARY

The alternatives described above present a range of options for the soil and groundwater contamination at the Conrail site identified to date. These alternatives have been determined to warrant further evaluation. The media-specific alternatives will be revised and refined through the FS process and ultimately will be combined into comprehensive sitewide alternatives. These comprehensive remedial alternatives will undergo detailed development and analysis as the FS continues.

As the analytical results from the Phase III RI and the results of the risk assessment become available, that information will be integrated into the evaluation of the extent of contamination and used to develop final remedial action objectives and calculate the volumes of media that require remediation.

The ARARs identified by federal and state agencies in response to this document will serve several purposes. ARARs will be used to establish remedial action objectives. ARARs also will be listed for each remedial alternative, and the ability of the remedial alternative to comply with those ARARs will be a primary evaluation criterion during the detailed analysis of each remedial alternative.

6. REFERENCES

Ecology and Environment, Inc. (E & E), 1992, *Conrail RI/FS Phase II Technical Memorandum.*

_______, 1991, *Phased Feasibility Study Report.*

_______, 1990, *Preliminary Evaluation of Phase I Results and Interim Remedial Alternatives.*

Imbrigiotta, Thomas E., and Angel Martin, Jr., October 1981, "Hydrologic and Chemical Evaluation of the Ground-Water Resources of Northwest Elkhart County, Indiana," USGS, Water Resources Division, Geological Survey Water-Resources Investigation 81-53.

Freeze, R.A., and J.A. Cherry, 1979, *Groundwater*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Office of Solid Waste and Emergency Response (OSWER), April 22, 1991, Directive 9355.0-30.

APPENDIX A

PHASE II SUBSURFACE SOIL ANALYTICAL RESULTS

DATA QUALIFERS

FIELD PARAMETERS

**	Designates field parameters were not collected.

ORGANICS	DEFINITION	INTERPRETATION
J	Indicates an estimated value.	Compound value may be semi-quantitative.
D	Identifies all compounds in an analysis at a secondary dilution factor.	Alerts data user to a possible change in the CRQL.
P	This flag is used for a pesticide/Aroclor target analyte when there is greater than 25% difference for detected concentrations between the two GC columns. The lower of the two values is reported and flagged with a "p".	

INORGANICS

QUALIFERS	DEFINITION	INTERPRETATION
J	Is an estimated value because of a QC Protocol.	Value may be semi-quantitative.
B	Value is real, but above instrument DL and below CRDL.	Value may be quantitative or semi-quantitative.
E	Estimated or not reported due to interference.	Compound or element was not detected or value may be semi-quantitative.
N	Spike recoveries outside QC protocols which indicates a possible matrix problem data may be biased high or low.	Value may be quantitative or semi-quantitative.
W	Post digestion spike for furnance AA analysis is out of control limits (35-115%), while sample absorbance is <50% of spike absorbance.	Value may be semi-quantitative.

QUANTITATION LIMITS

Water Samples - to calculate sample quantitation limit: (CRQL + dilution factor).

Soil Samples - to calculate sample quantitation limit: (CRQL + dilution factor)/(100-% moisture)/100).

The listed quantitation limits for soil/sediments are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

VOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings - Subsurface Soils

Location	CRB20	CRB20	CRB20	CRB21	CRB21	CRB21	CRB22	CRB22dup	CRB22	CRB22
Sample Depth (feet)	5-6.5	7.5-9.5	10-12	2.5-4.5	5-7	10-12	2.5-4.5	2.5-4.5	5-7	10-12
Date Sampled	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91
VOLATILE ORGANICS(UG/KG)										
chloromethane										
bromomethane										
vinyl chloride										
chloroethane										
methylene chloride		11J	5J	5J	4J	4J	3J		2J	
acetone	1800	650	150	84	19	170	160	180	170	100
carbon disulfide										
1, 1-dichloroethene										
1, 1-dichloroethane										
1, 2-dichloroethene (total)										
chloroform										
1, 2-dichloroethane										
2-butanone (MEK)										
1, 1, 1-trichloroethane										
carbon tetrachlororide										
vinyl acetate										
bromodichloromethane										
1, 2-dichloropropane										
cis-1, 3-dichloropropene										
trichloroethene										
dibromochloromethane										
1, 1, 2-trichloroethane										
benzene										
trans-1, 3-dichloropropene										
bromoform										
4-methyl-2-pentanone										
2-hexanone										
tetrachloroethene										
toluene										25
1, 1, 2, 2-tetrachloroethane										
chlorobenzene										
ethylbenzene										
styrene										
xylenes (total)										

VOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings – Subsurface Soils

Location	CRB23	CRB23	CRB23	CRB24	CRB24	CRB24	CRB25	CRB25	CRB25	CRB25dup
Sample Depth (feet)	2.5–4.5	5–7	10–12	5–7	20–22	22.5–24.5	5–7	20–22	23.5–25.5	23.5–25.5
Date Sampled	9/16/91	9/16/91	9/16/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91
VOLATILE ORGANICS(UG/KG)										
chloromethane										
bromomethane										
vinyl chloride										
chloroethane										
methylene chloride	3J									
acetone	71	19	18						4700J	
carbon disulfide										
1, 1–dichloroethene										
1, 1–dichloroethane										
1, 2–dichloroethene (total)										
chloroform					2300	3300D			1200J	13000J
1, 2–dichloroethane										
2–butanone (MEK)						6J				
1, 1, 1–trichloroethane										
carbon tetrachlororide				4J	27000	23000D	2J	8000	23000	260000J
vinyl acetate										
bromodichloromethane										
1, 2–dichloropropane										
cis–1, 3–dichloropropene										
trichloroethene				12		3J	12			7J
dibromochloromethane										
1, 1, 2–trichloroethane										
benzene										
trans–1, 3–dichloropropene										
bromoform										
4–methyl–2–pentanone			7J							
2–hexanone										
tetrachloroethene						1J	1J			
toluene		5J	16	7J		3J	7J			12
1, 1, 2, 2–tetrachloroethane										
chlorobenzene										
ethylbenzene										
styrene										
xylenes (total)										

VOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings – Subsurface Soils

Location Sample Depth (feet) Date Sampled	CRB26 2.5-4.5 10/01/91	CRB26 22.5-24.4 10/01/91	CRB26 27-29 10/01/91	CRB27 10-12 10/03/91	CRB28 0-2 10/03/91	CRB28dup 0-2 10/03/91	CRB28 2.5-4.5 10/03/91	CRB28 15-17 10/03/91	CRB29 0-2 10/03/91	CRB32 0-2 10/03/91
VOLATILE ORGANICS(UG/KG)										
chloromethane										
bromomethane										
vinyl chloride										8J
chloroethane										
methylene chloride										
acetone										
carbon disulfide										
1, 1-dichloroethene										
1, 1-dichloroethane										
1, 2-dichloroethene (total)					110	9J	7J		100	5600D
chloroform										
1, 2-dichloroethane										
2-butanone (MEK)					13J			11J	17J	22J
1, 1, 1-trichloroethane										
carbon tetrachlororide			2J							
vinyl acetate										
bromodichloromethane										
1, 2-dichloropropane										
cis-1, 3-dichloropropene										
trichloroethene		6J	8J	5J	15000D	13000D	240	6J	13	170
dibromochloromethane										
1, 1, 2-trichloroethane						2J				
benzene										
trans-1, 3-dichloropropene										
bromoform										
4-methyl-2-pentanone										
2-hexanone										
tetrachloroethene		2J		2J	4J	3J	3J	4J	1J	2J
toluene		6J	5J			5J				
1, 1, 2, 2-tetrachloroethane										
chlorobenzene										
ethylbenzene										
styrene										
xylenes (total)				2J	3J		2J	2J	2J	

VOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings – Subsurface Soils

Location	CRB35	CRB35	CRB35	CRB36	CRB36	CRB36	CRB37	CRB37	CRB37	CRB38
Sample Depth (feet)	0-2	7.5-9.5	12.5-14.5	2.5-4.5	5-7	12.5-14.5	5-7	15-17	17.5-19.5	2.5-4.5
Date Sampled	10/04/91	10/04/91	10/04/91	10/04/91	10/04/91	10/04/91	10/08/91	10/08/91	10/08/91	10/08/91
VOLATILE ORGANICS(UG/KG)										
chloromethane										
bromomethane										
vinyl chloride										
chloroethane										
methylene chloride										
acetone										
carbon disulfide										
1, 1-dichloroethene										
1, 1-dichloroethane										
1, 2-dichloroethene (total)										
chloroform										
1, 2-dichloroethane										
2-butanone (MEK)			6J							
1, 1, 1-trichloroethane										
carbon tetrachlororide										
vinyl acetate										
bromodichloromethane										
1, 2-dichloropropane										
cis-1, 3-dichloropropene										
trichloroethene	9J		1J					1J		
dibromochloromethane										
1, 1, 2-trichloroethane										
benzene										
trans-1, 3-dichloropropene										
bromoform										
4-methyl-2-pentanone										
2-hexanone										
tetrachloroethene	7J		1J							
toluene	38J	2J	4J	2J	6J	3J	1J	6J	17	
1, 1, 2, 2-tetrachloroethane										
chlorobenzene										
ethylbenzene										
styrene										
xylenes (total)										

VOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings - Subsurface Soils

Location	CRB38	CRB38	CRB39	CRB39dup	CRB39	CRB39
Sample Depth (feet)	10-12	15-17	5-7	5-7	15-17	20-22
Date Sampled	10/08/91	10/08/91	10/08/91	10/08/91	10/08/91	10/08/91
VOLATILE ORGANICS(UG/KG)						
chloromethane						
bromomethane						
vinyl chloride						
chloroethane						
methylene chloride						
acetone		310D			800D	
carbon disulfide						
1, 1-dichloroethene						
1, 1-dichloroethane						
1, 2-dichloroethene (total)						
chloroform						
1, 2-dichloroethane						
2-butanone (MEK)						6J
1, 1, 1-trichloroethane						
carbon tetrachlororide						
vinyl acetate						
bromodichloromethane						
1, 2-dichloropropane						
cis-1, 3-dichloropropene						
trichloroethene		1J			1J	
dibromochloromethane						
1, 1, 2-trichloroethane						
benzene						
trans-1, 3-dichloropropene						
bromoform						
4-methyl-2-pentanone						
2-hexanone						
tetrachloroethene						
toluene		3J	7J	27	9J	19
1, 1, 2, 2-tetrachloroethane						
chlorobenzene						
ethylbenzene						
styrene						
xylenes (total)						

SEMIVOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings - Subsurface Soils

Location	CRB20	CRB20	CRB20	CRB21	CRB21	CRB21	CRB22	CRB22dup	CRB22	CRB22
Sample Depth (feet)	5-6.5	7.5-9.5	10-12	2.5-4.5	5-7	10-12	2.5-4.5	2.5-4.5	5-7	10-12
Date Sampled	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91	9/16/91
SEMIVOLATILE ORGANICS(UG/KG)										
phenol										
bis(2-chloroethyl)ether										
2-chlorophenol										
1, 3-dichlorobenzene										
1, 4-dichlorobenzene										
benzyl alcohol										
1, 2-dichlorobenzene										
2-methylphenol										
bis(2-chloroisopropyl)ether										
4-methylphenol										
n-nitroso-di-n-dipropylamine										
hexachloroethane										
nitrobenzene										
isophorone										
2-nitrophenol										
2, 4-dimethylphenol										
benzoic acid										
bis(2-chloroethoxy)methane										
2, 4-dichlorophenol										
1, 2, 4-trichlorobenzene										
naphthalene	1800J	200J								
4-chloroaniline										
hexachlorobutadiene										
4-chloro-3-methylphenol										
2-methylnaphthalene	15000	3900								
hexachlorocyclopentadiene										
2, 4, 6-trichlorophenol										
2, 4, 5-trichlorophenol										
2-chloronaphthalene										
2-nitroaniline										
dimethylphthalate										
acenaphthylene										
2, 6-dinitrotolunene										
3-nitroaniline										
acenaphthene	3000J	780	61J							

SEMIVOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings - Subsurface Soils

Location Sample Depth (feet) Date Sampled	CRB20 5-6.5 9/16/91	CRB20 7.5-9.5 9/16/91	CRB20 10-12 9/16/91	CRB21. 2.5-4.5 9/16/91	CRB21 5-7 9/16/91	CRB21 10-12 9/16/91	CRB22 2.5-4.5 9/16/91	CRB22dup 2.5-4.5 9/16/91	CRB22 5-7 9/16/91	CRB22 10-12 9/16/91
SEMIVOLATILE ORGANICS(UG/KG)										
2, 4-dinitrophenol										
4-nitrophenol										
dibenzofuran	1600J	420J								
2, 4-dinitrotoluene										
diethylphthalate										
4-chlorophenyl-phenylether										
fluorene	3000J	890	63J							
4-nitroaniline										
4, 6-dinitro-2-methylphenol										
n-nitrosodiphenylamine										
4-bromophenyl-phenylether										
hexachlorobenzene										
pentachlorophenol										
phenanthrene	3800	1200	110J							
anthracene	1400J	340J								
di-n-butylphthalate						22J				23J
fluoranthene	6600J	1500	130J							38J
pyrene	6800J	1600	130J							30J
butylbenzylphthalate										
3, 3'dichlorobenzidine										
benzo[a]anthracene	1200J	270J								
chrysene	1500J	300J								
bis(2-ethylhexyl)phthalate	2400J	170J	540	49J	71J	68J				
di-n-octylphthalate										
benzo[b]fluoranthene										39J
benzo[k]fluoranthene										
benzo[a]pyrene										
indeno[1, 2, 3-cd]pyrene										
dibenzo[a, h]anthracene										
benzo[g, h, i]perylene										

SEMIVOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings - Subsurface Soils (cont...)

Location	CRB23	CRB23	CRB23	CRB24	CRB24	CRB24	CRB25	CRB25	CRB25	CRB25dup
Sample Depth (feet)	2.5-4.5	5-7	10-12	5-7	20-22	22.5-24.5	5-7	20-22	23.5-25.5	23.5-25.5
Date Sampled	9/16/91	9/16/91	9/16/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91
SEMIVOLATILE ORGANICS(UG/KG)										
phenol										
bis(2-chloroethyl)ether										
2-chlorophenol										
1, 3-dichlorobenzene										
1, 4-dichlorobenzene										
benzyl alcohol										
1, 2-dichlorobenzene										
2-methylphenol										
bis(2-chloroisopropyl)ether										
4-methylphenol										
n-nitroso-di-n-dipropylamine										
hexachloroethane					55J					
nitrobenzene										
isophorone										
2-nitrophenol										
2, 4-dimethylphenol										
benzoic acid										
bis(2-chloroethoxy)methane										
2, 4-dichlorophenol										
1, 2, 4-trichlorobenzene										
naphthalene										
4-chloroaniline										
hexachlorobutadiene										
4-chloro-3-methylphenol										
2-methylnaphthalene										
hexachlorocyclopentadiene										
2, 4, 6-trichlorophenol										
2, 4, 5-trichlorophenol										
2-chloronaphthalene										
2-nitroaniline										
dimethylphthalate										
acenaphthylene										
2, 6-dinitrotolunene										
3-nitroaniline										
acenaphthene										

SEMIVOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings - Subsurface Soils (cont...)

Location	CRB23	CRB23	CRB23	CRB24	CRB24	CRB24	CRB25	CRB25	CRB25	CRB25dup
Sample Depth (feet)	2.5-4.5	5-7	10-12	5-7	20-22	22.5-24.5	5-7	20-22	23.5-25.5	23.5-25.5
Date Sampled	9/16/91	9/16/91	9/16/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91
SEMIVOLATILE ORGANICS(UG/KG)										
2, 4-dinitrophenol										
4-nitrophenol										
dibenzofuran										
2, 4-dinitrotoluene										
diethylphthalate										
4-chlorophenyl-phenylether										
fluorene										
4-nitroaniline										
4, 6-dinitro-2-methylphenol										
n-nitrosodiphenylamine										
4-bromophenyl-phenylether										
hexachlorobenzene										
pentachlorophenol										
phenanthrene				83J						
anthracene										
di-n-butylphthalate										
fluoranthene				240J						
pyrene				230J						
butylbenzylphthalate										
3, 3'dichlorobenzidine										
benzo[a]anthracene				130J						
chrysene				170J						
bis(2-ethylhexyl)phthalate										
di-n-octylphthalate										
benzo[b]fluoranthene				150J						
benzo[k]fluoranthene				140J						
benzo[a]pyrene				100J						
indeno[1, 2, 3-cd]pyrene										
dibenzo[a, h]anthracene										
benzo[g, h, i]perylene										

SEMIVOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings - Subsurface Soils (cont...)

Location	CRB26	CRB26	CRB26	CRB27*	CRB28	CRB28dup	CRB28	CRB28	CRB29	CRB32
Sample Depth (feet)	2.5-4.5	22.5-24.5	27-29	10-12	0-2	0-2	2.5-4.5	15-17	0-2	0-2
Date Sampled	10/01/91	10/01/91	10/01/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91
SEMIVOLATILE ORGANICS(UG/KG)										
phenol										
bis(2-chloroethyl)ether										
2-chlorophenol										
1, 3-dichlorobenzene										
1, 4-dichlorobenzene										
benzyl alcohol										
1, 2-dichlorobenzene										
2-methylphenol										
bis(2-chloroisopropyl)ether										
4-methylphenol										
n-nitroso-di-n-dipropylamine										
hexachloroethane										
nitrobenzene										
isophorone										
2-nitrophenol										
2, 4-dimethylphenol										
benzoic acid										
bis(2-chloroethoxy)methane										
2, 4-dichlorophenol										
1, 2, 4-trichlorobenzene										
naphthalene										
4-chloroaniline										
hexachlorobutadiene										
4-chloro-3-methylphenol										
2-methylnaphthalene										
hexachlorocyclopentadiene										
2, 4, 6-trichlorophenol										
2, 4, 5-trichlorophenol										
2-chloronaphthalene										
2-nitroaniline										
dimethylphthalate										
acenaphthylene										61J
2, 6-dinitrotolunene										
3-nitroaniline										
acenaphthene										

SEMIVOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings – Subsurface Soils (cont...)

Location	CRB26	CRB26	CRB26	CRB27*	CRB28	CRB28dup	CRB28	CRB28	CRB29	CRB32
Sample Depth (feet)	2.5-4.5	22.5-24.5	27-29	10-12	0-2	0-2	2.5-4.5	15-17	0-2	0-2
Date Sampled	10/01/91	10/01/91	10/01/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91
SEMIVOLATILE ORGANICS(UG/KG)										
2, 4-dinitrophenol										
4-nitrophenol										
dibenzofuran										
2, 4-dinitrotoluene										
diethylphthalate										
4-chlorophenyl-phenylether										
fluorene										
4-nitroaniline										
4, 6-dinitro-2-methylphenol										
n-nitrosodiphenylamine										
4-bromophenyl-phenylether										
hexachlorobenzene										
pentachlorophenol										
phenanthrene										220J
anthracene										
di-n-butylphthalate										
fluoranthene						73J	59J			710J
pyrene					39J	110J	77J			570J
butylbenzylphthalate										
3, 3'dichlorobenzidine										
benzo[a]anthracene										510J
chrysene						41J	47J			400J
bis(2-ethylhexyl)phthalate										
di-n-octylphthalate										
benzo[b]fluoranthene						38J	41J			480J
benzo[k]fluoranthene										410J
benzo[a]pyrene										330J
indeno[1, 2, 3-cd]pyrene										390J
dibenzo[a, h]anthracene										
benzo[g, h, i]perylene										260J

SEMIVOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings – Subsurface Soils (cont...)

Location	CRB35*	CRB35	CRB35	CRB36*	CRB36*	CRB36*	CRB37	CRB37	CRB37	CRB38
Sample Depth (feet)	0-2	7.5-9.5	12.5-14.5	2.5-4.5	5-7	12.5-14.5	5-7	15-17	17.5-19.5	2.4-4.5
Date Sampled	10/04/91	10/04/91	10/04/91	10/04/91	10/04/91	10/04/91	10/08/91	10/08/91	10/08/91	10/08/91
SEMIVOLATILE ORGANICS(UG/KG)										
phenol										
bis(2-chloroethyl)ether										
2-chlorophenol										
1, 3-dichlorobenzene										
1, 4-dichlorobenzene										
benzyl alcohol										
1, 2-dichlorobenzene										
2-methylphenol										
bis(2-chloroisopropyl)ether										
4-methylphenol										
n-nitroso-di-n-dipropylamine										
hexachloroethane										
nitrobenzene										
isophorone										
2-nitrophenol										
2, 4-dimethylphenol										
benzoic acid										
bis(2-chloroethoxy)methane										
2, 4-dichlorophenol										
1, 2, 4-trichlorobenzene										
naphthalene										
4-chloroaniline										
hexachlorobutadiene										
4-chloro-3-methylphenol										
2-methylnaphthalene										
hexachlorocyclopentadiene										
2, 4, 6-trichlorophenol										
2, 4, 5-trichlorophenol										
2-chloronaphthalene										
2-nitroaniline										
dimethylphthalate										
acenaphthylene										
2, 6-dinitrotolunene										
3-nitroaniline										
acenaphthene										

SEMIVOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings – Subsurface Soils (cont...)

Location	CRB35*	CRB35	CRB35	CRB36*	CRB36*	CRB36*	CRB37	CRB37	CRB37	CRB38
Sample Depth (feet)	0–2	7.5–9.5	12.5–14.5	2.5–4.5	5–7	12.5–14.5	5–7	15–17	17.5–19.5	2.4–4.5
Date Sampled	10/04/91	10/04/91	10/04/91	10/04/91	10/04/91	10/04/91	10/08/91	10/08/91	10/08/91	10/08/91
SEMIVOLATILE ORGANICS(UG/KG)										
2, 4–dinitrophenol										
4–nitrophenol										
dibenzofuran										
2, 4–dinitrotoluene										
diethylphthalate										
4–chlorophenyl–phenylether										
fluorene										
4–nitroaniline										
4, 6–dinitro–2–methylphenol										
n–nitrosodiphenylamine										
4–bromophenyl–phenylether										
hexachlorobenzene										
pentachlorophenol										
phenanthrene										
anthracene										
di–n–butylphthalate										
fluoranthene										
pyrene										
butylbenzylphthalate										
3, 3'dichlorobenzidine										
benzo[a]anthracene										
chrysene										
bis(2–ethylhexyl)phthalate										
di–n–octylphthalate										
benzo[b]fluoranthene										
benzo[k]fluoranthene										
benzo[a]pyrene										
indeno[1, 2, 3–cd]pyrene										
dibenzo[a, h]anthracene										
benzo[g, h, i]perylene										

SEMIVOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings – Subsurface Soils (cont...)

Location	CRB38	CRB38	CRB39	CRB39dup	CRB39	CRB39
Sample Depth (feet)	10-12	15-17	5-7	5-7	15-17	20-22
Date Sampled	10/08/91	10/08/91	10/08/91	10/08/91	10/08/91	10/08/91
SEMIVOLATILE ORGANICS(UG/KG)						
phenol						
bis(2-chloroethyl)ether						
2-chlorophenol						
1, 3-dichlorobenzene						
1, 4-dichlorobenzene						
benzyl alcohol						
1, 2-dichlorobenzene						
2-methylphenol						
bis(2-chloroisopropyl)ether						
4-methylphenol						
n-nitroso-di-n-dipropylamine						
hexachloroethane						
nitrobenzene						
isophorone						
2-nitrophenol						
2, 4-dimethylphenol						
benzoic acid						
bis(2-chloroethoxy)methane						
2, 4-dichlorophenol						
1, 2, 4-trichlorobenzene						
naphthalene						
4-chloroaniline						
hexachlorobutadiene						
4-chloro-3-methylphenol						
2-methylnaphthalene						
hexachlorocyclopentadiene						
2, 4, 6-trichlorophenol						
2, 4, 5-trichlorophenol						
2-chloronaphthalene						
2-nitroaniline						
dimethylphthalate						
acenaphthylene						
2, 6-dinitrotolunene						
3-nitroaniline						
acenaphthene						

SEMIVOLATILE ORGANIC COMPOUND ANALYTICAL RESULTS
Soil Borings - Subsurface Soils (cont...)

Location	CRB38	CRB38	CRB39	CRB39dup	CRB39	CRB39
Sample Depth (feet)	10-12	15-17	5-7	5-7	15-17	20-22
Date Sampled	10/08/91	10/08/91	10/08/91	10/08/91	10/08/91	10/08/91
SEMIVOLATILE ORGANICS(UG/KG)						
2, 4-dinitrophenol						
4-nitrophenol						
dibenzofuran						
2, 4-dinitrotoluene						
diethylphthalate						
4-chlorophenyl-phenylether						
fluorene						
4-nitroaniline						
4, 6-dinitro-2-methylphenol						
n-nitrosodiphenylamine						
4-bromophenyl-phenylether						
hexachlorobenzene						
pentachlorophenol						
phenanthrene						
anthracene						
di-n-butylphthalate				56J		
fluoranthene						
pyrene						
butylbenzylphthalate						
3, 3'dichlorobenzidine						
benzo[a]anthracene						
chrysene						
bis(2-ethylhexyl)phthalate			57J			
di-n-octylphthalate						
benzo[b]fluoranthene			71J			
benzo[k]fluoranthene						
benzo[a]pyrene			61J			
indeno[1, 2, 3-cd]pyrene						
dibenzo[a, h]anthracene						
benzo[g, h, i]perylene						

PESTICIDES/PCBs COMPOUND ANALYTICAL RESULTS
Soil Borings - Subsurface Soils

Location	CRB22	CRB22dup	CRB26	CRB28	CRB36
Sample Depth (feet)	7.5-9.5	7.5-9.5	22.5-24.4	15-17	12.5-14.5
Date Sampled	9/16/91	9/16/91	10/01/91	10/03/91	10/04/91
PESTICIDES/PCBs(UG/KG)					
alpha BHC					
beta BHC					
delta BHC					
gamma BHC (lindane)					
Heptachlor					
Aldrin					
Heptachlor epoxide					
Endosulfan I					
Dieldrin	0.68J	2.9JP			
4, 4'-DDE					
Endrin	7.8PJ	44P			
Endosulfan II					
4, 4'-DDD					
Endosulfan sulfate	1.5J	1.9JP			
4, 4'-DDT					
Methoxychlor (Mariate)	4.9JP	5.4JP			
Endrin aldehyde	3.1J				
Endrin ketone					
alpha Chlordane					
gamma Chlordane		0.71JP			
Toxaphene					
Aroclor 1016					
Aroclor 1221					
Aroclor 1232					
Aroclor 1242					
Aroclor 1248					
Aroclor 1254					
Aroclor 1260	65PJ	260			

TOTAL METAL ANALYTE ANALYTICAL RESULTS
Soil Borings – Subsurface Soils

Location	CRB22	CRB22dup	CRB26	CRB28	CRB36
Sample Depth (feet)	7.5-10.5	7.5-10.5	22.5-24.5	15-17	12.5-14.5
Date Sampled	9/17/91	9/17/91	10/01/91	10/03/91	10/04/91
TOTAL METALS(MG/KG)					
aluminum	5560J	3360J	4780JE	1970JE	2040JE
antimony					
arsenic	3.3	1.5B	4.1	1.8B	2.3
barium	35.8B	13.8B	15.9BJE	5.8BJE	15.4BJE
beryllium					
cadmium	3.2	1.3	2.6	1.2	1.7
calcium	1470JE	1060JE	98200JE	66700JE	67600JE
chromium	18.7J	7.3J	13.7	6.3	6.7
cobalt	5.1B	2.9B	4B	2B	3.3B
copper	11.9	6.5J	9	4.6B	8.2
iron	12300J	6610J	10200JE	4910JE	6720JE
lead	6.9JN	3.8JN	4	2.3	2.9
magnesium	1950	1140	20800	10100	12500
manganese	702J	114J	206JEN	159JEN	197JEN
mercury					
nickel	15.8	7B	12.7	4.4B	7.1B
potassium	1020B	519B	477B	269B	267B
selenium					
silver					
sodium	179BJ	146BJ	169BJ	120BJ	131BJ
thallium			0.27BJ	0.32BJ	
vanadium	14.2	10.2B	8.9B	3.5B	4.6B
zinc	34.3J	21.1J	32.7	19.2	22

TOTAL ORGANIC CARBON ANALYTICAL RESULTS
Soil Borings - Subsurface Soils

Location **Sample Depth (feet)** **Date Sampled**	CRB22 7.5-9.5 9/17/91	CRB22dup 7.5-9.5 9/17/91	CRB26 22.5-24.5 10/01/91	CRB28 15-17 10/03/91	CRB36 12.5-14.5 10/04/91
TOTAL ORGANIC CARBON	0.21 J	0.38 J	1.31 J	1.79 J	2.38 JB

APPENDIX B

PHASE III GROUNDWATER ANALYTICAL RESULTS

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL SITE PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

	Sample No.	01-03		02S-03		02D-03		02BR-02		03-03		04S-03		04D-03		05S-02		05D-02	
	Temp. (F)	51.6	Q	53.7	Q	50.3	Q	50.0	Q	54.2	Q	48.0	Q	47.6	Q	47.0	Q	55.0	Q
	Sp. Cond. +	1302	U	2530	U	1749	U	667	U	608	U	572	U	539	U	330	U	719	U
	pH	8.02	A	8.03	A	7.87	A	7.97	A	8.15	A	8.27	A	8.23	A	8.53	A	8.2	A
	Dilution Factor	1.0	L	1.0	L	1.0(5.0)	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L
	EPA Sample	ESA10		ESA54		ESA55		ESA56		ESA11		ESA08		ESA09		ESA23		ESA24	
	Sample Date	11/16/92		11/17/92		11/17/92		11/17/92		11/16/92		11/16/92		11/16/92		11/16/92		11/16/92	
CRQL	VOLATILE ORGANICS																		
10	chloromethane		U		U		U		U		U		U		U		U		U
10	bromomethane		U		U		U		U		U		U		U		U		U
10	vinyl chloride		U		U		U		U		U		U		U		U		U
10	chloroethane		U		U		U		U		U		U		U		U		U
10	methylene chloride		U		U		U		U	10	BJU		U	10	BJU		U		U
10	acetone		U		U		U		U	10	BJU		U		U		U		U
10	carbon disulfide		U		U		U		U		U		U		U		U		U
10	1,1-dichloroethene		U		U		U		U		U		U		U		U		U
10	1,1-dichloroethane		U		U		U		U		U		U		U		U		U
10	1,2-dichloroethene (total)		U		U		U		U		U		U		U		U		U
10	chloroform		U	4	J	11			U		U		U		U		U	2	J
10	1,2-dichloroethane		U		U		U		U		U		U		U		U		U
10	2-butanone (MEK)		U		U		U		U		U		U	6	J		U		U
10	1,1,1-trichloroethane		U		U		U		U		U		U		U		U		U
10	carbon tetrachloride		U	79		110			U		U		U		U		U	17	J
10	bromodichloromethane		U		U		U		U		U		U		U		U		U
10	1,2-dichloropropane		U		U		U		U		U		U		U		U		U
10	cis-1,3-dichloropropene		U		U		U		U		U		U		U		U		U
10	trichloroethene		U	42		(500)	D	33			U		U		U		U		U
10	dibromochloromethane		U		U		U		U		U		U		U		U		U
10	1,1,2-trichloroethane		U		U		U		U		U		U		U		U		U
10	benzene		U		U		U		U		U		U		U		U		U
10	trans-1,3-dichloropropene		U		U		U		U		U		U		U		U		U
10	bromoform		U		U		U		U		U		U		U		U		U
10	4-methyl-2-pentanone		U		U		U		U		U		U		U		U		U
10	2-hexanone		U		U		U		U		U		U		U		U		U
10	tetrachloroethene		U		U		U		U		U		U		U		U		U
10	1,1,2,2-tetrachloroethane		U		U		U		U		U		U		U		U		U
10	toluene		U		U		U		U		U		U		U		U		U
10	chlorobenzene		U		U		U		U		U		U		U		U		U
10	ethylbenzene		U		U		U		U		U		U		U		U		U
10	styrene		U		U		U		U		U		U		U		U		U
10	xylenes (total)		U		U		U		U		U		U		U		U		U

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
+ = (umhos/cm)
( ) = Dilution Factor that corresponds with sample result in ( )

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL SITE PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

		Sample No.	06-02		07-03		08S-03		08D-03		08BR-02		09-02		10S-03		10D-03		11S-03	
		Temp. (F)	50.5	Q	50.8	Q	54.6	Q	52.2	Q	52.3	Q	48.5	Q	51.0	Q	49.1	Q	53.3	Q
		Sp. Cond. +	538	U	1005	U	1027	U	1110	U	1248	U	512	U	704	U	492	U	785	U
		pH	8.28	A	7.13	A	8.15	A	7.88	A	7.93	A	8.23	A	8.22	A	8.22	A	7.05	A
		Dilution Factor	1.0	L	1.0	L	1.0(5.0)	L	1.0(10.0)	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L
		EPA Sample	ESA25		ESA12		ESA72		ESA73		ESA74		ESA26		ESA06		ESA07		ESA01	
		Sample Date	11/16/92		11/16/92		11/17/92		11/17/92		11/17/92		11/16/92		11/16/92		11/16/92		11/17/92	
CRQL	VOLATILE ORGANICS																			
10	chloromethane			U		U		U		U		U		U		U		U		U
10	bromomethane			U		U		U		U		U		U		U		U		U
10	vinyl chloride			U		U		U		U		U		U		U		U		U
10	chloroethane			U		U		U		U		U		U		U		U		U
10	methylene chloride			U		U		U		U		U		U		U		U		U
10	acetone			U	10	BU		U		U		U		U		U		U		U
10	carbon disulfide			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethene			U		U		U		U		U	9	J		U		U		U
10	1,1-dichloroethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethene (total)			U		U		U		U		U		U		U		U		U
10	chloroform			U		U	32		28		27			U		U		U		U
10	1,2-dichloroethane			U		U		U		U		U		U		U		U		U
10	2-butanone (MEK)			U		U		U		U		U		U		U		U		U
10	1,1,1-trichloroethane		29			U		U		U		U	76			U		U		U
10	carbon tetrachloride			U		U	(820)	D	(360)	D	42			U		U		U		U
10	bromodichloromethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloropropane			U		U		U		U		U		U		U		U		U
10	cis-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	trichloroethene			U		U	110		180		5	J		U		U		U		U
10	dibromochloromethane			U		U		U		U		U		U		U		U		U
10	1,1,2-trichloroethane			U		U		U		U		U		U		U		U		U
10	benzene			U		U		U		U		U		U		U		U		U
10	trans-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	bromoform			U		U		U		U		U		U		U		U		U
10	4-methyl-2-pentanone			U		U		U		U		U		U		U		U		U
10	2-hexanone			U		U		U		U		U		U		U		U		U
10	tetrachloroethene			U		U		U		U		U		U		U		U		U
10	1,1,2,2-tetrachloroethane			U		U		U		U		U		U		U		U		U
10	toluene			U		U		U		U		U		U		U		U		U
10	chlorobenzene			U		U		U		U		U		U		U		U		U
10	ethylbenzene			U		U		U		U		U		U		U		U		U
10	styrene			U		U		U		U		U		U		U		U		U
10	xylenes (total)			U		U		U		U		U		U		U		U		U

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
+ = (umhos/cm)
() = Dilution Factor that corresponds with sample result in ()

recycled paper

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL SITE PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

		Sample No.	11D-03		12-03		13S-03		13SD-03		13D-03		14-03		15-03		16-03		18-03	
		Temp. (F)	51.8	Q	54.0	Q	51.4	Q	51.4	Q	52.1	Q	52.6	Q	51.6	Q	53.4	Q	57.2	Q
		Sp. Cond. +	505	U	1124	U	484	U	484	U	524	U	941	U	493	U	1116	U	835	U
		pH	7.38	A	7.28	A	7.21	A	7.21	A	6.9	A	7.83	A	6.9	A	6.1	A	7.54	A
		Dilution Factor	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L
		EPA Sample	ESA02		ESA14		ESA03		ESA04		ESA05		ESA69		ESA15		ESA13		ESA16	
		Sample Date	11/17/92		11/17/92		11/17/92		11/17/92		11/17/92		11/19/92		11/16/92		11/16/92		11/19/92	
CRQL	VOLATILE ORGANICS						**		**											
10	chloromethane			U		U		U		U		U	10	UJ		U		U		U
10	bromomethane			U		U		U		U		U		U		U		U		U
10	vinyl chloride			U		U		U		U		U		U		U		U		U
10	chloroethane			U		U		U		U		U		U		U		U		U
10	methylene chloride			U		U		U		U		U		U		U		U		U
10	acetone			U		U		U		U		U		U		U		U		U
10	carbon disulfide			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethene			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethene (total)			U		U		U		U		U		U		U		U		U
10	chloroform			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethane			U		U		U		U		U		U		U		U		U
10	2-butanone (MEK)			U		U		U		U		U		U	4	J		U		U
10	1,1,1-trichloroethane			U		U		U		U		U		U		U		U		U
10	carbon tetrachloride			U		U		U		U		U	2	J		U		U		U
10	bromodichloromethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloropropane			U		U		U		U		U		U		U		U		U
10	cis-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	trichloroethene			U		U		U		U		U	13			U		U		U
10	dibromochloromethane			U		U		U		U		U		U		U		U		U
10	1,1,2-trichloroethane			U		U		U		U		U		U		U		U		U
10	benzene			U		U		U		U		U		U		U		U		U
10	trans-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	bromoform			U		U		U		U		U		U		U		U		U
10	4-methyl-2-pentanone			U		U		U		U		U		U		U		U		U
10	2-hexanone			U		U		U		U		U		U		U		U		U
10	tetrachloroethene			U		U		U		U		U		U		U		U		U
10	1,1,2,2-tetrachloroethane			U		U		U		U		U		U		U		U		U
10	toluene			U		U		U		U		U		U		U		U		U
10	chlorobenzene			U		U		U		U		U		U		U		U		U
10	ethylbenzene			U		U		U		U		U		U		U		U		U
10	styrene			U		U		U		U		U		U		U		U		U
10	xylenes (total)			U		U		U		U		U		U		U		U		U

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
+ = (umhos/cm)
( ) = Dilution Factor that corresponds with sample result in ( )

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL SITE PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

		Sample No.	19S-03		19D-03.		20S-03		20D-03		21S-03		21SD-03		21D-03		23S-03		23D-03	
		Temp. (F)	51.7	Q	51.2	Q	53.2	Q	51.8	Q	53.0	Q	53.0	Q	50.3	Q	50.8	Q	50.7	Q
		Sp. Cond. +	1300	U	675	U	1089	U	762	U	933	U	933	U	758	U	736	U	620	U
		pH	6.25	A	6.80	A	7.77	A	8.02	A	6.93	A	6.93	A	6.99	A	6.82	A	6.96	A
		Dilution Factor	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L
		EPA Sample	ESA17		ESA18		ESA58		ESA59		ESA20		ESA21		ESA22		ESA70		ESA71	
		Sample Date	11/16/92		11/16/92		11/17/92		11/17/92		11/16/92		11/16/92		11/16/92		11/17/92		11/17/92	
CRQL	VOLATILE ORGANICS										**		**							
10	chloromethane			U		U		U		U		U		U		U		U		U
10	bromomethane			U		U		U		U		U		U		U		U		U
10	vinyl chloride			U		U		U		U		U		U		U		U		U
10	chloroethane			U		U		U		U		U		U		U		U		U
10	methylene chloride			U	10	BJU		U		U	10	BJU	10	BJU		U		U		U
10	acetone			U		U		U		U		U		U		U		U		U
10	carbon disulfide			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethene			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethene (total)			U		U		U		U		U		U		U	2	J		U
10	chloroform			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethane			U		U		U		U		U		U		U		U		U
10	2-butanone (MEK)			U		U		U		U	9	J		U		U		U		U
10	1,1,1-trichloroethane			U		U	9	J		U		U		U	19			U		U
10	carbon tetrachloride			U		U		U		U		U		U		U		U	12	
10	bromodichloromethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloropropane			U		U		U		U		U		U		U		U		U
10	cis-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	trichloroethene			U		U	15		4	J		U		U		U	75		64	
10	dibromochloromethane			U		U		U		U		U		U		U		U		U
10	1,1,2-trichloroethane			U		U		U		U		U		U		U		U		U
10	benzene			U		U		U		U		U		U		U		U	2	J
10	trans-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	bromoform			U		U		U		U		U		U		U		U		U
10	4-methyl-2-pentanone			U		U		U		U		U		U		U		U		U
10	2-hexanone			U		U		U		U		U		U		U		U		U
10	tetrachloroethene			U		U		U		U		U		U		U		U		U
10	1,1,2,2-tetrachloroethane			U		U		U		U		U		U		U		U		U
10	toluene			U		U		U		U		U		U		U		U		U
10	chlorobenzene			U		U		U		U		U		U		U		U		U
10	ethylbenzene			U		U		U		U		U		U		U		U		U
10	styrene			U		U		U		U		U		U		U		U		U
10	xylenes (total)			U		U		U		U		U		U		U		U		U

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
+ = (umhos/cm)
( ) = Dilution Factor that corresponds with sample result in ( )

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL SITE PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

		Sample No.	24-03		25-03		26-03		27S-02		27I-02		28S-02		28I-02		29S-02		29I-02	
		Temp. (F)	53.5	Q	51.1	Q	52.0	Q	53.3	Q	50.9	Q	48.7	Q	49.2	Q	54.4	Q	50.5	Q
		Sp. Cond. +	459	U	542	U	556	U	551	U	554	U	334	U	355	U	818	U	491	U
		pH	6.97	A	5.88	A	6.90	A	6.77	A	7.14	A	7.19	A	7.31	A	6.88	A	7.16	A
		Dilution Factor	1.0(2.0)	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L
		EPA Sample	ESA39		ESA40		ESA41		ESA30		ESA31		ESA32		ESA33		ESA34		ESA35	
		Sample Date	11/18/92		11/18/92		11/18/92		11/18/92		11/18/92		11/18/92		11/18/92		11/18/92		11/18/92	
CRQL	VOLATILE ORGANICS																			
10	chloromethane			U		U		U		U		U		U		U		U		U
10	bromomethane			U		U		U		U		U		U		U		U		U
10	vinyl chloride			U		U		U		U		U		U		U		U		U
10	chloroethane			U		U		U		U		U		U		U		U		U
10	methylene chloride			U		U		U		U		U		U		U		U		U
10	acetone			U		U		U		U		U		U		U		U		U
10	carbon disulfide			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethene			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethene (total)			U		U		U		U		U		U		U		U		U
10	chloroform		12			U	2	J		U		U		U		U		U		U
10	1,2-dichloroethane			U		U		U		U		U		U		U		U		U
10	2-butanone (MEK)			U		U		U		U		U		U		U		U		U
10	1,1,1-trichloroethane			U		U		U		U		U		U		U		U		U
10	carbon tetrachloride		(150)	D		U	24			U		U		U		U		U		U
10	bromodichloromethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloropropane			U		U		U		U		U		U		U		U		U
10	cis-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	trichloroethene		2	J		U		U		U		U		U		U		U		U
10	dibromochloromethane			U		U		U		U		U		U		U		U		U
10	1,1,2-trichloroethane			U		U		U		U		U		U		U		U		U
10	benzene			U		U		U		U		U		U		U		U		U
10	trans-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	bromoform			U		U		U		U		U		U		U		U		U
10	4-methyl-2-pentanone			U		U		U		U		U		U		U		U		U
10	2-hexanone			U		U		U		U		U		U		U		U		U
10	tetrachloroethene			U		U		U		U		U		U		U		U		U
10	1,1,2,2-tetrachloroethane			U		U		U		U		U		U		U		U		U
10	toluene			U		U		U		U		U		U		U		U		U
10	chlorobenzene			U		U		U		U		U		U		U		U		U
10	ethylbenzene			U		U		U		U		U		U		U		U		U
10	styrene			U		U		U		U		U		U		U		U		U
10	xylenes (total)			U		U		U		U		U		U		U		U		U

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
\+ = (umhos/cm)
( ) = Dilution Factor that corresponds with sample result in ( )

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL SITE PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

		Sample No.	30S-02		30I-02		30ID-02		30D-02		30BR-02		31S-02		31I-02		32S-02		32I-02	
		Temp. (F)	52.5	Q	49.0	Q	49.0	Q	47.2	Q	51.2	Q	47.4	Q	50.3	Q	51.6	Q	48.5	Q
		Sp. Cond. +	1031	U	731	U	731	U	596	U	825	U	336	U	381	U	1490	U	890	U
		pH	6.87	A	7.12	A	7.12	A	7.31	A	7.43	A	7.4	A	7.35	A	9.25	A	8.03	A
		Dilution Factor	1.0	L	50	L	1.0(50)	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L
		EPA Sample	ESA44		ESA45		ESA46		ESA47		ESA48		ESA36		ESA37		ESA49		ESA50	
		Sample Date	11/18/92		11/18/92		11/18/92		11/18/92		11/18/92		11/18/92		11/18/92		11/18/92		11/18/92	
CRQL	VOLATILE ORGANICS				**		**													
10	chloromethane			U		U		U		U		U		U		U		U		U
10	bromomethane			U		U		U		U		U		U		U		U		U
10	vinyl chloride			U		U		U		U		U		U		U		U		U
10	chloroethane			U		U		U		U		U		U		U		U		U
10	methylene chloride			U	500	BDJ		U		U		U		U		U		U		U
10	acetone			U		U		U		U		U		U		U		U	18	
10	carbon disulfide			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethene			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethene (total)		4	J		U	3	J		U		U		U		U		U		U
10	chloroform			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethane			U		U		U		U		U		U		U		U		U
10	2-butanone (MEK)			U		U		U		U		U		U		U		U		U
10	1,1,1-trichloroethane			U		U		U		U		U		U		U		U		U
10	carbon tetrachloride			U		U		U		U		U		U		U		U	1	J
10	bromodichloromethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloropropane			U		U		U		U		U		U		U		U		U
10	cis-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	trichloroethene		170	J	6700	BD	(7900)	BD	21	UB		U		U		U	10	BJU	59	
10	dibromochloromethane			U		U		U		U		U		U		U		U		U
10	1,1,2-trichloroethane			U		U		U		U		U		U		U		U		U
10	benzene			U		U		U		U		U		U		U		U		U
10	trans-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	bromoform			U		U		U		U		U		U		U		U		U
10	4-methyl-2-pentanone			U		U		U		U		U		U		U		U		U
10	2-hexanone			U		U		U		U		U		U		U		U		U
10	tetrachloroethene		8	J		U		U		U		U		U		U	3	J		U
10	1,1,2,2-tetrachloroethane			U		U		U		U		U		U		U		U		U
10	toluene			U		U		U		U		U		U		U		U		U
10	chlorobenzene			U		U		U		U		U		U		U		U		U
10	ethylbenzene			U		U		U		U		U		U		U		U		U
10	styrene			U		U		U		U		U		U		U		U		U
10	xylenes (total)			U		U		U		U		U		U		U		U		U

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
+ = (umhos/cm)
( ) = Dilution Factor that corresponds with sample result in ( )

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL SITE PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

CRQL	VOLATILE ORGANICS			Q		Q		Q		Q		Q		Q		Q		Q		Q
		Sample No.	33S-02		33I-02		34I-02		34ID-02		35S-02		36I-02		37S-02		37D-02		38S-02	
		Temp. (F)	51.4	U	50.0	U	50.1	U	50.1	U	50.5	U	50.0	U	52.1	U	47.7	U	52.0	U
		Sp. Cond. +	746	A	670	A	524	A	524	A	835	A	1293	A	699	A	8600	A	555	A
		pH	8.04	L	8.25	L	7.1	L	7.1	L	6.86	L	7.24	L	8.42	L	7.84	L	7.76	L
		Dilution Factor	1.0		1.0		1.0(5.0)		1.0(5.0)		1.0		1.0(2.0)		1.0		1.0(3.3)		1.0(5.0)	
		EPA Sample	ESA51		ESA52		ESA42		ESA43		ESA38		ESA53		ESA60		ESA61		ESA62	
		Sample Date	11/18/92		11/18/92		11/18/92		11/18/92		11/18/92		11/18/92		11/19/92		11/19/92		11/19/92	
							**		**											
10	chloromethane			U		U		U		U		U		U		U		U		U
10	bromomethane			U		U		U		U		U		U		U		U		U
10	vinyl chloride			U		U		U		U		U		U		U		U		U
10	chloroethane			U		U		U		U		U		U		U		U		U
10	methylene chloride			U		U		U		U		U		U		U		U		U
10	acetone			U		U		U		U		U	29			U		U	18	
10	carbon disulfide			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethene			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethene (total)			U		U	45		86			U	9	J		U		U		U
10	chloroform			U		U		U		U		U		U		U	9	J	18	
10	1,2-dichloroethane			U		U		U		U		U		U		U		U		U
10	2-butanone (MEK)			U		U		U		U		U		U		U		U		U
10	1,1,1-trichloroethane			U		U		U		U		U		U		U		U		U
10	carbon tetrachloride			U		U		U		U		U		U	12		51		(600)	D
10	bromodichloromethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloropropane			U		U		U		U		U		U		U		U		U
10	cis-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	trichloroethene			U		U	(580)	BD	(730)	BD	3	J	(280)	D	16		(360)	D	77	
10	dibromochloromethane			U		U		U		U		U		U		U		U		U
10	1,1,2-trichloroethane			U		U		U		U		U		U		U		U		U
10	benzene			U		U		U		U		U		U		U		U		U
10	trans-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	bromoform			U		U		U		U		U		U		U		U		U
10	4-methyl-2-pentanone			U		U		U		U		U		U		U		U		U
10	2-hexanone			U		U		U		U		U		U		U		U		U
10	tetrachloroethene			U		U	3	J	3	J		U		U		U		U		U
10	1,1,2,2-tetrachloroethane			U		U		U		U		U		U		U		U		U
10	toluene			U	1	J		U		U		U		U		U		U		U
10	chlorobenzene			U		U		U		U		U		U		U		U		U
10	ethylbenzene			U		U		U		U		U		U		U		U		U
10	styrene			U		U		U		U		U		U		U		U		U
10	xylenes (total)			U		U		U		U		U		U		U		U		U

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
+ = (umhos/cm)
( ) = Dilution Factor that corresponds with sample result in ( )

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL SITE PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

		Sample No.	38D-02		38DD-02		39-02		40-02		41-02		41D-02		42I-02		43S-02		43BR-02	
		Temp. (F)	47.7	Q	47.7	Q	53.5	Q	52.5	Q	50.2	Q	50.2	Q	51.9	Q	55.0	Q	52.0	Q
		Sp. Cond. +	542	U	542	U	1364	U	1069	U	742	U	742	U	759	U	469	U	606	U
		pH	8.15	A	8.15	A	7.47	A	7.69	A	7.98	A	7.98	A	8.06	A	7.05	A	10.56	A
		Dilution Factor	1.0(2.0)	L	1.0(2.0)	L	1.0	L	1.0	L	1.0(100.0)	L	1.0(100)	L	1.0	L	1.0	L	5.0	L
		EPA Sample	ESA63		ESA64		ESA19		ESA57		ESA66		ESA67		ESA68		ESA27		ESA28	
		Sample Date	11/19/92		11/19/92		11/17/92		11/17/92		11/19/92		11/19/92		11/19/92		11/17/92		11/17/92	
CRQL	VOLATILE ORGANICS		**		**						**		**						**	
10	chloromethane			U		U		U		U		U	10	UJ	10	UJ		U		U
10	bromomethane			U		U		U		U		U		U		U		U		U
10	vinyl chloride			U		U		U		U		U		U		U		U		U
10	chloroethane			U		U		U		U		U	10	UJ		U		U		U
10	methylene chloride			U		U		U		U		U	2	J		U		U		U
10	acetone		3	J		U		U		U	54			U		U		U		U
10	carbon disulfide			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethene			U		U		U		U	42		38			U		U		U
10	1,1-dichloroethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethene (total)			U		U		U		U	180		170			U		U		U
10	chloroform		170		180			U	2	J		U	2	J	2	J		U		U
10	1,2-dichloroethane			U		U		U		U		U		U		U		U		U
10	2-butanone (MEK)			U		U		U		U		U		U		U		U		U
10	1,1,1-trichloroethane			U		U		U		U		U		U		U		U		U
10	carbon tetrachloride		(2900)	D	(3200)	D		U	22		2	J	8	J	150			U		U
10	bromodichloromethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloropropane			U		U		U		U		U		U		U		U		U
10	cis-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	trichloroethene			U		U		U		U	(15000)	D	(15000)	D	12			U	450	D
10	dibromochloromethane			U		U		U		U		U		U		U		U		U
10	1,1,2-trichloroethane			U		U		U		U		U		U		U		U		U
10	benzene			U		U		U		U		U		U		U		U		U
10	trans-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	bromoform			U		U		U		U		U		U		U		U		U
10	4-methyl-2-pentanone			U		U		U		U		U		U		U		U		U
10	2-hexanone			U		U		U		U		U		U		U		U		U
10	tetrachloroethene			U		U		U		U		U		U		U		U		U
10	1,1,2,2-tetrachloroethane			U		U		U		U		U		U		U		U		U
10	toluene			U		U		U		U		U		U		U		U		U
10	chlorobenzene			U		U		U		U		U		U		U		U		U
10	ethylbenzene			U		U		U		U		U	10	UJ		U		U		U
10	styrene			U		U		U		U		U		U		U		U		U
10	xylenes (total)			U		U		U		U		U		U		U		U		U

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
+ = (umhos/cm)
( ) = Dilution Factor that corresponds to sample result in ( ).

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL SITE PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

		Sample No.	43BRD-02		44D-02		B1-01		B2-01		B3-01		B4-01		B5-01		B6-01		B7-01	
		Temp. (F)	52.0	Q	52.0	Q	NA	Q	NA	Q	NA	Q	NA	Q	NA	Q	NA	Q	NA	Q
		Sp. Cond. +	808	U	905	U	NA	U	NA	U	NA	U	NA	U	NA	U	NA	U	NA	U
		pH	10.56	A	7.61	A	NA	A	NA	A	NA	A	NA	A	NA	A	NA	A	NA	A
		Dilution Factor	5.0	L	1.0(10)	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L	1.0	L
		EPA Sample	ESA29		ESA65		ESA75		ESA76		ESA77		ESA78		ESA79		ESA80		ESA81	
		Sample Date	11/17/92		11/17/92		11/16/92		11/16/92		11/17/92		11/18/92		11/18/92		11/18/92		11/19/92	
CRQL	VOLATILE ORGANICS																			
10	chloromethane			U		U		U		U		U		U		U		U	10	UJ
10	bromomethane			U		U		U		U		U		U		U		U		U
10	vinyl chloride			U		U		U		U		U		U		U		U		U
10	chloroethane			U		U		U		U		U		U		U		U		U
10	methylene chloride			U		U		U		U		U		U		U		U		U
10	acetone			U		U		U		U		U		U		U		U		U
10	carbon disulfide			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethene			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethene (total)			U		U		U		U		U		U		U		U		U
10	chloroform			U	37			U		U		U		U		U		U		U
10	1,2-dichloroethane			U		U		U		U		U		U		U		U		U
10	2-butanone (MEK)			U		U		U		U		U		U		U		U		U
10	1,1,1-trichloroethane			U		U		U		U		U		U		U		U		U
10	carbon tetrachloride			U	(650)	D		U		U		U		U		U		U		U
10	bromodichloromethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloropropane			U		U		U		U		U		U		U		U		U
10	cis-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	trichloroethene		360	D	34			U		U		U		U		U		U		U
10	dibromochloromethane			U		U		U		U		U		U		U		U		U
10	1,1,2-trichloroethane			U		U		U		U		U		U		U		U		U
10	benzene			U		U		U		U		U		U		U		U		U
10	trans-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	bromoform			U		U		U		U		U		U		U		U		U
10	4-methyl-2-pentanone			U		U		U		U		U		U		U		U		U
10	2-hexanone			U		U		U		U		U		U		U		U		U
10	tetrachloroethene			U		U		U		U		U		U		U		U		U
10	1,1,2,2-tetrachloroethane			U		U		U		U		U		U		U		U		U
10	toluene			U		U		U		U		U		U	1	J		U		U
10	chlorobenzene			U		U		U		U		U		U		U		U		U
10	ethylbenzene			U		U		U		U		U		U		U		U		U
10	styrene			U		U		U		U		U		U		U		U		U
10	xylenes (total)			U		U		U		U		U		U		U		U		U

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
+ = (umhos/cm)
( ) = Dilution Factor that corresponds to sample result in ( ).

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL SITE PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

		Sample No.	TB1-01		TB2-01		TB3-01		TB4-01													
		Temp. (F)	NA	Q	NA	Q	NA	Q	NA	Q		Q		Q		Q		Q		Q		Q
		Sp. Cond. +	NA	U	NA	U	NA	U	NA	U		U		U		U		U		U		U
		pH	NA	A	NA	A	NA	A	NA	A		A		A		A		A		A		A
		Dilution Factor	1.0	L	1.0	L	1.0	L	1.0	L		L		L		L		L		L		L
		EPA Sample	ESA82		ESA83		ESA84		ESA85													
		Sample Date	11/16/92		11/17/92		11/18/92		11/19/92													
CRQL	VOLATILE ORGANICS																					
10	chloromethane			U		U		U	10	UJ												
10	bromomethane			U		U		U		U												
10	vinyl chloride			U		U		U		U												
10	chloroethane			U		U		U		U												
10	methylene chloride			U		U		U		U												
10	acetone			U		U		U		U												
10	carbon disulfide			U		U		U		U												
10	1,1-dichloroethene			U		U		U		U												
10	1,1-dichloroethane			U		U		U		U												
10	1,2-dichloroethene (total)			U		U		U		U												
10	chloroform			U		U		U		U												
10	1,2-dichloroethane			U		U		U		U												
10	2-butanone (MEK)			U		U		U		U												
10	1,1,1-trichloroethane			U		U		U		U												
10	carbon tetrachloride			U		U		U		U												
10	bromodichloromethane			U		U		U		U												
10	1,2-dichloropropane			U		U		U		U												
10	cis-1,3-dichloropropene			U		U		U		U												
10	trichloroethene			U		U		U		U												
10	dibromochloromethane			U		U		U		U												
10	1,1,2-trichloroethane			U		U		U		U												
10	benzene			U		U		U		U												
10	trans-1,3-dichloropropene			U		U		U		U												
10	bromoform			U		U		U		U												
10	4-methyl-2-pentanone			U		U		U		U												
10	2-hexanone			U		U		U		U												
10	tetrachloroethene			U		U		U		U												
10	1,1,2,2-tetrachloroethane			U		U		U		U												
10	toluene			U		U		U		U												
10	chlorobenzene			U		U		U		U												
10	ethylbenzene			U		U		U		U												
10	styrene			U		U		U		U												
10	xylenes (total)			U		U		U		U												

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
+ = (umhos/cm)
( ) = Dilution Factor that corresponds with sample result in ( )

DATA SUMMARY FORM: VOLATILES

GROUNDWATER
(ug/L)

CONRAIL PHASE III

Sample Quantitation Limits:
(CRQL x Dilution Factor)

CRQL	VOLATILE ORGANICS	Sample No.	07D-01	QUAL	45-01	QUAL	46S-01	QUAL	46S-01D	QUAL	46I-01	QUAL	47-01	QUAL	48-01	QUAL	49D-01	QUAL	49BR-01	QUAL
		Dilution Factor	10.0		1.0		1.0(620)		1.0(500)		1.0		10		1.0		1.0		1.0	
		Temp. (F)																		
		Sp. Cond. +																		
		pH																		
		EPA Sample	ERZ66		ERZ57		ERZ58		ERZ67		ERZ59		ERZ60		ERZ61		ERZ62		ERZ63	
		Sample Date	1/27/93		1/26/93		1/26/93		1/26/93		1/26/93		1/26/93		1/26/93		1/26/93		1/26/93	
							**		**											
10	chloromethane			U		U	140		8	J		U		U		U		U		U
10	bromomethane			U		U	7	J	4	J		U		U		U		U		U
10	vinyl chloride			U		U		U		U		U		U		U		U		U
10	chloroethane			U		U		U		U		U		U		U		U		U
10	methylene chloride			U		U	30		9	J		U		U	1	J	1	J		U
10	acetone			U		U		U		U		U		U		U		U		U
10	carbon disulfide			U		U	3	J	3	J		U		U		U		U		U
10	1,1-dichloroethene			U		U		U		U		U		U		U		U		U
10	1,1-dichloroethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloroethene (total)			U		U		U		U		U		U		U		U		U
10	chloroform			U	4	J	600	EJ	450	EJ		U		U		U		U		U
10	1,2-dichloroethane			U		U		U		U		U		U		U		U		U
10	2-butanone (MEK)			U		U		U		U		U		U		U		U		U
10	1,1,1-trichloroethane			U		U		U		U		U		U		U		U		U
10	carbon tetrachloride		60	J	76		(110000)	D	(79000)	D	3	J	37	J	13		1	J	47	
10	bromodichloromethane			U		U		U		U		U		U		U		U		U
10	1,2-dichloropropane			U		U		U		U		U		U		U		U		U
10	cis-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	trichloroethene		1100		3	J	1	J	9	J	26		1100		1	J	8	J	20	
10	dibromochloromethane			U		U		U		U		U		U		U		U		U
10	1,1,2-trichloroethane			U		U		U		U		U		U		U		U		U
10	benzene			U		U		U		U		U		U		U		U		U
10	trans-1,3-dichloropropene			U		U		U		U		U		U		U		U		U
10	bromoform			U		U		U		U		U		U		U		U		U
10	4-methyl-2-pentanone			U		U		U		U		U		U		U		U		U
10	2-hexanone			U		U		U		U		U		U		U		U		U
10	tetrachloroethene			U		U		U		U	5	J		U		U		U		U
10	1,1,2,2-tetrachloroethane			U		U		U		U		U		U		U		U		U
10	toluene			U		U		U		U		U		U		U		U		U
10	chlorobenzene			U		U		U		U		U		U		U		U		U
10	ethylbenzene			U		U		U		U		U		U		U		U		U
10	styrene			U		U		U		U		U		U		U		U		U
10	xylenes (total)			U		U		U		U		U		U		U		U		U

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
+ = (umhos/cm)
( ) = Dilution Factor that corresponds with sample result in ( ).

CONRAIL PHASE III

GROUNDWATER
(ug/L)

Sample Quantitation Limits
(CRQL x Dilution Factor)

		Sample No.	50-01		51-01		51-01D		B1-01		TB1-01		TB2-01							
		Dilution Factor	2.0	Q	1.0(12)	Q	12.0	Q	1.0	Q	1.0	Q	1.0	Q		Q		Q		Q
		Temp. (F)		U		U		U		U	NA	U	NA	U		U		U		U
		Sp. Cond. +		A		A		A		A	NA	A	NA	A		A		A		A
		pH		L		L		L		L	NA	L	NA	L		L		L		L
		EPA Sample	ERZ64		ERZ65		ERZ68		ERZ71		ERZ69		ERZ70							
		Sample Date	1/27/93		1/26/93		1/26/93		1/27/93		1/26/93		1/27/93							
CRQL	VOLATILE ORGANICS				**		**													
10	chloromethane			U		U		U		U		U		U						
10	bromomethane			U		U		U		U		U		U						
10	vinyl chloride			U	8	J		U		U		U		U						
10	chloroethane			U		U		U		U		U		U						
10	methylene chloride			U		U		U	1	J		U		U						
10	acetone			U	10			U		U		U		U						
10	carbon disulfide			U		U		U		U		U		U						
10	1,1-dichloroethene			U		U		U		U		U		U						
10	1,1-dichloroethane			U		U		U		U		U		U						
10	1,2-dichloroethene (total)			U	57		54	J		U		U		U						
10	chloroform		6	J		U		U		U		U		U						
10	1,2-dichloroethane			U		U		U		U		U		U						
10	2-butanone (MEK)			U		U		U		U		U		U						
10	1,1,1-trichloroethane			U		U		U		U		U		U						
10	carbon tetrachloride		250			U	42	J		U		U	2	J						
10	bromodichloromethane			U		U		U		U		U		U						
10	1,2-dichloropropane			U		U		U		U		U		U						
10	cis-1,3-dichloropropene			U		U		U		U		U		U						
10	trichloroethene		84		(2200)	D	2400			U		U		U						
10	dibromochloromethane			U		U		U		U		U		U						
10	1,1,2-trichloroethane			U		U		U		U		U		U						
10	benzene			U		U		U		U		U		U						
10	trans-1,3-dichloropropene			U		U		U		U		U		U						
10	bromoform			U		U		U		U		U		U						
10	4-methyl-2-pentanone			U		U		U		U		U		U						
10	2-hexanone			U		U		U		U		U		U						
10	tetrachloroethene			U		U		U		U		U		U						
10	1,1,2,2-tetrachloroethane			U		U		U		U		U		U						
10	toluene			U		U		U		U		U		U						
10	chlorobenzene			U		U		U		U		U		U						
10	ethylbenzene			U		U		U		U		U		U						
10	styrene			U		U		U		U		U		U						
10	xylenes (total)			U		U		U		U		U		U						

CRQL = Contract Required Quantitation Limits (OLM01.8)
** = Duplicates
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