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July 1994

EPA Superfund Record of Decision:

Diamond Shamrock Landfill Site, Cedartown, GA

RECORD OF DECISION

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

DIAMOND SHAMROCK LANDFILL SITE

CEDARTOWN, POLK COUNTY, GEORGIA

PREPARED BY

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ATLANTA, GEORGIA

DECLARATION
of the
RECORD OF DECISION

SITE NAME AND LOCATION

Diamond Shamrock Landfill Site
Cedartown, Polk County, Georgia

STATEMENT OF BASIS AND PURPOSE

This decision document (Record of Decision), presents the selected remedy for the Diamond Shamrock Landfill Site, Cedartown, Georgia, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. § 9601 et seq., and to the extent practicable, the National Contingency Plan (NCP), 40 CFR Part 300.

This decision is based on the administrative record for the Diamond Shamrock Landfill Site.

The State of Georgia concurs with the selected remedy.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE SELECTED REMEDY

This action is the final action planned for the Site. This alternative calls for implementation of response measures which will protect human health and the environment. The action addresses source and ground water contamination at the Site.

The major components of the selected remedy include:

- Implementation of deed restriction(s) or restrictive covenant(s) to prevent ground water usage and drilling resulting in exposure to ground water contaminants;

- Completion and maintenance of Site access restrictions (fencing and signage);

- Ground and surface water monitoring program to confirm that natural attenuation processes are effective and that contaminants would not migrate;

- Performance of five year reviews in accordance with Section 121(c) of CERCLA to assure that human health and the environment continue to be protected by the remedy, that natural attenuation continues to be effective, and whether ground water performance standards continue to be appropriate; and,

- Continued ground water monitoring upon attainment of the performance standards at sampling intervals to be approved by EPA. The ground water monitoring program would continue until EPA approves a five-year review concluding that the alternative has achieved continued attainment of the performance standards and remains protective of human health and the environment.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate, and is cost-effective. Because the treatment of ground water was not found to be practicable nor cost effective, this remedy does not satisfy the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Finally, it is determined that this remedy utilizes a permanent solution and treatment technology to the maximum extent practicable.

Because this remedy may result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of the remedy to ensure that the remedy continue to provide adequate protection of human health and the environment.

Patrick M Tobin for 5-3-94

JOHN H. HANKINSON, Jr., REGIONAL ADMINISTRATOR DATE

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Diamond Shamrock Landfill Site
Cedartown, Georgia

1.0 SITE LOCATION AND DESCRIPTION

The Diamond Shamrock Site comprises approximately 8 acres of land near the northwest margin of the town of Cedartown, in Polk County, Georgia. The site is located north of West Girard Avenue, adjacent to and east of Cedar Creek and is owned by Henkel Corporation as shown in Figures 1-1 and 1-2.

The areas immediately surrounding the site include the Cedartown Wastewater Treatment Plant approximately 300 yards north of the site and Henkel's wastewater treatment plant (Henkel WWTP) to the east (south of the access road and biotreatment cell areas). Beyond Henkel's WWTP to the east the land is primarily residential with the closest residences about 700 feet away from the site. Land to the south and east is largely residential with some commercial business and light industry. Much of the area to the north and northwest is rural, although the Cedartown wastewater treatment plant is located 300 yards to the north. The land immediately to the west is undeveloped and leads into predominately agricultural and industrial areas. The nearest residence to the west is approximately 1,000 feet from the site.

The property is primarily a meadow, becoming forested to the north and to the west along Cedar Creek. While the site is predominantly vegetated, a few small bare spots exist in the field. The property is relatively flat, ranging from 762 to 768 feet above sea level, with a broad swale bisecting the area and running from east to west.

The property is surrounded on three sides by a chain-link fence. Some gaps exist in the fence which can potentially allow access onto the site. The fourth side, to the west, is bounded by dense vegetation and Cedar Creek. The vegetation and a steep bank between the creek and the former trench areas make access to the site from the creek difficult though not impossible. Currently, workers visit the site periodically to cut the grass. Other than the grounds maintenance, no other activities occur at the site.

FINAL

FIGURE 1-1: LOCATION MAP

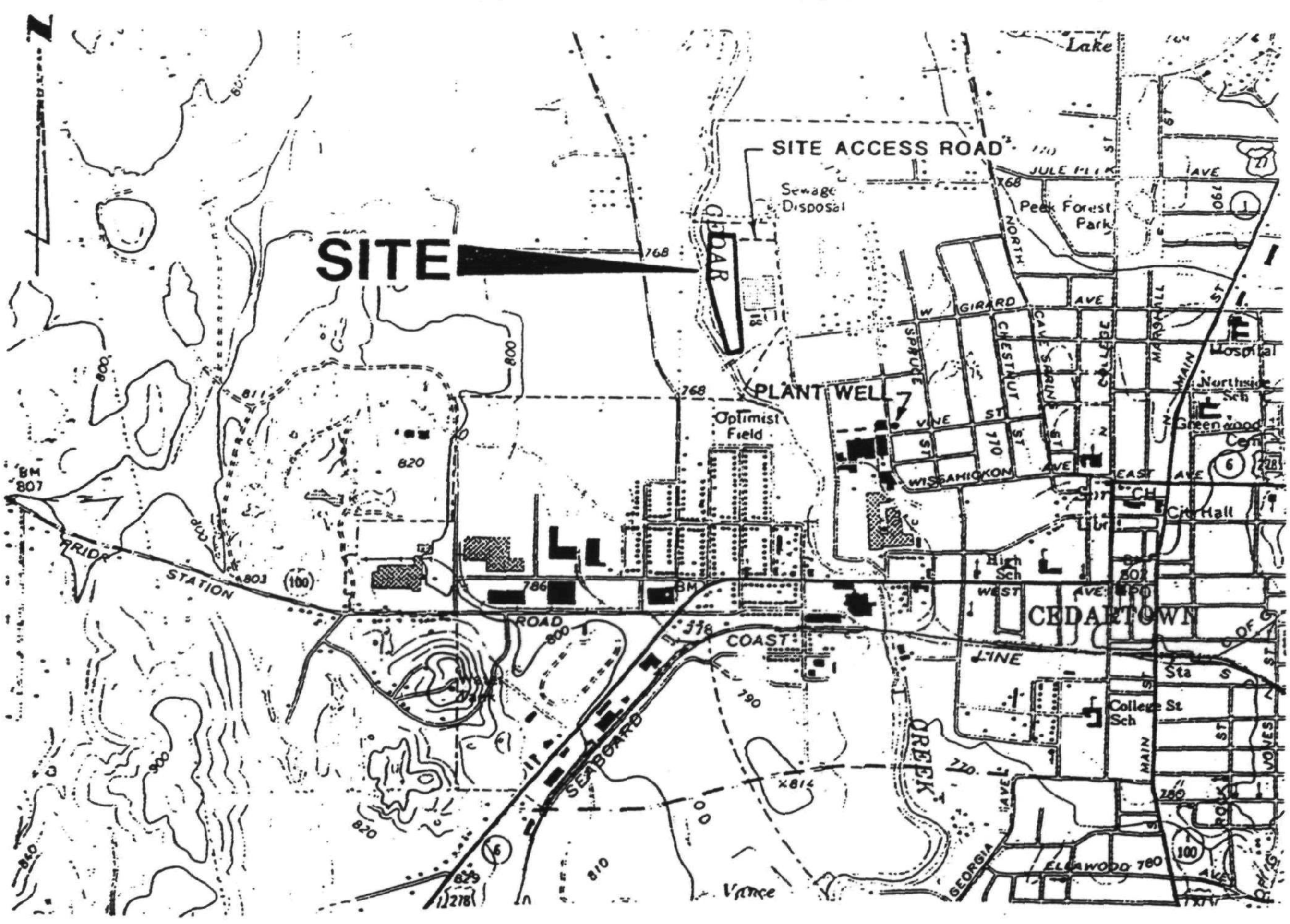
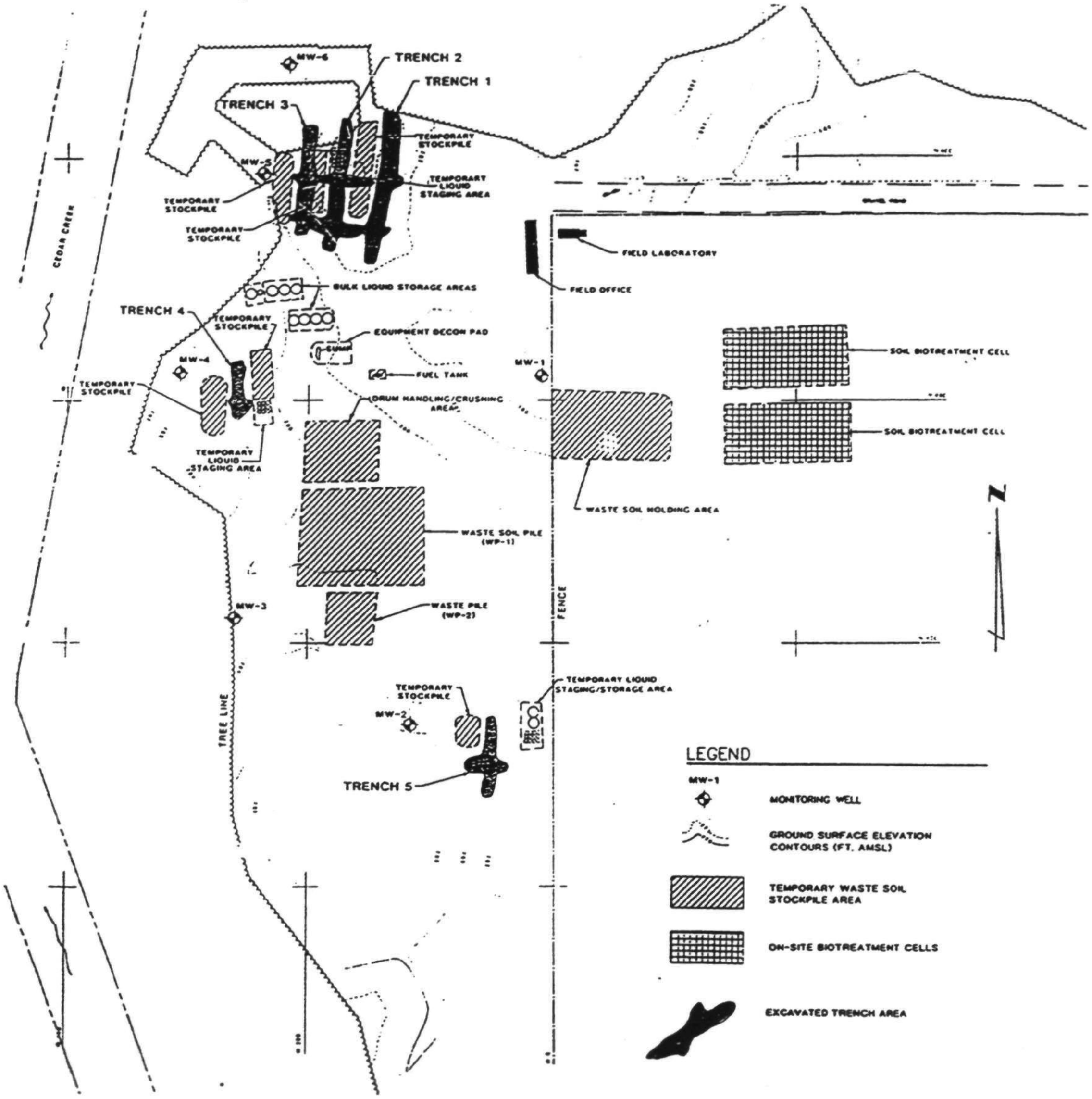


FIGURE 1-2: SITE MAP



2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Prior to 1968, the land use of the Site area included agricultural activities. In 1972, approximately 1,500 gallons of oil pitch and 600 to 800 drums containing reportedly obsolete, off-specification products and raw materials from chemical plant manufacturing operations were buried in unlined disposal trenches at the Diamond Shamrock Site.

On June 27, 1980, the Diamond Shamrock Corporation (DSC) which was the owner/operator reported to Georgia Environmental Protection Division (EPD) of the Department of Natural Resources the results of an internal investigation concerning waste material buried on Site. DSC reported that between 600 and 800 drums and approximately 1,500 gallons of material were buried at the Site.

Henkel Corporation acquired the property in 1987.

During March 1988, USEPA performed soil sampling, geophysical studies and an environmental assessment at the site. Four trench areas were approximately defined with a ground magnetometer survey, and soil samples were collected and split with Henkel.

In July of 1989, Henkel conducted a test excavation/waste characterization study which identified five drum/waste disposal areas. These disposal areas comprised less than one tenth of an acre and consisted of five trenches that were about 6 feet wide and from 6 to 14 feet in depth. The test excavation program identified that migration of waste into adjacent soils was limited to approximately 1 to 3 feet.

During September and October 1989, Henkel performed initial hydrogeologic investigations. Field work included the decommissioning of four old monitoring wells, the drilling of seven continuously sampled soil test borings, and the installation of six groundwater monitoring wells.

Under the direction of U.S. EPA Region IV, an interim waste removal project was completed in the fall of 1990, in which trench waste materials were removed for treatment/disposal under EPA oversight. The trenches were then backfilled with compacted clay-rich soils. Post-closure and surface soil samples were collected around the trench and soil/waste holding areas.

Henkel performed additional site characterization investigations during the RI/FS field work in the summer of 1992 to supplement the previous investigations. Two subsurface soil samples were collected to supplement the trench closure samples, one near the entrance to the access road to characterize background levels. Four more monitoring wells were installed and sampled along with the original six wells. Surface soil samples were collected around the trench and holding areas. Six surface water and sediment samples were collected from Cedar Creek to characterize current conditions in these media.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

All basic requirements for public participation under CERCLA sections 113(k)(2)(B)(i-v) and 117, were met in the remedy selection process. Because the local community has been interested and involved in the Cedartown Superfund Sites including Diamond Shamrock Landfill Site during the remedial activities at this Site, community relations activities remained an important aspect throughout the remedial process. The community relations program at the Site was designed to maintain communication between the residents in the affected community and the government agencies conducting remedial activities at the Diamond Shamrock Landfill Site. Frequent communication with nearby residents and local officials has been maintained as a priority. Special attention has been directed toward keeping the community informed of all study results. EPA officials attended a local Chamber of Commerce public forum and a Kiwanis Club meeting in 1991. In addition, a meeting was held with the community at an availability session in the Winter of 1991 to inform residents of EPA's intentions for the RI/FS.

On March 22, 1994, after the finalization of the Remedial Investigation (RI) Report and the completion of the Feasibility Study (FS), EPA presented its preferred remedy for the Diamond Shamrock Landfill Site during a public meeting on March 22, 1994, at the Cedartown Public Library, 245 East Avenue, Cedartown, Georgia. The 30-day public comment period was held March 4, through April 4, 1994. A copy of the Administrative Record, upon which the remedy was based, is located at the Cedartown Public Library, 245 East Avenue, Cedartown, Georgia 31701. EPA's responses to the comments received during the comment period are contained in Appendix A.

4.0 SCOPE AND ROLE OF ACTION

This selected remedy is the first and final remedial action for the Site. The function of this remedy is to reduce the risks associated with exposure to contaminated ground water.

The selected remedial alternative will address the following condition which poses a threat to human health and the environment:

- Contaminated ground water (may potentially impact drinking water supplies).

The pathway of exposure is the ingestion of contaminated ground water.

The major components of the remedy are:

- Implementation of deed restriction(s) or restrictive covenant(s) to prevent ground water usage and drilling resulting in exposure to ground water contaminants;

- Completion and maintenance of Site access restrictions (fencing and signage);

- Ground and surface water monitoring program to confirm that natural attenuation processes are effective and that contaminants would not migrate;

- Performance of five year reviews in accordance with Section 121(c) of CERCLA to assure that human health and the environment continue to be protected by the remedy, that natural attenuation continues to be effective, and whether ground water performance standards continue to be appropriate; and,

- Continued ground water monitoring upon attainment of the performance standards at sampling intervals to be approved by EPA. The ground water monitoring program would continue until EPA approves a five-year review concluding that the alternative has achieved continued attainment of the performance standards and remains protective of human health and the environment.

This remedy is the first and final cleanup action planned for the Site. The ground water present beneath the Site contains elevated levels of contaminants. Although this water bearing zone is affected, the contamination is not affecting the public drinking water supply (Cedartown Springs). The purpose of this proposed action is to prevent future exposure to contaminated ground water.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 METEOROLOGY

Mean monthly temperatures for Cedartown, Georgia range from 42 degrees Fahrenheit (°F) for January to 79°F during July and August. Record extreme temperatures range between 106°F to -5°F (NOAA, 1978). The mean annual rainfall in the area is approximately 52 inches. The wettest months of the year are normally from December to April (averaging 4.6 inches to 5.9 inches per month) with the driest months of the year typically from August to November (averaging 2.9 inches to 3.9 inches per month). Snowfall occurs occasionally during winter months with maximum accumulations between 6 inches to 8.3 inches. The 24-hour rainfall intensity for the 100-year storm is approximately 8 inches.

5.2 PHYSIOGRAPHY

The Diamond Shamrock Site is located in the Southeastern Mixed Forest Province ecoregion. Forests of the region are characterized by broadleaf deciduous and needleleaf evergreens. The former waste trench area is predominately a meadow, intermingled with some deciduous trees and a few large coniferous trees. Forests occur to the west along Cedar Creek and north towards the Cedartown waste treatment plant.

The Site area is relatively flat, with elevations ranging from approximately 768 feet above mean sea level (MSL) along the east margin of the Site to 762 feet MSL along the west margin of the Site, near Cedar Creek. A broad relatively flat swale bisects the Site, running approximately east to west.

Most of the Site is fenced; however, there are gaps between the northern fence and the eastern fence, the southern fence and Cedar Creek, and the northern fence and Cedar Creek. Thus, movement of trespassers and wildlife into and out of the area is possible.

Cedar Creek, which forms the western border of the site, is surrounded by dense vegetation on both sides. It is approximately 10 meters wide with an average depth of 1 to 2 meters, and is a potential swimming site. The Cedartown area is also drained by Cedar Creek and its tributaries.

5.3 GEOLOGY

REGIONAL

The Cedartown area is located in the Valley and Ridge Physiographic Province of the southern Appalachians. Cedartown lies near the margin of the province that is demarcated by the Cartersville vault (Cressler, 1970), located approximately seven miles south and southeast of Cedartown. The Valley and Ridge province is characterized by numerous elongated ridges and intervening valleys, that trend in a general northeast-southwest direction, as a result of folding and vaulting.

The Newala Limestone formation, which is part of the Knox Group, is the predominant bedrock geologic stratum in the Cedartown area. Bedding within the Newala is generally thick to massive, with some beds containing sandy zones.

The Site area is located near the axis of a broad north-trending syncline, which explains why the younger Newala Limestone is surrounded by older rocks of the Knox Group. The Knox Group, including the Newala Limestone, is prone to karst solutioning. Many of the small lakes and ponds in the area are expressions of sinkhole features.

Bedrock in the area is typically covered by residual soils that generally range in thickness from 8 feet to 14 feet. However, solutioning/weathering of the limestone bedrock results in localized thickness variations, with soils being absent at isolated rock outcrops to being over 35 feet thick near solution features.

Residual soils derived from the in-place weathering of Newala Limestone generally consist of silty-clays, or clays with variable amounts of sand and silt. Alluvial soils may be found in the area, but are primarily restricted to streambanks or the floodplains of streams and rivers. Alluvial soils generally consist of fine sand and clayey silt.

SITE

Structural geologic mapping within a 2-mile radius of the site was conducted on May 29, 1992. The two units which primarily underlie the area mapped, Knox Group and Newala Limestone, are generally deeply weathered, consequently a paucity of outcrops was available for measurement. Significant discontinuities were measured in nine fresh to saprolitic outcrops. The dominant types of fractures characterized were joints. Joint sets typically displayed spacing of a few inches to several feet along an outcrop and commonly showed evidence of water flow, as indicated by surface stains or staining haloes parallel to the fracture. The joints are commonly infilled with clay; however, locally dilated joints have remained open.

Sparse bedding and cleavage measurements were obtained during field mapping. Where measured, cleavage is oriented N30°E to N40°E with a wide distribution in dip. Bedding measured in one outcrop was oriented N40°E, 64°SE. The dip of bedding is most likely highly variable near this area due to proximity of the site to two major structural features, the Cartersville vault to the south and a related synclinal structure near the site.

Evidence of karstic features was observed during field mapping. These features are characterized as broad-based, shallow sink holes. As described above, the joint sets were dominantly near-vertically oriented near the Site. In lithologies where solutioning is controlled primarily by vertical joints, steep-walled, narrow sink holes typically develop. Based on the morphology of the sink holes observed near the site, bedding-controlled karstic solutioning may be more active than joint-controlled solutioning. Solution features are controlled by the distribution of joints or open fractures. The degree of solutioning within the limestone is likely to increase toward Cedar Creek. This phenomenon commonly occurs in limestone terrains as a result of the rise and fall of the creek levels, which cause fluctuations in groundwater levels and, thus, enhance the degree of solutioning.

Samples of Newala Limestone were retrieved. The Newala observed in core samples is gray to light gray, moderately hard to very hard, massive, finely crystalline (sparry) limestone, and is prone to karst solutioning.

Test borings and excavation data indicate that the contact between the limestone and residual soils occurs within a transition zone that is relatively thin (generally less than one foot), and contains small voids, cobbles and gray silty clay. This weathered transition zone between the rock and soil appears to be more permeable than the overlying clays. Groundwater is generally encountered near this transition zone.

5.4 SOILS AND OVERBURDEN

Overburden soils encountered at the Site consisted primarily of residual silty clays. These soils were derived from the in-place weathering of the Newala Limestone. Thin lenses of silty clayey sands have been encountered at the southern end of the site near the Henkel wastewater treatment plant and at the northern end of the site. The thickness of overburden soils on the Site range from zero feet to over 65 feet.

Grain size distribution data and laboratory permeability test results on overburden silty clay soils (Golder Associates, 1990b) demonstrate that residual soils have a low saturated hydraulic conductivity of approximately 7×10^{-8} centimeters per second (cm/s), and are, thus, relatively low permeable materials. These fine-grained, cohesive soils would tend to minimize the migration of site waste constituents in soil.

In-situ permeability testing generally confirms the relatively low permeability of the overburden soils, although hydraulic conductivity values derived using grain size distribution and laboratory permeability testing are lower. The methodology utilized to test the overburden permeability produced an average value for the hydraulic conductivity of the material intercepted by the borehole. The average hydraulic conductivity values for the materials intercepted ranged from 4×10^{-6} cm/s to 1×10^{-4} cm/s (B-104). The relatively high average hydraulic conductivity shown in B-104 is probably the result of the occurrence of the fine to medium sand intercepted near the bottom of this boring.

5.5 SURFACE HYDROLOGY

The Cedartown area is drained by Cedar Creek and its tributaries, which are part of the Mobile River basin (USGS, 1988). Cedar Creek flows north along the west margin of the site and eventually flows into the Coosa River approximately 14 miles from the site. Measured creek flows vary considerably, indicating substantial run-off and probable discharge through solutioned limestone. Ground water elevations measured at the Site are higher than the water level in the stream (except during periods of heavy precipitation), indicating that Cedar Creek is a gaining stream in the reach bounded by the Site. The bedrock under the Site is karstic, so significant discharge from the limestone into the stream should be expected. Water level data and stream reconnaissance support this evaluation. A stream gaging station for Cedar Creek is located at the Georgia Avenue bridge, approximately 1.5 miles upstream of the site. For the period of record from May 1981 to 1988, extreme flows in Cedar Creek have ranged from a low of 10 cubic feet per second (cfs) in August 1986 and 1988 to a high of 5,050 cfs in February 1982 (USGS, 1988). The drainage area associated with the gaging station at the Georgia Avenue bridge is 66.9 square miles.

The majority of the Site lies within the 100-year flood plain. Computed water level profiles indicate that the majority of the Site is also inundated by the 50-year flood, and a substantial portion of the Site is inundated by the 10-year flood.

Substantial surface water run-off occurs at the Site due to the low permeability of clay-rich overburden soils. Overland flow of runoff is toward localized shallow depressions and drainage features that ultimately direct flow to Cedar Creek. Sheet flow and intermittent shallow concentrated flow in drainage swales has been observed following major precipitation events. Intermittent flow in small, shallow drainage features is generally short in duration, ending within a few hours after major rainfall events. The Site is covered by perennial vegetation, and erosion potential is limited. Further, during numerous Site visits for investigation and maintenance, no evidence of erosion (such as ditch or gully formation) has been observed.

5.6 HYDROGEOLOGY

Groundwater flow in the area is expected to be toward Cedar Creek, the principal discharge area, although it may take an indirect (tortuous) path along solution features before discharging into the creek. The occurrence of significant quantities of groundwater in the area is primarily dependent upon the degree of secondary permeability caused by fractures and solutioning within the rock. Major springs and high yield wells in the Cedartown area are typically associated with major karst solution features. Springs in the Newala Limestone can discharge between 0.5 million gallons per day (mgd) and 15 mgd (Cressler, 1970).

The uppermost aquifer on Site is the Newala Limestone, as groundwater is generally encountered at or below the top of rock. Karst solution features encountered in the limestone during the drilling of Site monitoring wells indicate that the aquifer is nonhomogeneous and anisotropic, such that flow will be controlled by solution and joint features. Solution features or voids were encountered in many of the borings during the RI. Solution features vary in size, orientation, and in their degree of hydraulic connection, causing groundwater flow to take an indirect or tortuous path.

Water level data was obtained to help define the relationship of the water surface to the geology. Based on potentiometric maps developed from the water level data, the general direction of groundwater flow on site is to the west, toward Cedar Creek. However, a groundwater flow component very near the creek may have a north-northwest trend as creek flow is toward the north. The water level data and geologic data show higher potentiometric levels than the creek surface elevation, indicating flow to the creek. Therefore, Cedar Creek acts as a groundwater discharge zone.

Significant fluctuations in groundwater levels are expected due to the close proximity of the Site to Cedar Creek. The creek is a principal groundwater discharge area for the Newala Limestone, and this shallow bedrock aquifer is hydraulically connected with the creek. Previous water level measurements from Site monitoring wells have been used to document fluctuations of more than 6.5 feet; however, fluctuations of more than 10 feet are likely to occur during larger storms.

Groundwater underlying the Diamond Shamrock Site was encountered at or below the top of the Newala Limestone. Karst solution features encountered in this limestone indicate that the aquifer is nonhomogeneous and that groundwater flow will be controlled by solution and joint features. Groundwater flow velocities within the limestone aquifer will vary, depending upon the presence or absence of solution features and the degree of interconnected solution features.

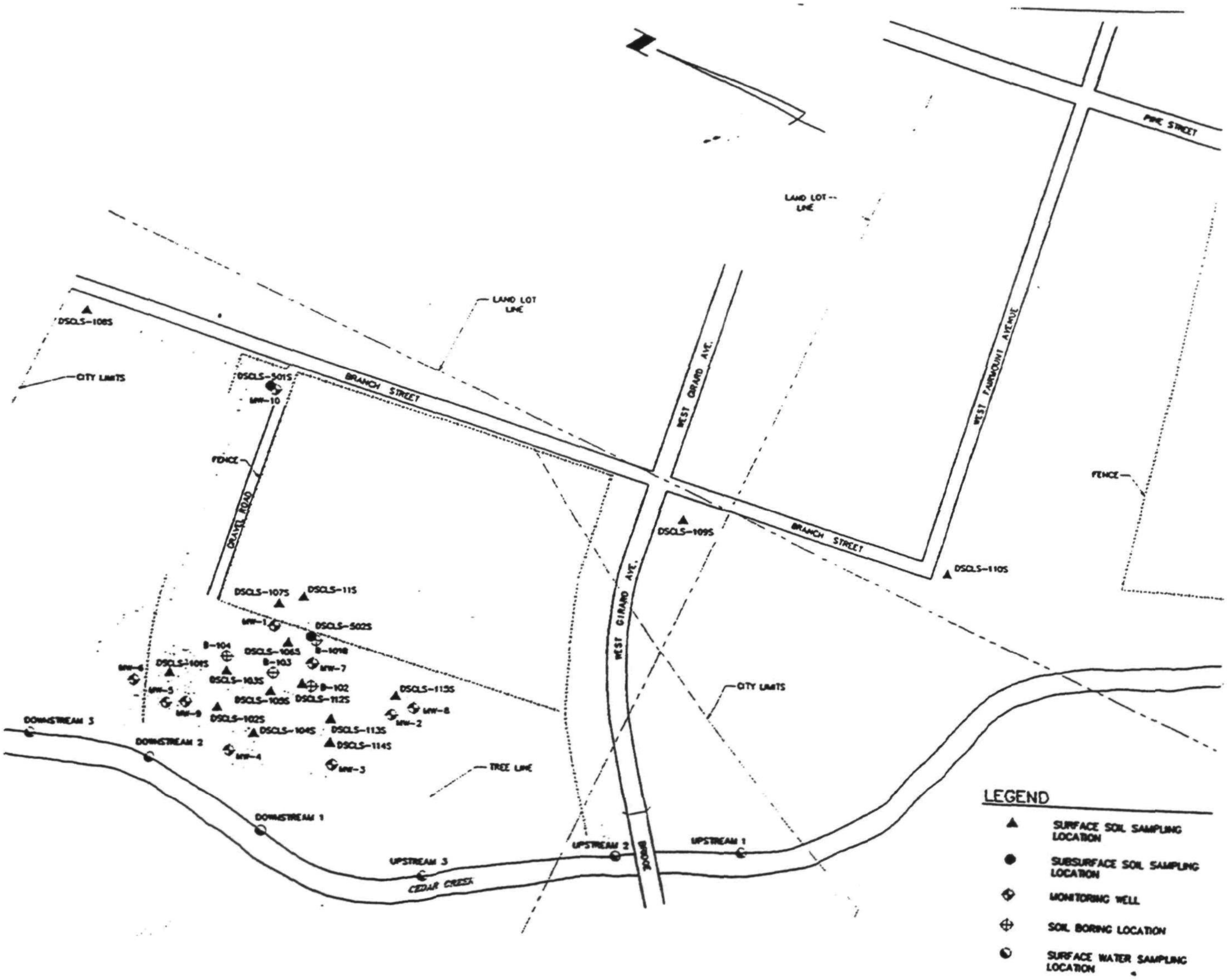
The current water supply for the city of Cedartown is a spring located near the center of the town. This spring is upgradient and upstream of the Site and approximately one mile southeast of the Site and has a flow range of approximately 3 million gallons per day (mgd) to 5 mgd. No private or domestic drinking water wells are believed to exist within a 2,000 foot radius of the Site, as residences in the area are reportedly served by municipal water supplies (i.e., the Cedartown Water Department or the Polk County Water Authority). Water sources for the municipal water supplies are located approximately one mile from the site. One of the Polk County Water Authority's production wells is located within a three mile radius of the Site. One other major groundwater user in the area is the Henkel Plant, which pumps an estimated 2 mgd from a shallow solutioned zone within the Newala Limestone. This well is located approximately 1/2 mile southeast of the Site. Water from the plant well is reportedly used only for plant processes, such as cooling.

5.7 SUMMARY OF SITE CONTAMINATION

Sampling and analysis of various media has been performed to evaluate site conditions. In addition to the initial work performed by Henkel before the RI/FS program, verification samples were collected specifically for the RI/FS. The groundwater summarization includes data collected prior to removal of the waste.

The media considered include surface soil, subsurface soil, groundwater, surface water, and stream sediment from Cedar Creek. Surface soil conditions are characterized by 12 surface soil samples collected on the Site during the summer of 1992, and three background surface soil samples that were collected off-site. Subsurface conditions are characterized by closure verification samples collected from the foot of the former waste disposal trenches after excavation was completed during the removal action, plus one subsurface background sample collected from the boring at monitoring well MW-10, and another subsurface soil sample collected near monitoring well MW-7. Groundwater conditions are characterized by samples collected during eight periodic sampling events conducted since October 1989. Surface water conditions are characterized by samples collected at six locations sampled during June 1992. Stream sediment conditions are represented by six sediment samples collected near the surface water sampling stations during June 1992. Sampling locations are presented on Figure 5-1.

FIGURE 5-1
SITE SAMPLING PLAN



5.7.1 GROUND WATER CHARACTERIZATION

Ground water sampling and analysis was performed according to procedures prescribed in the Sampling and Analysis Plan (Golder Associates Inc., 1992). The ten monitoring wells installed at the Site were sampled on July 21 and July 22, 1992, on January 26 and January 27, 1993, on June 29 and June 30, 1993, and again in January 1994. Prior to July 1992, only the six monitoring wells that existed were sampled. Four additional monitoring wells were installed during July 1992. A summary of contaminants detected in ground water since periodic monitoring was begun in October 1989 are summarized in Table 5-1.

ORGANICS

Detected concentrations of organic chemicals were found in MW-1, MW-4, and MW-9 and included acetone, bis(2-ethylhexyl)phthalate, toluene, and trichloroethene.

While there have been sporadic detections of volatile and semivolatile compounds in wells downgradient of the waste disposal areas, only three out of nine wells (excluding background) have had parameters sporadically detected above the Maximum Contaminant Levels (MCL).

1,2-Dichloroethane, with an MCL of 5.0 µg/L, was detected in the sample from MW-4 at 7.2 µg/L and in the duplicate sample at 8.1 µg/L during January 1990. This detection was reported before source removal, and has not been reported since in that well. 1,2-Dichloroethane was reported in the sample from well MW-9 at 6.5 µg/L during June 1993 and at 6.1 µg/L in the sample from background well MW-10 during the same sampling event. 1,2-Dichloroethane has been reported in the samples from background well MW-10 twice since its installation. 1,2-Dichloroethane has been reported only twice at low concentrations in any samples from downgradient wells in four years of sampling, and that was in two separate wells.

Toluene, with an MCL of 1000 µg/L, was reported in well MW-4 samples one time above the MCL, at a concentration of 2300 µg/L. MW-4 was resampled on October 29, 1993, and all wells during the January 1994 sampling event. The analytical results indicates toluene levels were below the detection limit.

Trichloroethene was reported in the MW-1 for four consecutive sampling events, from July 1990 to January 1992, then again in June 1993 (ranges from ND - 13 µg/l). Trichloroethene was not reported in MW-1 during the July 1992, January 1993, or January 1994 sampling events.

TABLE 5-1
SUMMARY OF SUBSTANCES DETECTED IN GROUND WATER

ORGANICS

PARAMETER	DETECTION FREQUENCY	RANGE	AFFECTED WELLS	STANDARD
Acetone	3/72	9JB-150	MW-4,MW-9,MW-5	NA
1,2-Dichloroethane	6/72	6.0B-59	MW-4,MW-9,MW-10	5
Toluene	4/72	6.5-2,300	MW-4	1,000
Trichloroethene	7/72	4J-13	MW-1,MW-4,MW-7	5
Benzyl alcohol	2/72	24-42	MW-4	NA
bis-2(Ethylhexyl)phthalate	2/72	3J-42	MW-5,MW-9	6
2-Chlorophenol	1/72	72	MW-4	NA
o-Cresol	1/72	110	MW-4	NA
Phenol	2/72	18-220	MW-4	NA
beta-BHC	4/72	0.17-0.87	MW-1,MW-4,MW-5 MW-3	NA
gamma-BHC	1/72	0.012	MW-5	0.2
Heptachlor	2/72	0.013-0.059	MW-4,MW-5	0.4
Xylenes	1/72	10	MW-5	10,000

Notes:
- Unit is ug/L.
- Standard refers to MCL.
- MCL for bis-2(Ethylhexyl)phthalate effective 1/17/94.
- J = Estimated Concentration
- B = Parameter detected in blank

TABLE 5-1 *(continued)*
SUMMARY OF SUBSTANCES DETECTED IN GROUND WATER
TOTAL METALS

PARAMETER	DETECTION FREQUENCY	RANGE	AFFECTED WELLS	STANDARD
Aluminum	55/71	0.10–11	All Wells	NA
Antimony	1/71	0.52	MW-6	0.006
Arsenic	1/71	0.013	MW-10	0.05
Barium	70/71	0.02–0.16	All Wells	2
Cadmium	1/71	0.0058	MW-6	0.005
Calcium	71/71	0.11–240	All Wells	NA
Chromium	16/71	0.010–0.052	MW-3,MW-4,MW-5,MW-6 MW-7,MW-8,MW-9,MW-10 MW-1	0.1
Cobalt	1/71	0.012	MW-10	NA
Copper	3/71	0.010–0.012	MW-3,MW-5,MW-4	1.3
Iron	70/71	0.040–10.8	All Wells	NA
Lead	10/71	0.005–0.017	MW-3,MW-4,MW-6,MW-10 MW-9	0.015
Magnesium	70/71	8.8–57	All Wells	NA
Manganese	70/71	0.017–2.5	All Wells	NA
Nickel	4/71	0.010–0.020	MW-1,MW-2,MW-5 MW-4	0.1
Potassium	54/71	1.0–13	All Wells	NA
Sodium	70/71	6.7–140	All Wells	NA
Vanadium	3/71	0.011–0.019	MW-4,MW-6,MW-9	NA
Zinc	60/71	0.013–0.17	All Wells	NA

Notes:
Unit is mg/L.
Standard refers to MCL, except for the Lead and Copper Standards, which are USEPA Action Levels.
Antimony and nickel MCLs effective 1/17/94.

METALS

Metal concentrations have varied somewhat between sampling events for any particular well. Manganese has been reported at elevated concentrations in some downgradient wells during some sampling events, but has also been reported in the background well MW-10. There is evidence that manganese concentrations may be influenced by variability of groundwater quality at the Site. Manganese concentrations have been reported in upgradient wells, and there is wide variability of results within a given well during different sampling events. Sample results have been reported on several occasions that varied by more than an order of magnitude for a particular well.

Statistically significant differences have been reported for total aluminum, barium, iron, lead, and manganese for groundwater samples collected from downgradient wells when compared to the upgradient well MW-1 during sampling events conducted prior to January 1991. No TAL metal concentrations have exceeded existing National Primary Drinking Water Standards for any groundwater sample.

BACKGROUND UNCERTAINTIES

The general groundwater flow in the vicinity is to the west, trending to the north near Cedar Creek. MW-10 is east of the former disposal trenches, making it upgradient. This interpretation is substantiated by the higher water level in MW-10, which is typically at least 0.5 foot higher than MW-1. This groundwater gradient prevails even during periods of historically high water levels in Cedar Creek, as demonstrated during the January 1993 sampling event. This sampling event was conducted during a high flow event in Cedar Creek, immediately following a flood which partially inundated the Site.

The are concerns that the high levels of manganese (Mn) found on Site may be a result of high background concentrations of Mn based on the June 1993, MW-10 sample results. When comparing the filtered versus non-filtered data, it is evident that there is a significant difference in this data which is not apparent in any of the other samples. The non-filtered detected concentration of Mn was 1800 ug/l and the filtered concentration was non-detect (<10 ug/l). This is not the case in any of the previous samples in this monitoring well or any other monitoring well. Secondly, in samples analyzed both prior to and after the June 93 sampling events, Mn was detected at substantially lower concentrations than the 1800 ug/l. The maximum detected concentration in all of the other samples from the two background wells was 390 ug/l. Therefore, the 1800 ug/l detection of Mn in MW-10 in June 1993 is not acceptable for a background comparison. The average background value for Mn (based on MW-10 data, excluding the 1800 μg/l as discussed above) is 145 μg/l, which is well within the human health risk-based performance standard.

After reviewing this information, EPA has concluded that the June 1993, MW-10 sample was probably not representative of background ground water concentrations (EPA letter dated January 20, 1994, acceptance of the Diamond Shamrock RI). The average background concentrations currently indicates that manganese is likely a site related contaminant and a risk-based performance standard for manganese is appropriate and attainable. However, future sampling analysis would be required to confirm background water quality and evaluate if the ground water performance standard remains appropriate. If, based on future sampling analysis, the background concentration for a contaminant exceeds the MCL or established acceptable risk-based standard, amending the performance standards to background groundwater contaminant concentrations would be evaluated.

5.7.2 SOIL CHARACTERIZATION

A total of 29 on-site surface soil samples (from a depth of 0 to 6 inches) were collected from various locations on-site, 17 just after closure of the excavated trenches (in 1991) and 12 in June of 1992. Two of the samples collected in 1992 were collected from the same locations as samples from the earlier round of sampling. For these locations, only the more recent data were used. Thus data from a total of 27 sampling locations were used for this assessment.

A total of 26 on-site subsurface soil samples were collected, 25 from the trenches as post-closure samples and one in 1992 from near the eastern fenceline at soil boring location B-101B. The post-closure samples were collected from the bottoms of trenches at depths ranging from 4 to 12 feet.

5.7.2.1 SURFACE SOILS

Surface soil sample locations are shown on Figure 5-1. The surface soil samples considered to be most representative of current site conditions were those collected during the additional site characterization conducted during June 1992. The analytical results are presented in Table 5-2 for all surface soil samples collected.

Surface soil samples collected during June 1992 indicated no unacceptable risks to human health and the environment. Since the additional surface soil samples were located in areas that were most likely to have residual contamination, these soil samples present the most accurate presentation of potential surface soil contamination.

TABLE 5-2
SUMMARY OF SUBSTANCES DETECTED IN SURFACE SOILS (a)

(Organics: ug/kg, inorganics: mg/kg)

Chemical	Frequency of Detection (b)	Mean Sample Size (c)	Arithmetic Mean	Range of Detection Limits	Range of Detected On-site Concentrations	Range of Detected Site-specific Background Concentrations (d)	Range of Regio Background Concentrations
Organics:							
* Acetone	1 / 27	27	21.1	10 - 120	110	ND (<10)	NA
* Bromoform	1 / 27	27	3	5 - 12	6.3	ND (<5)	NA
* 4,4'-DDE	1 / 10 (f)	10	2.7	4.3 - 5.1	5.2	NA	NA
* 1,2-Dichloroethane	1 / 27	27	3	5 - 12	6.7	ND (<5)	NA
* Methylene Chloride	1 / 27	27	3.3	5 - 12	14	ND (<5)	NA
* 4-Methylphenol	1 / 27	25	189	330 - 420	370	ND (<330)	NA
* Naphthalene	1 / 27	25	191	330 - 420	440	ND (<330)	NA
* N-nitrosodiphenylamine/ diphenylamine	1 / 27	25	208	330 - 420	860	ND (<330)	NA
* Phenol	5 / 27	27	3,530	330 - 2,000	380 - 47,000	ND (<330)	NA
* Trichloroethene	4 / 27	27	9.1	5 - 12	7.1 - 110	ND (<5)	NA
Inorganics: (g)							
Aluminum	12 / 12	12	5,060	NU	3,500 - 8,500	3,600 - 8,800	10,000 - >100,0
Arsenic	7 / 12	12	2.1	2	2.1 - 4.7	2.7 - 4.9	1.4 - 29.0
Barium	10 / 12	12	57.3	40	27.7 - 120	79 - 80	200 - 700
Beryllium	1 / 12	12	0.5	0.2 - 1	1.2	ND (<1)	1.0
Calcium	2 / 12	12	653	1,000	1,240 - 1,600	1,300 - 21,000	400 - 6,000
Chromium	12 / 12	12	12.5	NU	5.1 - 21	8.2 - 26	7.0 - 70.0
Cobalt	6 / 12	12	8.8	10	4.7 - 24	10	3 - 20
Copper	8 / 12	12	6.1	4	4.4 - 14	5.4 - 13	3 - 50
Iron	12 / 12	12	18,200	NU	6,600 - 60,000	4,100 - 32,000	10,000 - 70,000
Lead	12 / 12	12	17.7	NU	5 - 35	11 - 30	10 - 300
Magnesium	1 / 12	1	445	NU	445	ND (<1,000)	1,500 - 3,000
Manganese	12 / 12	12	743	NU	72 - 2,100	250 - 1,900	100 - 3,000
Nickel	5 / 12	12	9.9	8	5.7 - 33	ND (<8)	5 - 50
Potassium	1 / 12	1	302	NU	302	ND (<1,000)	3,300 - 16,000
Sodium	1 / 12	1	278	NU	278	ND (<1,000)	1,000 - 10,000
Vanadium	11 / 12	12	19.5	10	13.6 - 36	17 - 52	30 - 70
Zinc	12 / 12	12	62.3	NU	12 - 250	20 - 34	15 - 400

NU = Not used. No detection limits were used to calculate the arithmetic mean, either because the chemical was detected in all the samples or the detection limit was greater than 2 times the maximum detected concentration.
NA = Not analyzed.
* = Chemical of potential concern.

(a) Data from surface soil samples Surface-1 through Surface-10, Surface-11A, Surface-12, Surface-13, Surface-15, and Surface-16 from the 1991 post-closure samples; and DSCLS-101S through DSCLS-107S and DSCLS-111S through DSCLS-115S from the June 1992 samples.
(b) The number of samples in which the contaminant was detected divided by the total number of samples analyzed.
(c) The number of samples used to calculate the mean. This number may be less than the denominator of the frequency of detection because non-detect samples with high detection limits were not included in calculating the mean.
(d) Site-specific background data from samples DSCLS-108S, DSCLS-109S, and DSCLS-110S.
(e) Regional background data based on samples taken by Boerngen and Shacklette (1981) from within 50 miles of the site (Bartow, Cobb, Floyd and Haralson Counties in Georgia and DeKalb County in Alabama).
(f) Only 10 of the 1991 samples (and no 1992 samples) were analyzed for pesticides.
(g) Only the 1992 samples were analyzed for inorganics.

ORGANICS

Ten organic chemicals were detected in Pre-RI (removal) and RI surface soil samples. Phenol and trichloroethene were detected at the greatest frequency (5/27 and 4/27, respectively) and phenol was detected at the highest concentrations (e.g., 47,000 ug/kg). Neither of these chemicals was detected in any of the 1992 surface soil samples. The rest of the organic chemicals (acetone, bromoform, 4,4'-DDE, 1,2-dichloroethane, methylene chloride, 4-methylphenol, naphthalene, and N-nitrosodiphenylamine/diphenylamine) were each detected only once. Methylene chloride was the only chemical detected in any of the 1992 surface soil samples.

Acetone was reported in an equipment rinse blank, which was prepared during the soil sampling event. Resampling was not considered to be necessary due to the low concentrations.

INORGANICS

Only the 1992 surface soil samples were analyzed for inorganic chemicals. These inorganic chemical concentrations were compared to site-specific and regional background concentrations. Regional background data were used to supplement site-specific background in order to provide more information about chemicals that were not detected at elevated detection limits (e.g., magnesium, potassium, and sodium). Based on this comparison, all 17 of the inorganic chemicals detected in surface soil were statistically within background ranges.

5.7.2.2 SUBSURFACE SOIL

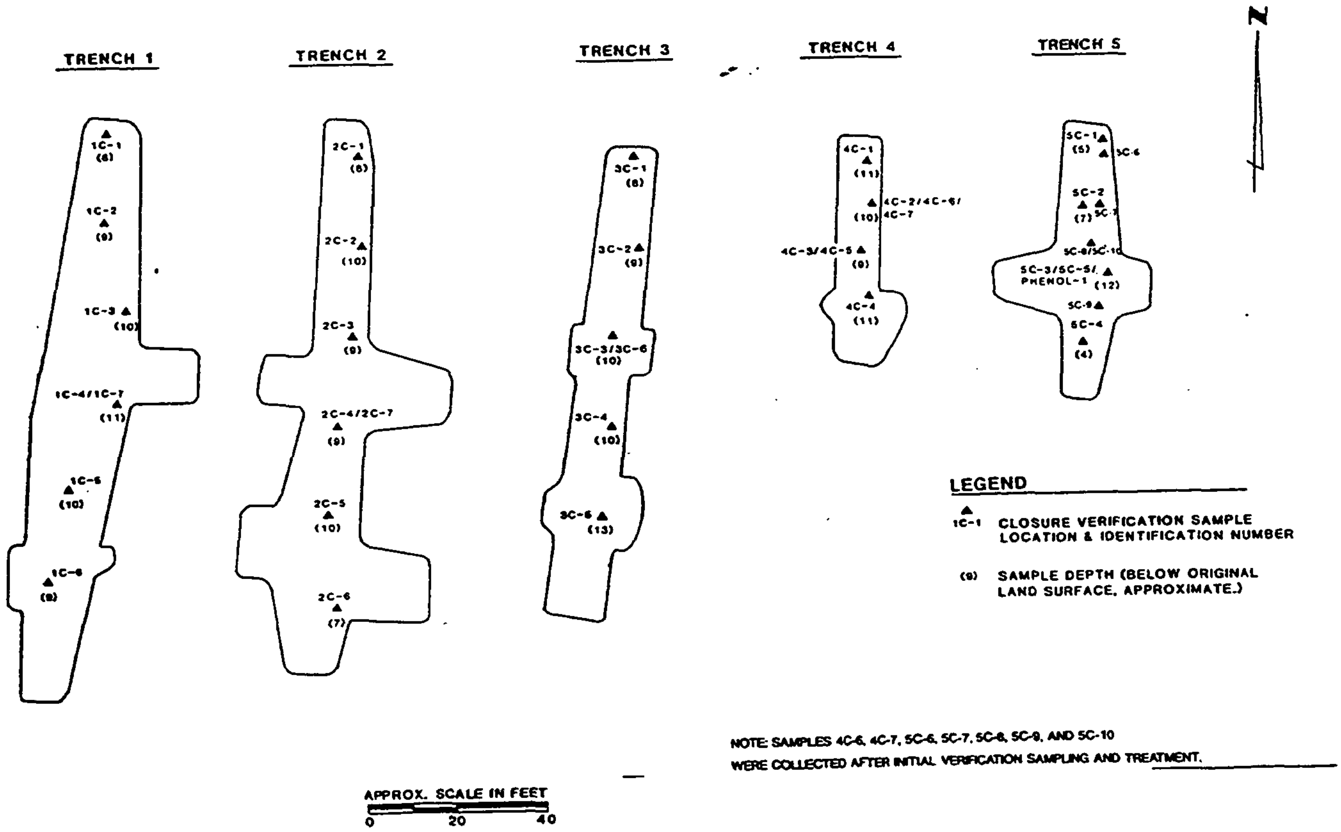
27 on-site subsurface soil samples (excluding background) were collected and are grouped and summarized as follows:

1) Removal and Trench Post-Closure: 4 areas: (1) Trenches 1,2,3 with 17 samples; (2) Trench 4 with 4 samples; (3) Trench 5 with 4 samples; and,

2) RI Subsurface Samples: Two additional subsurface soil samples were analyzed, one background sample collected from east of the Site from the boring at monitoring well MW-10 (sample DSCLS-501S), and another at boring B-101B (sample DSCLS-502S), which was collected near the top of bedrock at a location identified as an area of possible contamination during the soil gas survey.

The locations of subsurface soil samples are shown on Figures 5-1 (p.13) & 5-2.

FIGURE 5-2
TRENCH CLOSURE AND SUBSURFACE SAMPLING PLAN



Subsurface soil samples collected during 1992 indicated no unacceptable risks to human health and the environment. Residual subsurface soil contamination produced by former waste disposal practices has been determined to be in isolated areas and at low concentrations. Waste constituents are mainly confined to the foot of the former waste disposal trenches, which varied in depth from eight to fourteen feet.

REMOVAL AND TRENCH CLOSURE SAMPLE RESULTS

During the removal, closure verification samples were collected from trench floors using a systematic random sampling strategy, as outlined in SW 846, third edition, September 1986 (hereafter referred to as SW 846). A starting point was established for each trench by choosing a random number between one and ten. This determined the initial sample point, in feet from the northern end of that particular trench. From that point sample locations were distributed along the length of the trench at pre-determined intervals depending on the length of the particular trench. The sample locations were further randomized by choosing random numbers for the distances from a trench wall (perpendicular to the long dimension of the trench). At least four closure sample locations were selected for each trench, with the number of samples proportional to the length of the trench.

TCL pesticides, PCBs and cyanide were not detected in any of the closure verification samples; therefore, these parameters will not be discussed further.

Organics

Each disposal trench was excavated and sampled for closure as individual waste units, as they often contained different proportions of various waste materials. Therefore, the following presents a summary of organic constituents detected within each waste trench unit.

Trench 1 - A total of seven samples were collected from Trench 1 on October 24, 1990, to evaluate residual soil conditions prior to closure. No TCL semi-volatile organic compounds were detected in Trench 1 closure samples. The following is a summary of volatile organic constituents detected in Trench 1 samples:

TRENCH 1

COMPOUND (Units - mg/kg)	1C-1	1C-2	1C-3	1C-4	1C-7 DUP OF 1C-4	1C-5	1C-6	MEAN CONC
Acetone	.039	0.99	<0.032	0.22	0.23	0.25	0.31	0.31
1,2-Dichloroethane	<0.0057	0.03	<0.0064	<0.0059	<0.0061	<0.0062	0.60	0.11
Trichloroethylene	<0.0057	0.054	<0.0064	<0.0079	<0.0061	0.019	0.0071	0.017

Trench 2 - A total of seven closure verification samples were collected on November 7, 1990 from Trench 2. Volatile and semi-volatile organic constituents detected in Trench 2 closure samples included the following:

TRENCH 2

COMPOUND (Units - mg/kg)	2C-1	2C-2	2C-3	2C-4	2C-7 DUP OF 2C-4	2C-5	2C-6	MEAN CONC W/O DUP
Acetone	0.59	0.053	0.078	0.37	0.45	<2.9	0.170	0.694
Carbon Disulfide	<0.006	<0.0058	<0.0063	<0.03	<0.03	1.7	<0.03	0.296
Toluene	<0.006	.0076	<0.0063	<0.03	<0.03	3.4	0.039	0.581
Trichloroethylene	<0.006	<0.0058	<0.0063	<0.03	<0.03	0.750	<0.03	0.138
Phenol	<0.40	<0.38	<0.42	1.3	1.3	7.8	<0.40	1.8

Trench 3 - A total of six closure verification samples were collected on October 10, 1990 from Trench 3. Volatile and semi-volatile organic constituents detected in Trench 3 closure samples include the following:

TRENCH 3							
COMPOUND (Units - mg/kg)	3C-1	3C-2	3C-3	3C-6 DUP OF 3C-3	3C-4	3C-5	MEAN CONC W/O DUP
Acetone	<0.032	2.0	1.4	4.0	1.4	0.11	0.99
2-Butanone (MEK)	<0.013	<0.013	<0.013	<1.70	0.013	<0.012	0.013
Chlorobenzene	<0.0063	<0.0064	0.029	<0.83	<0.0063	<0.0059	0.011
1,2 Dichloroethane	<0.0063	<0.0064	<0.0066	<0.83	0.017	0.035	0.14
Ethyl benzene	<0.0063	<0.0064	<0.0066	<0.83	0.21	0.015	0.049
4-methyl-2-pentanone	<0.013	0.017	<0.013	<1.70	2.0	2.50	0.91
Toluene	<0.0063	<0.0064	0.0092	<0.83	0.01	<0.0059	0.008

TRENCH 3							
COMPOUND (Units - mg/kg)	3C-1	3C-2	3C-3	3C-6 DUP OF 3C-3	3C-4	3C-5	MEAN CONC. W/O DUP
Xylenes	<0.0063	<0.0064	0.014	<0.83	<0.0063	<0.0059	0.008
bis(2-Ethyl(hexyl)phthalate	1.7	<0.42	<8.60	<8.60	<8.10	<7.90	<5.34
Phenol	<0.42	<0.42	<8.60	<8.60	12.0	<7.90	5.87

Trench 4 - A total of five closure verification samples (includes duplicate) were collected on October 10, 1990 from Trench 4, with an additional closure sample collected on November 11 and on November 16, 1990 following in-place treatment. No TCL semi-volatile organic constituents were detected in any of the Trench 4 closure verification samples. TCL volatile organic constituents detected include the following:

TRENCH 4

COMPOUND (Units - mg/kg)	4C-1	4C-3	4C-5 DUP OF 4C-3	4C-4	4C-7	MEAN CONC. W/O DUP.
Acetone	0.053	<2.4	<1.2	1.3	<0.032	0.95
2-Butanone	0.018	3.4	2.5	<0.012	<0.013	0.86
Ethyl benzene	<0.0057	<0.48	<0.24	0.65	<0.0063	0.29
4-methyl-2pentanone	<0.011	<0.95	<0.48	0.015	<0.013	0.25
Styrene	<0.0057	<0.48	0.53	<0.006	<0.0063	0.124
Toluene	0.010	21.0	27.0	0.098	<0.0063	5.28

Closure sample 4C-7 was obtained subsequent to and at the same location as samples 4C-2 and 4C-6, after in-place treatment; therefore, results of samples 4C-2 and 4C-6 are not summarized above, as they are not indicative of soil conditions during closure.

Trench 5 - A total of five closure verification samples were collected on October 31, 1990 from Trench 5. A number of volatile and semivolatile constituents were detected. Phenol was detected in all of the samples above closure standards.

However, additional soil could not be removed from the bottom of the trench using available excavating equipment. Therefore, the trench was left open, and the remaining soil was treated in-situ, using a proprietary bacterial consortium and nutrients. On August 19, 1991, the trench was resampled. Detected TCL organic parameters are summarized below.

TRENCH 5

COMPOUND (Units - mg/kg)	5C-6	5C-7	5C-8	5C-10 DUP OF 5C-8	5C-9	MEAN CONC.
Acetone	<0.110	6.0	<0.120	<0.012	<0.130	0.64
Phenol	4.9	30.0	21.0	11.0	22.0	17.8

Phenol was detected in all five samples. The mean concentration was reduced from 527.8 mg/kg for the October 1990 samples to 17.8 mg/kg for the August 1991 samples, about a 97% reduction. The residual contamination was evaluated according to health risk-based criteria. The calculated intake was well below the published reference dose (RfD) for phenol. The trench was backfilled during January 7 and January 8, 1992.

Closure Results - TAL Inorganics

Concentrations of TAL parameters detected in closure verification samples were generally consistent with background values. However, select samples contained metal concentrations that may have been slightly elevated with respect to background concentrations. A comparison of metals in closure samples with background sample results is summarized as follows for metals that were detected at least once in any closure sample:

INORGANICS						
		CLOSURE SAMPLES (mg/kg)				
PARAMETER	BACKGROUND (12 SAMPLES) (mg/kg)	TRENCH 1 (6 SAMPLES)	TRENCH 2 (6 SAMPLES)	TRENCH 3 (5 SAMPLES)	TRENCH 4 (4 SAMPLES)	TRENCH 5 (4 SAMPLES)
Aluminum	3800-23000	18000-39000	16000-42000	11000-19000	5800-100000	5500-13000
Antimony	ND	ND	ND	ND	ND-11	ND
Arsenic	4.8-40	7.2-17	5.9-15	ND-38	5.7-18	ND-2.6

INORGANICS						
		CLOSURE SAMPLES (mg/kg)				
Barium	23-370	38-220	69-650	1.0-130	25-97	44-82
Beryllium	ND-1.5	ND-2.0	ND-1.3	ND-1.2	ND-4.0	ND-1.5
Calcium	370-1700	380-1500	390-910	400-1300	170-4900	470-3500
Chromium	8.4-32	16-31	16-49	11-23	8.6-28	17-24
Cobalt	ND-42	6.2-16	9.9-19	7.5-32.2	2.8-15	5.2-14
Copper	ND-19	12-28	14-23	13-32	7.0-20	5.7-17
Iron	12000-48000	20000-45000	31000-65000	34000-73100	18000-41000	15000-53000
Lead	3.7-51	4.3-65	12-33	12-36	14-29	9.5-12.3
Magnesium	520-1800	550-1700	630-3000	450-1100	140-1700	280-740
Manganese	89-4800	74-1500	120-1800	88-1090	89-390	290-380
Mercury	ND-0.080	0.05-0.11	0.081-0.14	0.086-0.18	0.052-0.18	0.04-0.23
Nickel	4.4-26	12-34	9.8-35	8.8-36.7	ND-27	5.5-12.1
Potassium	24-1400	580-3400	1300-6500	1030-2200	470-1600	320-850
Sodium	ND-96	ND-2000	90-420	ND-100	ND	ND
Vanadium	ND-48	21-57	35-87	29-47.2	15-37	17-31
Zinc	ND-73	40-71	66-120	36-90.7	34-85	41-510

ND - Non Detected

RI SUBSURFACE SAMPLES

There were no TCL organic parameters detected in sample DSCLS-501S. Acetone was reported in sample DSCLS-502S at a concentration of 240 µg/kg. Sample DSCLS-502S was collected near the eastern fenceline in an attempt to determine the source of trichloroethene in a nearby monitoring well (MW-1). For this reason the sample was only analyzed for volatile organic chemicals. The only VOC detected in this sample was acetone at 240 ug/kg.

5.7.3 SURFACE WATER CHARACTERIZATION

Surface water samples were collected from locations illustrated in Figure 5-1. Surface water data are presented in Table 5-3. Surface water samples indicated no unacceptable risks to human health and the environment.

ORGANICS

Some organic chemicals (acetone, 2-butanone, bis(2-ethylhexyl)phthalate, 4-methyl-2-pentanone, toluene, and xylenes) were detected at low levels in surface water samples collected in January and June of 1991. Also, these chemicals were all also detected in subsurface closure samples from the trenches (collected in the fall of 1990). However, no organic chemicals were detected in surface water in the most recent sampling events.

INORGANICS

Inorganic chemical concentrations in surface water were compared to background concentrations. Based on this comparison, all detected inorganic chemicals except manganese were statistically within background ranges. However, the detected concentrations of manganese in the downstream samples were all only slightly higher than (less than 2 times) the maximum concentration detected in the upstream samples. Based on both comparisons to background concentrations, no chemicals were selected as chemicals of potential concern for surface water.

5.7.3.1 SEEP STUDY OF CEDAR CREEK

A survey of the eastern bank and the bed of Cedar Creek was performed on June 9, 1992 to identify seeps that may discharge groundwater flowing under the Site. Visual inspection of the stream bed and bank was accomplished by walking within the stream bed. The stream bed and eastern bank were inspected under the water surface using Self Contained Underwater Breathing Apparatus (SCUBA) equipment. No seeps were found in the survey reach.

5.5.4 SEDIMENTS CHARACTERIZATION

Three sediment samples were collected in June, 1992 from the same downstream locations in Cedar Creek as the surface water samples.

Results are shown in Table 5-4.

TABLE 5-3
SUMMARY OF SUBSTANCES DETECTED IN SURFACE WATERS

SUBSTANCE	DETECTION FREQUENCY	CONCENTRATION RANGE	BACKGROUND CONCENTRATIONS
ORGANICS – µg/l			
Acetone	1/24	12	ND
2–Butanone	1/24	120	ND
4–Methyl–2–pentanone	1/24	14	ND
Toluene	2/24	6.6 – 23	6.6 –7.1
Trichlorethene	1/24	1	ND
Bis–2(Ethylhexyl)phthalate	3/24	14 – 150	28 – 68
Xylenes	1/24	6	ND
INORGANICS - mg/l			
Aluminum	17/24	.2 – .63	ND – .36
Barium	24/24	.019 – .029	.019 – .028
Calcium	24/24	15 – 34	ND
Chromium	1/24	.024	ND – .024
Iron	24/24	.19 – .93	.19 – .69
Magnesium	24/24	4.9 – 11	5 – 11
Manganese	24/24	.032 – .081	.032 – .070
Potassium	2/24	1 – 1.1	ND
Sodium	24/24	1.5 – 32	1.5 – 32
Zinc	2/24	.018 – .093	ND – .093
ND = Non Detect			

TABLE 5-4
SUMMARY OF SUBSTANCES DETECTED IN SEDIMENTS

SUBSTANCE	DETECTION FREQUENCY	CONCENTRATION RANGE	BACKGROUND CONCENTRATIONS
ORGANICS -- µg/kg			
Acetone	2/6	13 – 68	68
Aroclor 1248	1/6	340	ND
INORGANICS - mg/kg			
Aluminum	6/6	2100 – 3780	2100 – 3780
Arsenic	5/6	2.7 – 6.8	4.9 – 6.8
Barium	5/6	20 – 40.2	26 – 40.2
Calcium	2/6	807 – 1300	ND – 807
Chromium	6/6	11 – 42.5	26 – 42.5
Cobalt	3/6	7.8 – 12	7.8 – 12
Copper	6/6	6.4 – 22.7	7.2 – 22.7
Iron	6/6	7200 – 27000	12900 – 27000
Lead	6/6	21 – 84	40 – 68
Manganese	6/6	47 – 570	334 – 570
Vanadium	4/6	10 – 21	12.3 – 21
Zinc	6/6	40 – 170	43 – 53.6

ND = Non Detect

Sediment samples indicated no unacceptable risks to human health and the environment.

ORGANICS

Acetone was detected in one sediment sample Downstream-1, located adjacent to the site. However, acetone was also detected in the background sediment sample at a concentration five times higher than the downstream concentration (68 ug/kg and 13 ug/kg, respectively). Sample DSCLS-115B, an equipment rinse blank prepared during the same event as sediment sampling, was reported to contain 11 µg/L of acetone. Acetone was not be considered a chemical of potential concern for sediment due to detected concentrations in background and rinse blank samples.

No TCL semivolatile parameters were reported above detection limits in any of the samples.

For Pesticide/PCB parameters, Aroclor 1248 was reported in one sample, collected at the most downstream sampling station, at 340 µg/kg (polychlorinated biphenyls concentrations are evaluated relative to Aroclor compounds). None of the PCBs has been detected in any sample collected at the Site in any medium. No aroclors were detected in any other sample, in any other media or location at the Diamond Shamrock site.

INORGANICS

Various TAL metal parameters were reported in all of the sediment samples. Inorganic concentrations for downstream samples are similar to upstream samples, although for several analytes (aluminum, antimony, arsenic, barium, beryllium, cobalt, iron, manganese, and vanadium) the upstream samples tended to have higher concentrations than the downstream samples.

Inorganic chemical concentrations were compared to background concentrations. The results showed that none of the detected concentrations of inorganic chemicals were statistically greater than background. For this reason, no inorganic chemicals were selected as chemicals of potential concern.

6.0 SUMMARY OF SITE RISK

CERCLA directs EPA to conduct a Baseline Risk Assessment (BRA) to determine whether a Superfund Site poses a current or potential threat to human health and the environment in the absence of any remedial action. A baseline risk assessment was conducted as part of the RI and provided the basis for determining whether or not remedial action is necessary and the justification for performing remedial action.

The Summary of Site Risk Section includes only exposure pathways and chemicals of concern if the results of the risk assessment indicate a potential current or future significant risk. The criteria for determining a significant risk are those contaminants that contributed to a pathway which exceeds a 1E-4 risk or Hazard Index (HI) of 1; chemicals contributing risk to these pathways need not be included if their individual carcinogenic risk is less than 1E-6 or their noncarcinogenic risk Hazard Quotient (HQ) is less than .1. The only pathway meeting this criteria is the *Future Residential Ingestion of Ground Water Route.*

6.1 HUMAN HEALTH RISKS

The human health risk assessment evaluated the nature and extent of the threat to public health caused by the release or threatened release of hazardous substances from the Site.

6.1.1 CONTAMINANTS OF CONCERN (COCs)

The following methodology was used for selection:

- All organic chemicals detected in soils and groundwater were considered to be chemicals of potential concern (USEPA 1989a). All organic chemicals in surface water and sediment downstream of the site were considered to be chemicals of potential concern associated with the site unless also detected at high concentrations in upstream samples.

- Because many of the inorganic chemicals detected at the site occur naturally, concentrations in site-related samples were compared to concentrations in background samples. This statistical comparison could be made for data from surface soil, surface water, and sediment samples. If less than three background samples were collected (e.g., for groundwater at this site) or detection limits for background were not provided (e.g., for subsurface soil), maximum concentrations of inorganic chemicals detected at the site were compared with two times the maximum background concentrations to determine if the detected levels were elevated above background according to Region IV guidance (1992c). If a chemical concentration within a medium and area group was greater than two times the maximum site-specific or regional background level (whichever was higher), then it was selected as a chemical of potential concern. This method was used for subsurface soil and groundwater data.

- Chemicals with low toxicity and no available USEPA validated toxicological information relevant to human health were not considered. This includes aluminum, calcium, cobalt, iron, magnesium, potassium, and sodium.

Most of the organic chemicals detected during the waste excavation/remediation and during the remedial investigation were selected as chemicals of potential concern. Organic chemicals which were detected historically in groundwater and surface water samples were not selected as chemicals of concern if they were not detected in the past two rounds of sampling in these media. Acetone was not selected as a chemical of potential concern for sediment from Cedar Creek because it was detected at elevated concentrations in sediment upstream of the site and in an equipment rinse blank. Inorganic chemicals were selected as chemicals of potential concern by a comparison to site-specific and regional background data.

6.1.1.1 COCs IN GROUND WATER

Monitoring wells MW-10 is upgradient of the Site and provided background ground water quality data. However, due to the substantial analytical differences and variability in the background results, background water quality will need to be confirmed during future ground water monitoring.

Metal concentrations in background ground water will be confirmed using low stress sampling techniques during future ground water sampling.

Seven chemicals detected in the monitoring wells met the COC criteria: acetone, barium, bis(2-Ethylhexyl)phalate, lead, manganese, toluene, and trichloroethene. Chemicals of concern and their related exposure point concentrations for the *Future Residential Ingestion of Ground Water Route* are summarized in Table 6-1

TABLE 6-1 CONTAMINANTS OF CONCERN & EXPOSURE POINT CONCENTRATIONS			
Media and Chemical	Exposure Point Concentrations		
	Frequency of Detection [1]	RME [2]	Background
GROUND WATER		µg/l	µg/l
Acetone	1/9	32	ND
Barium	5/14	228	81
Bis(2-Ethylhexyl)phalate	1/9	3	ND
Lead	2/9	8.2 [3]	ND
Manganese	4/14	1,970	160
Toluene	1/9	850	ND
Trichloroethene	1/9	8.5	ND

1 Frequency of detection indicates the number of wells that in which the chemical was detected during sampling events 1/92 and 7/92 which were utilized in establishing point concentrations in the risk assessment.

2 Reasonable Maximum Exposure (RME) defined as the 95% upper confidence limit chemical concentration (UCL) on the arithmetic mean (or maximum concentration when the UCL exceeds the maximum).

3 RME for lead was the highest detected concentration.

6.1.2 EXPOSURE ASSESSMENT

Whether a chemical is actually a concern to human health depends upon the likelihood of exposure, i.e. whether the exposure pathway is currently complete or could be complete in the future. A complete exposure pathway (a sequence of events leading to contact with a chemical) is defined by the following four elements:

- Source and mechanism of release;
- a transport medium (e.g., Ground water, surface water, air) and mechanisms of migration through the medium;
- the presence or potential presence of a receptor at the exposure point; and
- a route of exposure (ingestion, inhalation, dermal absorption).

If all four elements are present, the pathway is considered complete.

The two major constituent release and transport mechanisms potentially associated with the Site are as follows:

- Infiltration of precipitation through the residual chemical affected soils from waste storage and the percolation of the resulting leachate into the ground water; and,
- release of affected soil by seeps/leachate run-off to surface waters, sediments, and soils.

Because of infrequent and low detection of VOCs in surface soils, any exposure via inhalation to constituents in air transport is not considered significant.

An evaluation was undertaken of all potential exposure pathways which could connect chemical sources at the Site with potential receptors. All possible pathways were first hypothesized and evaluated for completeness using the above criteria. The current pathways represent exposure pathways which could exist under current Site conditions while the future pathways represent exposure pathways which could exist, in the future, if the current exposure conditions change.

6.1.2.1 CURRENT EXPOSURE

The following pathways were evaluated under current land-use conditions:

- Incidental ingestion of surface soil by trespassers and workers at the site;
- Dermal absorption of chemicals from surface soil by trespassers and workers at the site;

- Incidental ingestion of sediment by trespassers near the site; and
- Dermal absorption of chemicals from sediment by trespassers near the site.

Excess upperbound lifetime cancer and noncarcinogenic risks associated with the above exposures were all less than EPA's benchmark and are not likely to occur. Inhalation risks from exposures to chemicals volatilizing from surface soil were not quantified because volatile organic compounds were detected infrequently, at low concentrations, and because the site is fairly well vegetated.

GROUND WATER

Under current land use conditions, no nearby residents or workers are known to use groundwater for drinking water. Residents in the area use Polk County and Cedartown municipal drinking water supplies. Therefore, exposures via the use of groundwater for ingestion was not be considered under current land-use conditions.

6.1.2.2 FUTURE EXPOSURE

Changes of land use associated with the site which may result in exposure and risk to the chemicals of potential concern were addresses. It was assumed that the Diamond Shamrock Site could potentially be developed in the future. The type of development considered to pose the greatest potential for health risks is residential; accordingly, for the exposure pathway analysis, it has been assumed that a hypothetical future residence would be built directly on the site in the area of the former trenches. Potential future exposure scenarios included all the exposures examined under current conditions. Exposure assumptions were considered the same in evaluating future conditions as were used in evaluating current conditions.

The table below summarizes the exposure pathway analysis for hypothetical future land use conditions.

- Ingestion of groundwater by hypothetical residents living on the site;
- Incidental ingestion of surface soils by hypothetical residents living at the site;
- Dermal absorption of chemicals from surface soils by hypothetical residents living at the site;
- Incidental ingestion of sediment by hypothetical residents at the site; and

- Dermal absorption of chemicals from sediment by hypothetical residents at the site.

GROUNDWATER

The only pathway indicating an unacceptable human health risk is the *Future Residential Ingestion of Ground Water Route*. Under future land-use conditions, a hypothetical on-site resident could install a well and be exposed to groundwater from the site.

Routes of exposure associated with groundwater could include ingestion of drinking water, inhalation of chemicals that have volatilized from groundwater during use (e.g., while showering, cooking, watering the lawn); and dermal contact with groundwater during in-home use (e.g., while bathing, washing dishes). According to USEPA (1992b), dermal contact with most chemicals in water during bathing will usually result in lower exposures than direct consumption of the same water.

Inhalation exposure to volatile chemicals in groundwater tends to be on the same order of magnitude as exposure from direct consumption of the same water. Only the ingestion of drinking water exposure pathway was evaluated quantitatively in the assessment with the understanding that inhalation exposures will occur at a level comparable to ingestion exposures.

Below indicates the exposure medium, source and/or release mechanism, exposure point, potential receptor and route of exposure for ground water under the future land-use scenario.

Medium:	Groundwater
Source and mechanism:	Leaching of contaminants from soils to groundwater
Exposure Point:	Potable use of ground water
Potential Receptor:	Resident Adult/Child (1-6yrs)
Route of Exposure:	Ingestion/inhalation while showering

6.1.2.3 EXPOSURE POINT CONCENTRATIONS

Exposures were estimated for each of the wells that contained chemicals of concern using data from the RI. The Reasonable Maximum Exposure (RME) concentration defined as the 95% upper confidence limit chemical concentration (UCL) on the arithmetic mean (or maximum concentration when the UCL exceeds the maximum) for each chemical of concern is shown in Section 6.1.1, Table 6-1 (p.33).

For organic chemicals of concern, the exposure point concentration was based on concentrations in each well. MW-9 was only sampled once, so the concentrations of acetone and bis(2-ethylhexyl)phthalate detected at that time were used as the exposure point concentrations. MW-4 was sampled eight times and the exposure point concentration for this well was based on recent trends in sampled concentrations. The concentration of toluene in MW-4 was 6.5 ug/L in January 1992, and increased to 850 ug/L in June 1992. The value of 850 ug/L was conservatively used as the exposure point concentration, rather than the mean of these two detects since the dramatic increase in concentration may indicate the presence of a chemical slug moving across the area, and the concentration of toluene may continue to increase.

MW-1 was also sampled eight times. In MW-1, the concentration of trichloroethene (TCE) has fluctuated within a range during the past five samples collected: 13 ug/L (7/90), 9.3 ug/L (1/91), 5.8 ug/L (6/91), 12 ug/L (1/92), <5 ug/L (7/92). Although TCE was not detected in the most recent sample, concentrations have dropped close to the detection limit in the past and then increased again. For this reason, the nondetect was assumed to be a temporary drop in the concentration of TCE in MW-1, and one-half the detection limit for the 7/92 nondetect was included in calculating the arithmetic mean. This arithmetic mean of TCE concentrations detected in the samples from 7/90 to 7/92 was used as the exposure point concentration.

Exposure point concentrations for the inorganic chemicals of potential concern are based on the concentration measured in the June 1992 sampling event.

The future residential ingestion of ground water exposure scenario assumed a 30 year duration (6 years as a child), and an exposure frequency of 350 days per year. The assumed ingestion rates for an adult and a child were 2 liters and 1 liter, respectively. Body weights were 70 kg for adults and 15 kg for a child.

6.1.3 TOXICITY ASSESSMENT

A cancer slope factor (CSF) and a reference dose (RfD) are applied to estimate the potential risk of cancer from an exposure and the potential for non-carcinogenic effects to occur from the exposure.

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

This increased cancer risk is expressed by terms such as 1E-6. To state that a chemical exposure causes a 1E-6 added upper limit risk of cancer means that if 1,000,000 people are exposed, one additional incident of cancer is expected to occur. The calculations and assumptions yield an upper limit estimate which assures that no more than one case is expected and, in fact, there may be no additional cases of cancer. USEPA policy has established that an upper limit cancer risk falling below or within the range of 1E-6 to 1E-4 is acceptable.

RfDs have been developed by EPA for indicating the potential for adverse health effects from exposure to contaminants exhibiting noncarcinogenic effects. RfDs which are expressed in units of mg/kg/day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals, that are likely to be without appreciable risk of an adverse health effect. Estimated intakes of COCs from environmental media (e.g. amount of COCs ingested from contaminated ground water) can be compared to the RfD. RfDs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied (e.g. to account for the use of animal data to predict effects on humans). If the estimated exposure to a chemical expressed as mg/kg/day is less than the RfD, the exposure is not expected to cause any non-carcinogenic health effects, even if the exposure is continued for a lifetime. In other words, if the estimated dose divided by the RfD is less than 1.0, there is no concern for adverse non-carcinogenic health effects.

The toxicity values which were used to calculate human health risks are summarized in Table 6-2.

TABLE 6-2 CONTAMINANTS OF CONCERN TOXICITY ASSESSMENT		
Media and Chemical	Toxicity	
	CSF [2] 1/(mg/kg/day)	RfD [1] mg/kg/day
GROUND WATER		
Acetone	*	.1
Barium	*	.07
bis(2–Ethylhexyl)phalate	1.4E–02	.02
Manganese	*	.005
Trichloroethene	1.1E–02	.074
Toluene	*	.2

1 Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting non–carcinogenic effects. Adapted from USEPA IRIS, January 1993 except for Trichloroethene (1987 Office of Drinking Water, Health Advisory).

2 Cancer potency factors (CPFs) have been developed for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. Adapted from USEPA IRIS, January 1993 except for Trichloroethene (Memo from EPA, Chemical Mixture Assessment Branch, Joan Dollarhide, July 1992).

* NOT APPLICABLE

6.1.4 RISK CHARACTERIZATION

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

RISK = CDI X CSF

where:

risk = a unit less probability (e.g., 2×10^{-5}) of an individual developing cancer;

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

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

These risks are probabilities that are generally expressed in scientific notation (e.g., $1X10^{-6}$ or $1E^{-6}$). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a reasonable maximum estimate, an individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at the Site.

The pótential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose derived for a similar exposure period. The ratio of exposure to toxicity is called a hazard quotient (HQ). By adding the HQ's for all COCs that affects the same target organ within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

where:

CDI = Chronic Daily intake

RfD = Reference Dose; and,

CDI and RfD are expressed in the same units and represent the same exposure period (i.g., chronic, subchronic, or short-term).

To evaluate the estimated cancer risks, a risk level lower than $1x10^{-6}$ is considered a minimal or deminimis risk. The risk range of $1x10^{-6}$ to $1x10^{-4}$ is an acceptable risk range and would not be expected to require a response action. A risk level greater than $1x10^{-4}$ would be evaluated further, and a remedial action to decrease the estimated risk considered.

A hazard index (HI) of less than unity (1.0) indicates that the exposures are not expected to cause adverse health effects. An HI greater than one (1.0) requires further evaluation. For example, although the hazard quotients of the several chemicals present are added and exceed 1.0, further evaluation may show that their toxicities are not additive because each chemical affects different target organs. When total affects are evaluated on an effect and target organ basis, the hazard index of the separate chemicals may be at acceptable levels.

Carcinogenic risks and non-carcinogenic hazards were evaluated for potential exposures to media-specific chemicals of concern in surface soil, surface water, surface sediment and ground water. Receptor populations were potentially exposed workers, trespassers and area residents that could, theoretically, use ground water for a household water source.

Estimated potential exposure to chemicals of concern in surface water, surface soil and surface sediments did not result in unacceptable carcinogenic risk or non-carcinogenic hazard.

Estimated potential added non-carcinogenic risks from the use of contaminated ground water for household use are in an unacceptable range.

TABLE 6-3: SUMMARY OF UNACCEPTABLE RISK -- GROUND WATER INGESTION [a]

Chemical	Lifetime Excess Cancer Risk	Hazard Quotient
Acetone	N/A	.02
Barium	N/A	.2
bis(2-Ethylhexyl)phalate	2E-07	.01
Manganese	N/A	30
Toluene	N/A	0.1
Trichloroethene	1E-06	.08

a Calculations based on RME values for exposure assumptions and point concentrations

6.1.5 IDENTIFICATION OF UNCERTAINTIES

The following primary sources of uncertainty were associated with the estimation of chemical uptake from exposure to ground water:

- Environmental sampling and analysis, and selection of chemicals;
- Exposure parameter estimation; and
- Toxicological data.

The important sources of uncertainty in this assessment are discussed below. As a result of the uncertainties described below, this risk assessment should not be construed as presenting an absolute estimate of risk to persons potentially exposed to chemicals at the site. Rather, it is a conservative analysis intended to indicate the potential for adverse impacts to occur.

Environmental Sampling and Analysis, and Selection of Chemicals

Environmental chemistry analysis error can stem from several sources, including errors inherent in the sampling or analytical methods.

- Systematic or random errors in the chemical analysis may yield erroneous data.

- The maximum detected site concentration was compared to 2 times the maximum background level when less than three site-specific background samples were available.

Many of the samples in the Diamond Shamrock data had non-detects associated with high detection limits. This may result in an underestimation of risk if chemicals were not detected, and thus not evaluated, because of the elevated detection limits. High detection limits were particularly associated with semi-volatile chemical analysis in soils, due both to matrix interference and high concentrations of phenol.

Additional uncertainty is associated with chemicals reported in samples at concentrations below the reported quantification limit, but still included in data analysis. No qualifier was used in the validation of Diamond Shamrock data to denote which concentrations were below the quantification limit. However some reported concentrations were below detection limits shown for non-detects in other samples indicating that some of the concentrations were probably estimated.

A limited number of samples for background and for some potentially-affected environmental media may result in an over- or under-estimation of risk. For groundwater, only one well (MW-10) was at a great enough distance from the site to be considered background. This well was only installed in 1992 and was sampled once for inorganics and twice for volatile organic chemicals (VOCs).

Exposure Parameter Estimation

There are two major areas of uncertainty affecting exposure parameter estimation. The first relates to estimation of exposure point concentrations. The second relates to parameter values used to estimate chemical exposures (as either average daily doses or inhalation exposure concentrations).

(1) Estimation of Exposure Point Concentration Uncertainties

- Environmental concentrations were based on data available from the RI.
- Chemical concentrations reported as non-detected were included as one-half the detection limit in calculating concentrations.
- The 95% upper confidence limit on the population mean or maximum (whichever was lower) was used as the exposure point concentration.

The approach used to select exposure point concentrations may overestimate potential exposures and thus risks. The exposure point concentration for a specific chemical in a particular medium was based on the 95% upper confidence limit (UCL) on the population mean, or the maximum detected concentration, whichever was less. Since the 95% UCL is highly unstable from a mathematical standpoint, and is strongly influenced by the sample size and geometric standard deviation (GSD) of the chemical concentrations being evaluated, the approach to estimating exposure point concentrations often results in the default use of the maximum detected concentration. The use of maximum concentrations in the risk assessment resulted in conservative estimates of exposures and risks.

When calculating exposure point concentrations from sampling data, 1/2 of the reported detection limits for non-detect samples were included in the calculation of the 95% UCL if 1/2 of the detection limit was not greater than the maximum measured value. Any approach dealing with non-detected chemical concentrations is associated with some uncertainty. Non-detect results do not indicate whether the chemical is absent from the medium, present at a concentration just above zero, or present at a concentration just below the detection limit.

(2) Parameter Values (chemical exposures) Uncertainties

- Exposures were assumed to occur on a regular basis for each selected pathway.
- Frequency of exposure was based on consideration of site-specific conditions.
- Default USEPA assumptions regarding body weight, duration of exposure, and life expectancy may not be representative for the site area population.
- Exposures were estimated assuming no migration of residents out of the facility area for 30 years.
- Default reasonable maximum exposure (RME) values were used for soil ingestion rates.
- The dermal absorption of chemicals from soils/sediment through skin was based on default USEPA Region IV assumptions.

Uncertainties are inherent in the selection of pathways for evaluation. It was assumed that individuals in the site area would engage in certain activities that would result in exposures for each selected pathway. This assumption is conservative. It may be likely that the activity patterns assumed to occur in this analysis only occasionally occur. Furthermore, even if an individual were to engage in an activity, it is not necessarily true that an exposure would be experienced. It may be unlikely that every time an individual trespasses on the site (assuming this were to occur), he or she will contact and incidentally ingest surface soils.

Evaluation of the dermal exposure pathway is also affected by uncertainties in many of the exposure parameters. Assumptions were made about which portions of the body's skin surface areas would be exposed. The choice of exposed body parts may slightly under- or over-estimate risk. Significant uncertainties are also associated with the use of the dermal absorption fraction related to contact with sediment and soil. The limited information available on the dermal absorption of chemicals from contacted soil under realistic environmental conditions may result in an under or an over-estimation of risk.

Toxicological Data

Toxicological data uncertainties are presented below.

- Quantitative toxicity criteria were not available for all of the selected chemicals of concern.

- Cancer slope factors derived from animal studies are based on upper 95th percentile confidence limits derived from the linearized multi-stage model.

- Uncertainties in the design, extrapolation and interpretation of toxicological experimental studies.

- Conservatively derived reference doses were used to assess risks.

- Risks were assumed to be additive although they may potentially be synergistic or antagonistic.

- The dermal exposure pathways were evaluated using oral toxicity criteria in conjunction with oral absorption factors obtained from ATSDR where available, or default oral absorption factors from Region IV.

In the hazard and risk evaluations, the risks or hazards presented by several chemicals reported for the same exposure have been added to provide a sum of estimated total risk or hazard for that particular exposure. This is a conservative assumption and is scientifically accurate only in those instances where the health effects of individual chemicals are directed at the same effect and same target organ. The effects may be additive, synergistic or antagonistic. Since a large number of chemicals have no similarity as to their non-carcinogenic action or the target of their action, this approach may over-estimate risk.

There is a degree of uncertainty regarding the RfD for manganese in the ground water ingestion scenario. There is currently a debate whether it is appropriate to separate the exposures from food and water as currently done by IRIS for some chemicals, and whether it is appropriate to separate the exposure from food and water as presently done for manganese (and some other inorganics) by IRIS. Due to the high degree of uncertainty associated with the present RfD of 0.005 mg/kg/day for manganese, the RfD determination is scheduled for future EPA review. The current EPA RfD for manganese in water of 0.005 mg/kg/day was used to evaluate risks concerning manganese drinking water intake.

6.2 ENVIRONMENTAL ASSESSMENT

The environmental assessment evaluated impacts to ecological receptors caused by the release or potential release of hazardous substances from the Site. The approaches used in the environmental assessment roughly paralleled those used in the human health risk assessment.

All organic and inorganic chemicals present at levels greater than background were considered for inclusion as chemicals of potential concern for the ecological assessment. Chemical concentration, frequency of detection, and toxicity were then used in choosing the chemicals of potential concern for the individual media.

6.2.1 TERRESTRIAL

The former waste trench area is predominantly meadow, with forested areas to the north and to the west along Cedar Creek. The Site is fairly well vegetated, with a few small bare spots in the field. Various reptiles, birds, and mammals have been observed at the Site.

The Freshwater Wetlands and Heritage Inventory Program (FWHIP) of the Georgia Department of Natural Resources and the U.S. Fish and Wildlife Service has indicated that the endangered and threatened species presented below may be within Polk County, the county in which the Diamond Shamrock Landfill site is located.

Animals

Haliaeetus leucocephalus	**Bald Eagle**	**Endangered**
Myotis grisescens	**Gray Bat**	**Endangered**
Myotis sodalis	**Indiana Bat**	**Endangered**

Plants

Isotoria meldeoloides	**Small whorled pogonia**	**Endangered**
Cypripdeium acaule	**Pink lady's slipper**	**Unusual**
Cypripdeium calceo	**Yellow lady's slipper**	**Unusual**
Veratrum woodii	**Wood false hellebore**	**Endangered**
Lygodium palmatum	**Climbing fern**	**Imperiled in State due to rarity**
Silene regia	**Royal catchfly**	**Critically imperiled in State due to extreme rarity**
Trichomanes petersii	**Dwarf filmy fern**	**Imperiled in State due to rarity**

The FWHIP also provided more detailed information for the topographic quadrangles located within a five-mile radius of the site. This more detailed information indicated that the plant species listed below have not been observed at the site or in the quadrangle that the site is located within. Also, some of the plant species on the list, like the small whorled pogonia, prefer open understory, which does not occur at the site due to the thick understory of swamp-privet. However, the FWHIP has only inventoried approximately 5% of its data. Thus, the possibility of endangered or threatened plant species occurring at the site cannot be precluded.

Gray bat, although listed in Polk County, was not listed in any of the quadrangles within five miles of the site so the likelihood of its presence onsite is minimal. Although Indiana bat could feed at Cedar Creek, the small size of the creek might limit the number of bats that forage at the site. Bald eagles, although they prefer nesting in areas near water, are unlikely to nest near Cedar Creek or spend much time foraging there because the creek is extremely small compared to that typically used by foraging bald eagles. The FWHIP and USFWS also provided endangered species information for Floyd County. However, the likelihood of species of special concern in Floyd County occurring at the site is minimal given the distance of over four miles. Even animal species with large foraging ranges are unlikely to spend much, if any, time at the site due to the small size, proximity to human activity, and the partial fencing.

Only phenol was selected as a chemical of potential concern in surface soil because of its concentration, frequency of detection, and toxicity. Contaminants in subsurface soils were not evaluated, since these soils are generally inaccessible to plants and wildlife at the Site.

Wildlife may be exposed to chemicals of potential concern in surface soils at the Diamond Shamrock Landfill site by several pathways: 1) ingestion of contaminated soil while foraging or grooming; 2) ingestion of food that has accumulated chemicals from soil; 3) dermal absorption; and, 4) inhalation of chemicals that have volatilized or been wind-eroded from soil. Terrestrial species most likely to be impacted by chemicals in the soil at the Diamond Shamrock Landfill site are soil-dwelling invertebrates (e.g., earthworms) and small mammals (e.g., shrews) because of their intimate contact with the soil which can lead to dermal absorption and ingestion of potentially contaminated soil and food (e.g., soil-dwelling invertebrates). Predatory mammals and birds are unlikely to be adversely impacted because phenol does not bioaccumulate in the food chain (i.e., bioconcentration factors <25).

Earthworm toxicity to phenol was evaluated by examining the toxicity of pentachlorophenol, a chlorinated, more toxic form of phenol, which findings suggests that earthworms would not be adversely affected by phenol concentrations at the site. Data on small mammals were not available so they could not be quantitatively evaluated. However, the presence of vegetation over most of the former waste trench areas suggests that contact by small mammals with surface soil would be minimal and adverse effects are unlikely.

Due to lack of phytotoxicity data, a quantitative assessment of potential terrestrial plant impacts was not performed. However, the presence of vegetation over many of the former waste trench areas suggests that current concentrations of phenol are not adversely impacting plant species.

Terrestrial animals higher in the food web, such as birds or mammals, also could be exposed to sediment contaminants via ingestion of aquatic organisms which have accumulated sediment contaminants in their tissues. Since aroclor-1248 (a PCB, with a relatively high bioaccumulation potential) was found in a downstream sediment sample, the potential risk of aroclor-1248 in sediment to birds feeding on aquatic invertebrates was quantitatively evaluated. The results indicate that birds are not expected to be adversely affected from levels of aroclor-1248 in the sediments. There is uncertainty associated with the dietary toxicity value and the estimated bioaccumulation of PCBs in aquatic invertebrates. However, the single sample detect of aroclor-1248 suggests that significant exposures to aroclor-1248 are unlikely given the larger feeding range of bird species, especially migratory waterfowl.

6.2.2 AQUATIC

Cedar Creek is the only permanent surface water body at the Site. The Site is bisected by a broad swale which directs surface water runoff from the Site into Cedar Creek. Also, ground water from beneath the Site discharges into Cedar Creek. Various amphibians, reptiles, and fish have been observed in the creek, and a variety of aquatic invertebrates are expected to occur there.

Aroclor-1248, lead, and zinc were evaluated as chemicals of potential concern in sediment; these chemicals were found at elevated concentrations at one downstream sediment sampling location. The maximum detected value in sediments for these constituents fall between NOAA ER-L and ER-M values indicating the potential for adverse effects to aquatic organisms in Cedar Creek. Although the toxicity comparisons suggest that any adverse impacts that might occur would only happen to sensitive life stages and/or species, adverse impacts are unlikely due to only detection of lead, zinc, and aroclor 1248 in only one sediment sample. Therefore, exposures would most likely be minimal. Additionally, there is some uncertainty associated with the sediment toxicity values since the levels of organic carbon in the sediments have been estimated. In addition the toxicity values for invertebrates are based on studies on estuarine organisms. It is not known if the organisms at the site are different in sensitivity than the estuarine organisms.

No chemicals in surface water were selected for evaluation because the downstream concentrations were within, or only slightly greater than, the upstream concentrations.

Since there is a potential for ground water discharge into Cedar Creek; acetone, barium, bis(2-ethylhexyl)phthalate, lead, manganese, toluene, and trichloroethene were selected as ground water chemicals of potential concern and evaluated with respect to potential effects on Cedar Creek biota. However, the absence of Site related chemicals in surface waters during monitoring suggest that discharge of chemicals from ground water does not appear to currently be occurring to any measurable degree, and therefore, adverse effects are not expected. However, surface water will be monitored to confirm that ground water contaminant discharges are not occurring.

6.3 CONTAMINANTS OF CONCERN & PERFORMANCE STANDARDS

Estimated potential exposure to site chemicals in surface water, surface soil, and subsurface soils, and sediments do not result in unacceptable cancer or non cancer risks at the Diamond Shamrock Site. However, the estimated non-cancer risks from future exposure to ground water exceeds EPA's cleanup target risk range and an HQ of 1. Therefore, EPA established performance standards for chemicals in ground water detected at levels above EPA's target risk range or Safe Drinking Water Act MCL to ensure that any future ground water users would not be exposed to unsafe levels of site-related contaminants. Performance standards for the remediation of ground water are shown in Table 6-4.

Since remediation below background levels is not technically feasible, additional sampling will be conducted to confirm if data is indicative of background conditions and evaluate if the ground water performance standard remains appropriate. If, based on future sampling analysis, the background concentration for a contaminant exceeds the MCL or established acceptable risk-based standard, amending the performance standards to background groundwater contaminant concentrations would be evaluated

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

TABLE 6-4
SUMMARY OF REMEDY PERFORMANCE STANDARDS (GROUND WATER)

Contaminant	Performance Standard (µg/l)
Manganese	200 [a]
Toluene	1,000 [b]
Trichloroethene	5 [b]
1,2, Dichloroethane	5 [b]

a - Calculated value based on an acceptable risk or a Hazard Quotient (HQ) of 1. Exposure assumptions are a 2 liter per day ingestion rate and a 70 kilogram body weight.

b - Safe Drinking Water Act Maximum Contaminant Level (MCL).

7.0 DESCRIPTION OF ALTERNATIVES

The Feasibility Study Report evaluated possible alternatives for remediation of conditions at the Diamond Shamrock Landfill Site. A total of four (4) alternatives have been established for detailed analysis consideration. These alternatives were selected to provide a range of remedial actions for the Site.

7.1 ALTERNATIVE GW-1: NO ACTION

EPA is required to consider the no action alternative by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the regulation implementing the Superfund law. It is used as a baseline for comparing other alternatives. Under this alternative, EPA would take no action to minimize the impact ground water contamination has on the area. There is no cost associated with this alternative since no additional activities would be conducted.

7.2 ALTERNATIVE GW-2: INSTITUTIONAL CONTROLS AND GROUND WATER MONITORING

This alternative would include:

- Implementation of deed restriction(s) or restrictive covenant(s) to prevent ground water usage and drilling resulting in exposure to ground water contaminants;

- Completion and maintenance of Site access restrictions (fencing and signage);
- Ground and surface water monitoring program to confirm that natural attenuation processes are effective and that contaminants would not migrate;
- Performance of five year reviews in accordance with Section 121(c) of CERCLA to assure that human health and the environment continue to be protected by the remedy, that natural attenuation continues to be effective, and whether ground water performance standards continue to be appropriate; and,
- Continued ground water monitoring upon attainment of the performance standards at sampling intervals to be approved by EPA. The ground water monitoring program would continue until EPA approves a five-year review concluding that the alternative has achieved continued attainment of the performance standards and remains protective of human health and the environment.

The groundwater monitoring program would require additional sampling and analysis to further define background groundwater concentrations of contaminants and the effectiveness of natural attenuation. If, based on future sampling analysis, the background concentration for a contaminant exceeds its MCL or acceptable risk-based standard, EPA may evaluate whether ground water performance standards continue to be appropriate and may consider amending the performance standards to background groundwater contaminant concentrations. The installation of additional well(s) may be required in evaluating background water conditions. Ground and surface water samples would be collected at sampling points and intervals to be approved by EPA. EPA, at its sole discretion, may revise sampling intervals of the groundwater monitoring program. Low-stress sampling methods would be used during the monitoring to determine whether contaminants continue to be a problem.

The present worth of this alternative is estimated at $461,331 (semi-annual sampling) with a ***capital cost*** of $30,360 and annual ***Operation and Maintenance (O&M)*** costs of $34,730 for 30 years.

7.3 ALTERNATIVE GW-3: GROUND WATER COLLECTION WELLS

This alternative would include:

- Institutional Controls described in Alternative GW-2;

- Active remediation of ground water. Ground water would be extracted, treated and discharged until all performance standards are met for two consecutive sampling events. Operation of the groundwater extraction systems for an estimated period of 30 years. System to include:

    - Install extraction wells (estimated at 7 @ 45 feet deep). Pumping of a total of approximately 100 gpm from the extraction wells;
    - Ground water discharge to Henkel Waste Water Treatment Plant;
    - Modifications to Henkel Waste Water Treatment plant for increased capacity and to meet NPDES requirements; and,
    - Install pipe transfer systems from the well systems to the treatment plant;

- Performance of five year reviews and ground/surface water monitoring program to ensure effectiveness of treatment and reduction in movement as described in alternative GW-2;

- Continued ground water monitoring upon attainment of the performance standards at sampling intervals to be approved by EPA. The ground water monitoring program would continue until EPA approves a five-year review concluding that the alternative has achieved continued attainment of the performance standards and remains protective of human health and the environment.

Contaminated groundwater would be extracted and discharged to the Henkel wastewater treatment plant for treatment. During the pump and treat operations, the withdrawn groundwater would be stored in an equalization tank from which it would be pumped to a treatment system. The equalization tank would provide storage during times when a downstream treatment system might be shut down. The number of wells, location, extraction rates, and WWTP modifications will be determined during the RD and may require further characterization such as pump tests and treatability studies. The final system and methods may be different due to variations in the hydrogeologic conditions and will be determined during the design.

The present-worth cost of this alternative is estimated at $5,053,051 with a capital cost of $662,682 and annual O&M costs of $353,804 for 30 years.

7.4 ALTERNATIVE GW-4: GROUNDWATER COLLECTION TRENCHES

This alternative would include:

- Institutional Controls described in Alternative GW-2;
- Active remediation of ground water. Ground water would be extracted, treated and discharged until all performance standards are met for two consecutive sampling events. Operation of the groundwater extraction systems for an estimated period of 30 years. System to include:
  - Construction of three collection trenches (estimated at 50 to 150 feet long and 30 feet deep);
  - Pumping rate estimated at 150 gpm from the trenches; and,
  - Ground Water Treatment and Discharge as described in GW-3;
- Performance of five year reviews and ground/surface water monitoring program as described in alternative GW-2.
- Continued ground water monitoring upon attainment of the performance standards as described in GW-3.

Contaminated groundwater would be extracted and discharged to the Henkel wastewater treatment plant for treatment. During the pump and treat operations, the withdrawn groundwater would be stored in an equalization tank from which it would be pumped to a treatment system. The equalization tank would provide storage during times when a downstream treatment system might be shut down. The number of extraction trenches, final dimensions, pumping rate, and WWTP modifications will be determined during the RD and may require further characterization such as pump tests and treatability studies. The final system and methods may be different due to variations in the hydrogeologic conditions and would be determined during the design.

The present-worth cost of this alternative is estimated at $7,234,449 with a capital cost of $881,184 and annual O&M costs of $511,987 for 30 years.

7.5 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

The remedial action for the Diamond Shamrock Landfill Site, under CERCLA Section 121(d), must comply with federal and state environmental laws that are either applicable or relevant and appropriate requirements (ARARs). Applicable requirements are those standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA Site. Relevant and appropriate requirements are those that, while not applicable, still address problems or situations sufficiently similar to those encountered at the Site that their use is well suited to the particular Site. To-Be-Considered Criteria (TBCs) are non-promulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary level of cleanup for protection of health or the environment.

The affected ground water in the aquifer beneath the Diamond Shamrock Landfill Site has been classified by EPA as Class IIA. Class IIA ground water is a current source of drinking water. It is EPA's policy that ground water resources be protected and restored to their beneficial uses. A complete definition for ground water classification is provided in the Guidelines for Ground water Classification under the EPA Ground water Protection Strategy, Final Draft, December 1986.

While TBCs do not have the status of ARARS, EPA's approach to determining if a remedial action is protective of human health and the environment involves consideration of TBCs along with ARARs.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely on the basis of location. Examples of location-specific ARARs include state and federal requirements to protect floodplains, critical habitats, and wetlands, and solid and hazardous waste facility siting criteria. Table 7-1 summarizes the potential location-specific ARARs for the Diamond Shamrock Landfill Site.

TABLE 7-1
POTENTIAL LOCATION SPECIFIC ARARs

	Location	Citation
R&A	Critical habitat upon which endangered or threatened species depends	Endangered Species Act of 1973 50 CFR Parts 200 and 402 Fish and Wildlife Coordination Act 33 CFR Parts 320–330
R&A	Area affecting stream or river	Wild and Scenic River Act 40 CFR Part 6.302(e)
STATE OF GEORGIA REGULATIONS		
R&A	Establishes facility location standards	Georgia Comprehensive Solid Waste Management Act, O.C.G.A. § 12–8–20 et seq. and Rules, Chapter 391–3–4.
R&A	Critical habitat upon which endangered or threatened species depends	Endangered Wildlife and Wildflower Preservation Act of 1973 O.C.G.A. § 12–6–172 et seq. and Rules, Chapter 391–4–10.

A — APPLICABLE REQUIREMENTS WHICH WERE PROMULGATED UNDER FEDERAL LAW TO SPECIFICALLY ADDRESS A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION LOCATION OR OTHER CIRCUMSTANCE AT THE DIAMOND SHAMROCK LANDFILL SITE.

R & A — RELEVANT AND APPROPRIATE REQUIREMENTS WHICH WHILE THEY ARE NOT "APPLICABLE" TO A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION, LOCATION, OR OTHER CIRCUMSTANCE AT THE DIAMOND SHAMROCK LANDFILL SITE, ADDRESS PROBLEMS OR SITUATIONS SUFFICIENTLY SIMILAR TO THOSE ENCOUNTERED AT THIS SITE THAT THEIR USE IS WELL SUITED.

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Since there are usually several alternative actions for any remedial Site, various requirements can be ARARs. Table 7-2 lists potential action-specific ARARs and TBCs for the selected ground water remedy for the Diamond Shamrock Landfill Site.

TABLE 7-2
POTENTIAL ACTION-SPECIFIC ARARs

CLEAN WATER ACT - 33 U. S. C. §§ 1251-1376		
R&A	40 CFR Part 131 – Ambient Water Quality Criteria	Ambient Water Quality Criteria: Ambient water standards for the protection of human health and aquatic life.
R&A	40 CFR Part 122, 125 – National Pollutant Discharge Elimination System, 40 CFR Part 125, 40 CFR Part 131, and 40 CFR Part 136.1	Requires permits for the discharge of pollutants for any point source into waters of the United States.
R&A	40 CFR Part 141 – National Primary Drinking Water Standards	Specifies sampling, analytical and monitoring requirements for public water systems.
R&A	40 CFR Part 403 – National Pretreatment Standards	Sets standards to control pollutants which pass through, interfere, or contaminate treatment processes in public treatment works.
RESOURCE CONSERVATION AND RECOVERY ACT - 42 U.S.C. §§ 6901-6987		
R&A	40 CFR 257 – 258 – Solid Waste Management Regulations	Establishes minimum levels of performance required of any solid waste land disposal Site operation and including operation and maintenance.
R&A	40 CFR Part 261 – Identification & Listing of Hazardous Wastes	Characterizations of Treatment Facility Generated Sludges.
R&A	40 CFR Part 262 – Standards Applicable to Generators of Hazardous Waste	General requirements for identifying and managing hazardous wastes and manifest requirements for hazardous wastes
R&A	40 CFR Part 263 – Standards Applicable to Transporters of Hazardous Waste	Establishes standards which apply to transporting hazardous waste within the U.S., if required under 40 CFR 262.
R&A	40 CFR Part 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal (TSD) Facilities	Establishes minimum national standards which define the acceptable management of hazardous wastes for owners and operators of facilities which treat, store or dispose of hazardous wastes.

TABLE 7-2
POTENTIAL ACTION-SPECIFIC ARARs

CLEAN AIR ACT - 42 U.S.C. §§ 7401-7642		
R&A	40 CFR Part 61 – National Emission Standards for Hazardous Air Pollutants	Addresses hazardous air pollutants at their point of emission from specific sources
STATE OF GEORGIA REGULATIONS		
A	Georgia Hazardous Site Response Act § O.C.G.A. 12–8–90 et seq.	Requires corrective action for releases of hazardous waste, constituents, and substances.
R&A	Georgia Comprehensive Solid Waste Management Act § O.C.G.A. 12–8–20 et seq. and Rules, Chapter 391–3–4.	Establishes minimum levels of performance required of any solid waste land disposal Site operation and includes operation and maintenance.
R&A	Georgia Hazardous Waste Management Act O.C.G.A. § 12–8–60 et seq. and Rules, Chapter 391–3–11.	Establishes minimum state standards which define the acceptable management of hazardous wastes for owners and operators of facilities which treat, store or dispose of hazardous wastes in the State of Georgia.
A	Water Well Act of 1991 O.C.G.A § 12–5–120 et seq.	Establishes the requirements for the drilling and abandoning of monitoring wells.
R&A	Georgia Water Quality Control Act O.C.G.A. § 12–5–20 and Rules, Chapter 391–3–6.	Pre–treatment standards and permit requirements for Publicly Owned Treatment Works, criteria and standards for injection wells, and authorizes DNR to issue discharge permits.

A ——— APPLICABLE REQUIREMENTS WHICH WERE PROMULGATED UNDER FEDERAL LAW TO SPECIFICALLY ADDRESS A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION LOCATION OR OTHER CIRCUMSTANCE AT THE DIAMOND SHAMROCK LANDFILL SITE.

R & A – RELEVANT AND APPROPRIATE REQUIREMENTS WHICH WHILE THEY ARE NOT "APPLICABLE" TO A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION, LOCATION, OR OTHER CIRCUMSTANCE AT THE DIAMOND SHAMROCK LANDFILL SITE, ADDRESS PROBLEMS OR SITUATIONS SUFFICIENTLY SIMILAR TO THOSE ENCOUNTERED AT THE DIAMOND SHAMROCK LANDFILL SITE THAT THEIR USE IS WELL SUITED TO THE SITE.

Chemical-specific ARARs are specific numerical quantity restrictions on individually-listed chemicals in specific media. Examples of chemical-specific ARARs include the MCLs specified under the Safe Drinking Water Act as well as the ambient water quality criteria that are enumerated under the Clean Water Act. Since there are usually numerous chemicals of concern for any remedial Site, various numerical quantity requirements can be ARARs. Table 7-3 lists potential chemical-specific ARARs for the Diamond Shamrock Landfill Site.

TABLE 7-3
POTENTIAL CHEMICAL-SPECIFIC ARARS

CLEAN WATER ACT - 33 U.S.C. §§ 1251-1376		
A	40 CFR Part 131 – Ambient Water Quality Criteria	Suggested ambient standards for the protection of human health and aquatic life.
R&A	40 CFR Part 403 – National Pretreatment Standards	Sets standards to control pollutants which pass through or interfere with treatment processes in publicly–owned treatment works or which may contaminate sewage sludge.
RESOURCE CONSERVATION AND RECOVERY ACT - 42 U.S.C. §§ 6901-6987		
R&A	40 CFR Part 261 – Identification and Listing of Hazardous Wastes	Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 263–265 and Parts 124, 270, and 271.
R&A	40 CFR Part 262 – Standards Applicable to Generators of Hazardous Waste	Establishes standards for generators of hazardous waste.
CLEAN AIR ACT - 42 U.S.C. §§ 7401-7642		
R&A	40 CFR Part 50 – National Primary and Secondary Ambient Air Quality Standards	Establishes standards for ambient air quality to protect public health and welfare.
SAFE DRINKING WATER ACT - 40 U.S.C. §§ 300		
R&A	40 CFR Part 141 – National Primary Drinking Water Standards	Establishes maximum contaminant levels (MCLs) which are health–based standards for public water systems.

TABLE 7-3 POTENTIAL CHEMICAL-SPECIFIC ARARS		
R&A	PL No. 99–339 100 Stat. 462 (1986) – Maximum Contaminant Level Goals (MCLGs)	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects with an adequate margin of safety.
STATE OF GEORGIA REGULATIONS		
R&A	Air Quality Act of 1978 O.C.G.A. § 12–9–1 _et seq._ and Rules, Chapter 391–3–1.	Establishes standards for ambient air quality to protect public health and welfare.
R&A	Safe Drinking Water Act O.C.G.A. § 12–5–170 _et seq._ and Rules, Chapter 391–3–5.	Establishes maximum contaminant levels (MCLs) which are health-based standards for public water systems.
R&A	Georgia Water Quality Control Act O.C.G.A. § 12–5–20 _et seq._ and Rules, Chapter 391–3–6.	Establishes treatment standards for public water systems.
A —	APPLICABLE REQUIREMENTS WHICH WERE PROMULGATED UNDER FEDERAL LAW TO SPECIFICALLY ADDRESS A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION LOCATION OR OTHER CIRCUMSTANCE AT THE DIAMOND SHAMROCK LANDFILL SITE.	
R & A —	RELEVANT AND APPROPRIATE REQUIREMENTS WHICH WHILE THEY ARE NOT "APPLICABLE" TO A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION, LOCATION, OR OTHER CIRCUMSTANCE AT THE DIAMOND SHAMROCK LANDFILL SITE, ADDRESS PROBLEMS OR SITUATIONS SUFFICIENTLY SIMILAR TO THOSE ENCOUNTERED AT THE DIAMOND SHAMROCK LANDFILL SITE THAT THEIR USE IS WELL SUITED TO THE SITE.	

8.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the ROD provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA, 42 U.S.C. Section 9621, and in the NCP, 40 CFR, Section 300.430. The major objective of the FS was to develop, screen, and evaluate alternatives for the remediation of the Diamond Shamrock Landfill Site. A wide variety of alternatives and technologies were identified as candidates to remediate the contamination at the Diamond Shamrock Landfill Site. These were screened based on their feasibility with respect to the contaminants present and Site characteristics. After the initial screening, the remaining alternatives/technologies were combined into potential remedial alternatives and evaluated in detail. The remedial alternative was selected from the screening process using the following nine evaluation criteria:

- Overall protection of human health and the environment;
- Compliance with applicable and/or relevant and appropriate Federal or State public health or environmental standards;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of hazardous substances or contaminants;
- Short-term effectiveness or the impacts a remedy might have on the community, workers, or the environment during the course of implementation;
- Implementability, that is, the administrative or technical capacity to carry out the alternative;
- Cost-effectiveness considering costs for construction, operation, and maintenance of the alternative over the life of the project, including additional costs should it fail;
- Acceptance by the State; and,
- Acceptance by the Community.

The NCP categorizes the nine criteria into three groups:

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

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

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

The selected alternative must meet the threshold criteria and comply with all ARARs or be granted a waiver for compliance with ARARs. Any alternative that does not satisfy both of these requirements is not eligible for selection and will be removed from further consideration and comparison. The Primary Balancing Criteria are the technical criteria upon which the detailed analysis of alternatives is primarily based. The final two criteria, known as Modifying Criteria, assess the public's and the state agency's acceptance of the alternative. Based on these final two criteria, EPA may modify aspects of a specific alternative.

The following analysis is a summary of the evaluation of alternatives for remediating the Diamond Shamrock Landfill Superfund Site under each of the criteria. A comparison is made between each of the alternatives for achievement of a specific criterion.

8.1 THRESHOLD CRITERIA

8.1.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The No-Action Alternative will not mitigate the risks associated with contamination at or originating from the Diamond Shamrock Landfill Site. Therefore, this alternative is not protective of human health and the environment and will no longer be considered in this discussion.

Alternative GW-2 would restrict exposure to ground water through restrictions in ground water usage and drilling until ground water monitoring indicates that ground water performance standards have been met. Alternatives GW-3 and 4 would provide for active restoration of the ground water. Alternatives 3 and 4 would provide the best and most immediate protection of human health and the environment.

Alternative GW-2 allows the ground water to attain the ground water performance standards through natural attenuation. This alternatives protects human health and the environment through preventing any potential exposure to contaminated ground water and restoring the aquifer in time. Since there is not a current direct exposure route to ground water and the source has been removed, institutional controls and natural attenuation of the ground water contamination is protective. Continued monitoring and performance of five year reviews would confirm that this remedy remains protective.

Alternatives GW-3 and 4 treat the contaminated ground water allowing the ground water to attain performance standards through extraction and treatment. These alternatives protect human health and the environment through restoring the aquifer and preventing any potential migration. These alternatives would be the most protective.

8.1.2 COMPLIANCE WITH ARARS

Alternatives GW-2, 3 and 4, will meet all of their respective ARARs.

Ground water ARARs include Maximum Contaminant Levels (MCLs) that establish chemical-specific limits on certain contaminants in community water systems. Long-term monitoring is included in Alternatives GW-2, 3 and 4. Additional statistical analysis of data will further substantiate the presence/absence of ground water contamination.

For Alternative GW-2, remedial action would include further sampling and analysis of ground water to assure that water beneath the Site would meet ARARs through attenuation. Surface water currently meets ARARs.

Alternatives GW-3 and 4 would be able to meet all Federal and State standards for contaminants and proposed actions.

8.2 PRIMARY BALANCING CRITERIA

8.2.1 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternatives GW-2, 3 and 4 would provide long-term effectiveness and permanence. Alternative GW-2 would use institutional controls to prevent any potential exposure to contaminated ground water. Effectiveness of the monitoring program and attenuation would be evaluated during five-year reviews. Although this alternative would require additional time to meet the performance standards, it would likely be as effective from a long-term standpoint and will be verified during the five-year reviews. Alternatives GW-3 and 4 would use active ground water restoration and treatment technologies to reduce hazards posed by the contaminants in the ground water at the Site. Alternative GW-4 may be most effective since trenches would more effectively extract contaminated ground water from the complex hydrogeologic conditions.

Alternatives GW-2, 3 and 4 would require five-year reviews to verify that the cleanup remained protective.

8.2.2 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternatives GW-3 and 4 would provide for active ground water remediation and treatment. Alternative GW-2 would not provide for ground water treatment, but would likely reduce contaminants over time. Toxicity, volume, and mobility of ground water would be reduced through active restoration in Alternatives GW-3 and 4.

Therefore, Alternatives 3 and 4 would best satisfy CERCLA's statutory preference for treatment and use of treatment to reduce toxicity, mobility, and volume of contaminants.

8.2.3 SHORT-TERM EFFECTIVENESS

Alternative GW-2 is expected to have the least short-term risk in execution because its implementation presents minimal risk to workers, community, and the environment. Its effectiveness would be achieved over a longer period of time, although it is expected to achieve a comparable reduction in toxicity.

Alternatives GW-3 and 4 would also be effective in the short-term. Alternatives GW-3 and 4 (ground water treatment) would need additional studies to determine ground water treatment design specifications. However, these Alternatives would more quickly remediate ground water contamination through extraction and treatment. The installation of ground water wells or trench excavation may impose risks by disturbing the contamination in the soil or ground water; however, it is not expected to pose unacceptable short-term environmental or health hazards, which could not be controlled.

8.2.4 IMPLEMENTABILITY

Alternative GW-2 would be the simplest to implement and operate. Materials, services, capabilities, and specialists would be readily available for implementing the institutional controls and monitoring program. The ground water monitoring program would determine the effectiveness of attenuation of the contaminated ground water.

Alternative GW-3 and GW-4 would both be the most technically difficult to implement and would require complex treatability studies and testing to define the design parameters for these processes. These Alternatives would also likely require off-site disposal of treatment sludges at regulated off-site facilities.

8.2.5 COST

Cost details are provided in the FS and are summarized below in Table 8-1. Alternative GW-2, institutional controls/monitoring, has the lowest present worth cost and Alternative GW-3, ground water treatment, is high and Alternative GW-4 the highest. Alternatives GW-3 and 4 is significantly more expensive to construct and operate because of the ground water extraction and treatment component. Due to the contaminant source being removed and local ground water flow control asserted by Cedar Creek, Alternative GW-2 provides for the best ratio of costs to benefit received through the permanent reduction of risks to human health and the environment.

TABLE 8-1
COMPARISON OF COSTS

Alternative	30 Year Present-worth Cost	Capital Cost	Monitoring and Maintenance Cost Annual/30 year [1]
GW-2: Institutional Controls and Ground water Monitoring	$ 461,331	$30,360	$ 34,730 / $430,971
GW-3: Ground Water Extraction with Wells	$ 5,053,051	$662,682	$353,804 / $4,390,369
GW-4: Ground Water Extraction with Trenches	$7,234,449	$881,184	$511,987 / $6,353,265

[1] 30 years cost is net present worth cost based on a 7% discount rate.

8.3 MODIFYING CRITERIA

8.3.1 STATE ACCEPTANCE

The State of Georgia has concurred with the selection of Alternative GW-2 to remediate the Diamond Shamrock Landfill Site.

8.3.2 COMMUNITY ACCEPTANCE

Based on comments expressed at the March 22, 1994, public meeting and receipt of one written comment during the comment period, it appears that the Cedartown community generally agrees with the selected remedy. Specific responses to issues raised by the community can be found in Appendix A, The Responsiveness Summary.

9.0 SUMMARY OF SELECTED REMEDY

Based upon consideration of the following requirements, EPA has selected Alternative GW-2, institutional controls and ground/surface water monitoring for this Site:

- Trench closure and soil sampling results confirm that the source of ground water contamination has been removed;
- The concentrations, of ground water contaminants of concern, that are above their respective MCLs and/or health-based standards are variable, sporadic, or appear to be decreasing over time;
- Cedar Creek appears to be exerting control of ground water flow at the Site. Contaminated ground water appears to be localized on-site and is not affecting the Cedartown Public Water supply. Cedar Creek sampling results confirm that no detectable levels of these contaminants of concern are seeping to this surface water; and,
- The alternative meets requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments.

At the completion of this remedy, the risk associated with this Site will be protective of human health and the environment.

The selected alternative for the Diamond Shamrock Landfill Site is consistent with the requirements of Section 121 of CERCLA and the National Contingency Plan. The selected alternative will prevent the future exposure to contaminated ground water at the Site while reduction of the mobility, toxicity, and volume of contaminated ground water occurs through natural attenuation processes. In addition, the selected alternative is protective of human health and the environment, and will attain all Federal and State applicable or relevant and appropriate requirements, as well as being cost-effective and utilizing permanent solutions to the maximum extent practicable.

Based on the information available at this time, the selected alternative represents the best balance among the criteria used to evaluate remedies. Alternative GW-2 is believed to be protective of human health and the environment, will attain ARARs, will be cost effective, and will utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

A. GROUND WATER MONITORING/RESTORATION

Institutional controls will be implemented to prevent potential exposure to contaminated ground water. Ground water monitoring will be implemented at this Site to assess the movement of contamination through ground water.

A.1. The major components of ground water monitoring/restoration to be implemented include:

- Long-term monitoring of ground water to consist of the following:

  1 Ground and surface water monitoring program to confirm that natural attenuation works and contaminants do not move.

  2 Five-year reviews performed in accordance with Section 121(c) of CERCLA by EPA to assure that human health and the environment continue to be protected by the remedy, that natural attenuation continues to be effective, and whether ground water performance standards continue to be appropriate.

  3 The ground/surface water monitoring program would require further sampling and analysis to further define background ground water concentrations of contaminants and the effectiveness of natural attenuation. This remedy could require the installation of additional well(s). If, based on future sampling

analysis, the background concentration for a contaminant exceeds its MCL or acceptable risk-based standard, EPA may evaluate whether ground water performance standards continue to be appropriate and may consider amending the performance standards to background groundwater contaminant concentrations. Ground/surface water samples would be collected at intervals to be approved by EPA. Surface water sampling shall be evaluated to ensure ground water contaminants do not adversely affect the quality of Cedar Creek waters and continue to meet Federal and State water quality ARARs. Proper well construction and development techniques along with a low-stress sampling method would be used during the ground water monitoring to determine whether inorganic substances continue to be a problem.

4 Continued ground water monitoring upon attainment of the performance standards at sampling intervals approved by EPA. The ground water monitoring program would continue until EPA approves a five-year review concluding that the alternative has achieved continued attainment of the ground water performance standards listed in Table 9-1 and remains protective of human health and the environment.

- Placement of institutional controls to consist of the following to preclude usage of ground water:

  1 Implementation of deed restriction(s) or restrictive covenant(s) to prevent ground water usage and drilling resulting in exposure to contaminants of concern; and,

  2 Completion and maintenance of Site access restrictions (fencing and signage).

TABLE 9-1
SUMMARY OF MONITORING PERFORMANCE STANDARDS
(GROUND WATER)

Contaminant	Performance Standard (µg/l)
Manganese	200 [a]
Toluene	1,000 [b]
Trichloroethene	5 [b]
1,2, Dichloroethane	5 [b]

[a] - Calculated value based on an acceptable risk or a Hazard Quotient (HQ) of 1. Exposure assumptions are a 2 liter per day ingestion rate and a 70 kilogram body weight.

[b] - Safe Drinking Water Act Maximum Contaminant Level (MCL).

C. Compliance Testing

Ground water monitoring shall be conducted at this Site through demonstration of compliance with all Performance Standards for 2 consecutive sampling events and continued attainment through the five-year review at the wells approved by the EPA as compliance points. The five-year reviews shall be performed in accordance with Section 121(c) of CERCLA by EPA to assure that human health and the environment continue to be protected by the remedy and that natural attenuation processes are effective.

10.0 STATUTORY DETERMINATION

Under CERCLA Section 121, 42 U.S.C. § 9621, EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as the their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy provides protection of human health and the environment by eliminating, reducing, and controlling risk through engineering controls and/or institutional controls and ground water treatment, if required as delineated through performance standards described in Section 9.0 - SUMMARY OF SELECTED REMEDY, subsection A (Ground water Restoration). Ground water monitoring will be implemented in accordance with performance standards described in Section 9.0 - SUMMARY OF SELECTED REMEDY, subsection A.1 (Ground Water Monitoring) to ensure that no exposure through ingestion of contaminated ground water occurs. Institutional controls and ground water monitoring will prevent exposure to contaminants while natural attenuation occurs over time.

10.2 ATTAINMENT OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Remedial actions performed under CERCLA, Section 121, 42 U.S.C. § 9621 must comply with all applicable or relevant and appropriate requirements (ARARs). All alternatives considered for the Site were evaluated on the basis of the degree to which they complied with these requirements. The selected remedy was found to meet or exceed ARARs identified in Tables 7-1, 2, 3 and 4. The following is a short narrative in support of attainment of the pertinent ARARs.

Chemical-Specific ARARs

Ground water restoration performance standards were SDWA MCLs for the applicable contaminants of concern and surface water sampling shall be evaluated with federal and State water quality criteria or standards which are consistent with chemical specific ARARs listed in table 7-3.

Location-Specific ARARs

Performance standards are consistent with ARARs identified in Tables 7-1.

Waivers

Section 121 (d)(4)(C) of CERCLA, 42 U.S.C. § 9621(d)(4)(c), provides that an ARAR may be waived when compliance with an ARAR is technically impracticable from an engineering perspective. While waivers are not anticipated to be invoked at this Site, further analysis for verification that background average values will be required. However, it is anticipated that the contaminated ground water will meet all ARARs through attenuation processes.

The selected remedy will require further sampling and analysis to further define background ground water concentrations of contaminants. If, based on future sampling analysis, the background concentration for a contaminant exceeds its MCL or acceptable risk-based standard, EPA may evaluate whether ground water performance standards continue to be appropriate and may consider amending the performance standards to background groundwater contaminant concentrations. A technical infeasibility or inability to attain the ARAR as caused by existing background ground water conditions as supported by further background sampling and analysis support may be evaluated as part of an amended performance standard.

Other Guidance To Be Considered

Other Guidance To Be Considered (TBCs) include health-based advisories and guidance. TBCs have been utilized in estimating incremental cancer risk numbers for remedial activities at the Sites and in determining RCRA applications to contaminated media. TBCs for this Site include Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy, Final Draft, December 1986.

10.3 COST EFFECTIVENESS

EPA believes the selected remedy, Alternative GW-2 will eliminate the risks to human health at an estimated cost of $ 461,331. Alternative GW-2 is expected to achieve a comparable effectiveness at a substantially lower cost (although over a longer period of time). Alternative GW-2 provides an overall effectiveness proportionate to its costs, such that it represents a reasonable value achieved for the investment as discussed in Section 8.2.5.

10.4 UTILIZATION OF PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE

EPA and the State of Georgia have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final remediation at the Diamond Shamrock Landfill Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA and the State have determined that this selected remedy provides the best balance in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element and consideration of state and community acceptance. The statutory preference for remedies that employ treatment as a principal element is not satisfied for this Site. The RI data and FS concluded that remedies which employ treatment technologies are impracticable and not cost effective at this Site due to low levels of organics and inorganic contaminants, high volume of inorganic contaminants, and removal of the ground water contamination source. The selected remedy provides for long-term effectiveness and permanence, is easily implemented, reduces toxicity, mobility or volume, and is cost effective.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy utilizes treatment technologies to the extent practicable. The statutory preference for remedies that employ treatment as a principal element is not satisfied. The RI data and FS concludes that remedies which employ treatment technologies are impracticable and not cost effective at this Site due to low levels of organics and inorganic contaminants, high volume of inorganic contaminants, and removal of the ground water contamination source.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

There have been no significant changes in the selected remedy, Alternative GW-2, from the preferred remedy described in the proposed plan.

APPENDIX A:

RESPONSIVENESS SUMMARY - DIAMOND SHAMROCK LANDFILL

RECORD OF DECISION

APPENDIX A: RESPONSIVENESS SUMMARY - DIAMOND SHAMROCK LANDFILL RECORD OF DECISION

The U.S. Environmental Protection Agency (EPA) held a 30-day public comment period from March 4, 1994, through April 4, 1994 for interested parties to give input on EPA's Proposed Plan for Remedial Action at the Diamond Shamrock Landfill Superfund Site in Cedartown, Georgia. A public meeting was conducted on March 22, 1994, at the Cedartown Public Library, 245 East Avenue, Cedartown, Georgia. At the meeting, EPA staff presented the results of the Remedial Investigation and Feasibility Study (RI/FS) and explained EPA's preferred remedy for the Site.

A responsiveness summary is required to document how EPA addressed citizen comments and concerns, as raised during the public comment period. All comments summarized in this appendix have been factored into the final decision of the remedial action for the Diamond Shamrock Landfill Site.

SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA's RESPONSES

ISSUE		EPA RESPONSE
1.	How does the dye tracer test performed at the Henkel waste water treatment plant affect the results of the RI/Fs and selection of the clean-up remedy?	The results of the dye tracer test were considered during the selection of the remedy. Since RI/FS data indicates that the source of ground-water contamination has been removed and that Cedar Creek appears to be exerting control of ground-water flow at the Site, that contaminated ground water appears to be localized on-site, is not affecting the Cedartown Public Water supply, and no significant levels of these contaminants of concern are seeping to Cedar Creek. Therefore, the selection of alternative GW-2 as the preferred alternative is protective of human health and the environment.
2.	What are the health effects of manganese in drinking water?	Per data from the toxicological profile provided in the Baseline Risk Assessment, individuals who chronically (over the long term) ingest drinking water from wells containing manganese concentrations of 1,600 to 2,300 µg/l, showed a statistically significant increase in minor neurologic effects (neurologic exam scores) (Kondakis et al. 1989). Higher concentrations in drinking water have resulted in symptoms including lethargy, increased muscle tonus, tremor and mental disturbances (Kawamura et al. 1941). Additionally, manganese has been observed to cause depressed reproductive performance and reduced fertility in humans and experimental animals (EPA 1984a).
3.	Were any fungicides referenced in the Eckhart survey found in the landfill?	No. Data collected from soil, sediments, surface and ground water samples indicate that pesticides/fungicides do not present an unacceptable risk to human health and the environment.

SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA's RESPONSES

	ISSUE	EPA RESPONSE
4.	Due to apparent high background levels of manganese and the limited epidemiology studies of health affects, is continued monitoring of groundwater needed?	A high level of manganese (Mn) were detected in the June 1993, MW-10 (background well) ground water sampling result. After reviewing the information, EPA concluded that the June 1993, MW-10 sample was probably not representative for determining background ground-water concentrations and utilization for use in determining ground water performance or clean-up standards. Firstly, when comparing the filtered versus non-filtered data, it is evident that there is a significant difference in this data which is not apparent in any of the other samples. Secondly, in the previous and post samples of MW-10 and in the other background well (MW-1), Mn was detected at much lower concentrations than 1800 ug/l. Sample results from other sampling events (highest detected was 94 µg/l) indicates the spike of 1800 µg/l is not an accurate characterization of water quality at this well. Therefore, the remedy includes a ground-water monitoring program to further define background ground water concentrations of contaminants. If, based on future sampling analysis, the background concentration for a contaminant exceeds its performance standard, EPA may evaluate whether ground water performance standards continue to be appropriate and may consider amending the performance standards to background ground-water contaminant concentrations.
5.	Based on data collected, is potential surface water contamination from the site a concern?	Surface waters do not present a current unacceptable health risk. However, since contaminated water does discharge to Cedar Creek, surface samples will continue to be collected to confirm that contaminants concentrations do not present an unacceptable risk to human health and the environment in this surface water.
6.	Table 1 on page 4 of the proposed plan fact sheet is misleading in that Toluene, Trichloroethene and 1,2 Dichloroethane should not be contaminants of concern.	Toluene, Trichloroethene, and 1,2 Dichloroethane have been detected above their respective drinking water standard in ground water during various RI/FS sampling events. While none of these contaminants were detected above their respective detection limits during the January 1994 sampling event, it is premature to conclude that these compounds are no longer contaminants of concern and not should be analyzed for. If future monitoring under the selected remedy indicate that these constituents meet the ground water performance standards, EPA can discontinue analyzing for that particular constituent.

SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA's RESPONSES

ISSUE		EPA RESPONSE
7.	Table 1 on page 4 is misleading since comparisons were made of the highest detected concentration to the average background for a particular contaminant.	The purpose of this table was to show what the contaminant reasonable maximum exposure concentration that was used in the risk assessment process to determine if an unacceptable health risk exists and to establish ground water clean up or performance standards. Since a comparison of reasonable maximum detection to average background was utilized in the risk assessment process to determine if a constituent is a potential contaminant of concern, the average background concentration was represented in this table.
8.	All background results should be considered and data supports that the manganese in ground water is likely naturally occurring.	The data does not support that manganese in ground water is naturally occurring. MW-10 results indicate only one sample above the performance standard of 200 µg/l as discussed in response #4; therefore, EPA has concluded that additional background data will be required as part of the selected remedy to confirm and further define background water quality. The performance standard of 200 µg/l for manganese will remain as part of the selected remedy until and if future sampling analysis indicates that background concentration for manganese exceeds the acceptable risk-based standard of 200 µg/l. EPA will evaluate this data and determine whether ground water performance standards continue to be appropriate and whether amending the performance standards to background ground-water contaminant concentrations is appropriate.
9.	The performance standard of 200 µg/l is based on a single epidemiological study and includes a great deal of uncertainty.	EPA considered in the selection of this remedy that there is a degree of uncertainty regarding the toxicity of manganese in the ground water ingestion scenario. Due to the uncertainty associated with the present RfD (the amount that can be ingested daily without adverse affect) for manganese, the RfD determination is scheduled for future EPA review. The current EPA RfD for manganese in water of 0.005 mg/kg/day was used to evaluate risks concerning manganese drinking water intake and in establishing clean-up goals. EPA may evaluate and modify the clean-up standard as stated in the selected remedy, if the RfD for manganese is revised.

APPENDIX B:

STATE OF GEORGIA CONCURRENCE LETTER

Georgia Department of Natural Resources

205 Butler Street, S.E., Suite 1154 Atlanta, Georgia 30334
Joe D. Tanner, Commissioner
Environmental Protection Division
Harold F. Reheis, Director
404/656-2833 404/656-7802

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BRANCH

March 29, 1994

Mr. Richard Green
Associate Division Director
Office of Superfund
U.S. EPA, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

RE: Record of Decision
Diamond Shamrock Landfill NPL Site

Dear Mr. Green:

The Georgia Environmental Protection Division (EPD) has reviewed the Record of Decision, Summary of Remedial Alternative Selection for the Diamond Shamrock Landfill Site in Cedartown, Georgia. EPD concurs with the selected remedy in which the major components include: a deed restriction or restrictive covenant for ground water usage, completion and maintenance of site access restrictions, and a ground water and surface water monitoring program.

If you have any questions, please contact Penny Mingst at (404) 656-2833.

Sincerely,

Harold F. Reheis
Director

HFR/pm

cc: Jay V. Bassett

file: Diamond Shamrock Landfill NPL Site

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